Federal Energy Regulatory Commission

Office of Energy Projects

June 2018

FERC/EIS-0278D

DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR
Venture Global Calcasieu Pass, LLC and TransCameron Pipeline, LLC
Calcasieu Pass Project

Docket Nos. CP15-550-000, CP15-551-000, CP15-551-001

Federal Energy Regulatory Commission
Office of Energy Projects
888 First Street, NE, Washington, DC 20426

Cooperating Agencies:

U.S. Environmental Protection Agency

U.S. Department of Transportation

U.S. Coast Guard

U.S. Department of Energy

U.S. Army Corps of Engineers

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

In Reply Refer To:
OEP/DG2E/Gas Branch 1
Venture Global Calcasieu Pass, LLC; and
TransCameron Pipeline, LLC
Docket Nos. CP15-550-000, CP15 551-000,
and CP15-551-001

TO THE PARTY ADDRESSED:

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared a draft environmental impact statement (EIS) for the Calcasieu Pass Project, proposed by Venture Global Calcasieu Pass, LLC (Venture Global Calcasieu Pass) and TransCameron Pipeline, LLC (TransCameron Pipeline) in the above-referenced dockets. Venture Global Calcasieu Pass requests authorization to site, construct, and operate a natural gas liquefaction and storage facility, and marine export terminal in Cameron Parish, Louisiana. TransCameron Pipeline requests authorization to construct, install, and operate certain natural gas pipeline facilities also in Cameron Parish, Louisiana. The new liquefaction facilities would have a design production capacity of 12 million metric ton of liquefied natural gas (LNG) per annum.

The draft EIS assesses the potential environmental effects of construction and operation of the Calcasieu Pass Project in accordance with the requirements of the National Environmental Policy Act. The FERC staff concludes that approval of the proposed project would have some adverse environmental impacts; however, all of these impacts would be reduced to less-than-significant levels with the implementation of Venture Global Calcasieu Pass' and TransCameron Pipeline's proposed mitigation measures and the additional measures recommended in the draft 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 draft EIS. Cooperating agencies have jurisdiction by law or special expertise with respect to resources potentially affected by a proposal and participate in the National Environmental Policy Act analysis. Although the cooperating agencies provided input on the conclusions and recommendations presented in the draft EIS, the agencies will present their own conclusions and recommendations in their respective Records of Decision for the project.

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

- nine integrated pre-cooled single mixed refrigerant (SMR) blocks;
- two full-containment aboveground LNG storage tanks, each with a usable capacity of approximately 200,000 cubic meters;
- a 1,500-foot by 3,000-foot turning basin adjacent to the Calcasieu River Ship Channel;
- two LNG berthing docks, each designed to handle carriers of 120,000 to 210,000 cubic meter cargo capacity;

- a 720 megawatt natural gas-fired combined cycle gas turbine electric generation facility;
- approximately 23.4 miles of 42-inch-diameter pipeline to bring feed gas from interconnections with ANR Pipeline Company, Texas Eastern Transmission, LP, and Bridgeline Holdings, LP to the terminal site;
- one meter station;
- three mainline valves; and
- one pig launcher at the meter station and one pig receiver at the gas gate station on the terminal site.

The FERC staff mailed copies of the draft EIS 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; libraries in the project area; and parties to this proceeding. Paper copy versions of this EIS were mailed to those specifically requesting them; all others received a CD version. In addition, the EIS is available for public viewing on the FERC's website (www.ferc.gov) using the eLibrary link. A limited number of hardcopies of the EIS are available for distribution and public inspection at:

Federal Energy Regulatory Commission
Public Reference Room
888 First Street NE, Room 2A
Washington, DC 20426
(202) 502-8371

Any person wishing to comment on the draft EIS may do so. To ensure consideration of your comments on the proposal in the draft EIS, it is important that the Commission receive your comments on or before 5:00pm Eastern Time on **August 13, 2018**.

For your convenience, there are four methods you can use to submit your comments with the Commission. The Commission will provide equal consideration to all comments received, whether filed in written form or provided verbally. The Commission encourages electronic filing of comments and has staff available to assist you at (866) 208-3676 or FercOnlineSupport@ferc.gov. Please carefully follow these instructions so that your comments are properly recorded.

1) You can file your comments electronically using the eComment feature located on the Commission's website (www.ferc.gov) under the link to Documents and Filings. This is an easy method for submitting brief, text-only comments on a project;

2) You can also file your comments electronically using the eFiling feature on the Commission's website (www.ferc.gov) under the link to Documents and Filings. With eFiling, you can provide comments in a variety of formats by attaching them as a file with your submission. New eFiling users must first create an account by clicking on "eRegister." You must select the type of filing you are making. If you are filing a comment on a particular project, please select "Comment on a Filing"; or

3) You can file a paper copy of your comments by mailing them to the following address. Be sure to reference the project docket number (CP15-550-000, CP15-551-000, and CP15-551-001) with your submission:

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, DC 20426

4) In lieu of sending written or electronic comments, the Commission invites you to attend the public comment session its staff will conduct in the project area to receive comments on the draft EIS, scheduled as follows:

Date (time)	Location
August 1, 2018 (4:00 p.m. – 7:00 p.m. CST)	Cameron Parish School Board Educational Conference Center 510 Marshall Street Cameron, Louisiana 70631 (337) 775-5784

The primary goal of this comment session is to have you identify the specific environmental issues and concerns with the draft EIS. Individual verbal comments will be taken on a one-on-one basis with a court reporter. This format is designed to receive the maximum amount of verbal comments, in a convenient way during the timeframe allotted.

The comment session is scheduled from 4 pm to 7 pm CST. You may arrive at any time after 4 pm. There will not be a formal presentation by Commission staff when the session opens. If you wish to speak, the Commission staff will hand out numbers in the order of your arrival; distribution of numbers will be discontinued at 6 pm. However, if no additional numbers have been handed out and all individuals who wish to provide comments have had an opportunity to do so, staff may conclude the session at 6 pm.

Your verbal comments will be recorded by the court reporter (with FERC staff or representative present) and become part of the public record for this proceeding. Transcripts will be publicly available on FERC’s eLibrary system (see below for instructions on using eLibrary). If a significant number of people are interested in providing verbal comments in the one-on-one settings, a time limit of 5 minutes may be implemented for each commentor.

It is important to note that verbal comments hold the same weight as written or electronically submitted comments. Although there will not be a formal presentation, Commission staff will be available throughout the comment session to answer your questions about the environmental review process.

Filing environmental comments will not give you intervenor status, but you do not need intervenor status to have your comments considered. However, only intervenors have the right to seek rehearing or judicial review of the Commission’s decisions. Any person may seek to intervene on environmental grounds and thereby become a party to this proceeding by filing a motion to intervene that complies with the requirements in Rule 214 of the Commission's Rules of Practice and Procedures (18 CFR Part 385.214). Any such intervention must be filed within the comment period for the draft EIS to be deemed timely. Motions to intervene that are filed after the comment due date for the draft EIS are untimely and may be denied. Any late-filed motion to intervene must show good cause why the time limitation should be waived and provide justification by reference to factors set forth in Rule 214(d) of the Commission's Rules of Practice and Procedures (18 CFR Part 385.214(b)(3) and (d)). The Commission strongly encourages electronic filing of interventions in lieu of paper using the "eFiling" feature described above, and available at http://www.ferc.gov. Persons unable to file electronically may submit a paper copy of the intervention to the Federal Energy Regulatory Commission, 888 First Street, NE, Washington, DC 20426.

Questions?

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. Click on the eLibrary link, click on "General Search," and enter the docket number in the "Docket Number" field, excluding the last three digits (i.e., CP15-550; CP15-551). 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. 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

$\mu g/m^3$	microgram per cubic meter
ACHP	Advisory Council on Historic Preservation
ACI	American Concrete Institute
ADT	average daily traffic count
AEGL	Acute Exposure Guideline Levels
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
ALE	Aftershock Level Earthquake
amsl	above mean sea level
ANR	ANR Pipeline Company
API	American Petroleum Institute
AQCR	Air Quality Control Region
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
Bcf/d	billion cubic feet per day
Bcf/yr	billion cubic feet per year
BLEVE	Boiling Liquid Expanding Vapor Explosion
BMP	best management practice
BPVC	Boiler and Pressure Vessel Code
Bridgeline	Bridgeline Holdings, LP
BST	Baker-Strehlow-Tang
BUDM	Beneficial Use of Dredged Material Plan
C3-MR	Propane Mixed Refrigerant
CAA	Clean Air Act of 1970
CAAA	1990 Clean Air Act Amendments
CAMx	Comprehensive Air Quality Model with Extensions
CCS	carbon capture and storage
CCTV	closed-circuit television
CEA	cooperative endeavor agreement
Certificate	Certificate of Public Convenience and Necessity
CFR	Code of Federal Regulations
CH_4	methane
CI ICE	compression ignition internal combustion engine
CMP	Compensatory Mitigation Plan
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent

Commission	Federal Energy Regulatory Commission
COTP	Captain of the Port
CPNWR	Cameron Prairie National Wildlife Refuge
CPT	Cone Penetration Test
CWA	Clean Water Act of 1972
CZMA	Coastal Zone Management Act of 1972
CZMP	Coastal Zone Management Program
SEL	sound exposure level
dBA	decibels on the A-weighted scale
dB_{PEAK}	peak decibels
dB_{RMS}	root mean square decibels
DHS	U.S. Department of Homeland Security
DMR	Dual Mixed Refrigerant
DOE	U.S. Department of Energy
DOE/FE	U.S. Department of Energy's Office of Fossil Energy
DOD	U.S. Department of Defense
DOT	U.S. Department of Transportation
E2EM	estuarine intertidal emergent
E2FO	estuarine intertidal forested
E2SS	estuarine intertidal scrub shrub
EA	environmental assessment
EEM	estuarine emergent-mosaic
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
EI	environmental inspector
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ERIC	Emissions Reporting and Inventory Center
ERP	Emergency Response Plan
ERPG	Emergency Response Planning Guidelines
ESA	Endangered Species Act of 1973
ESD	emergency shutdown
FEED	Front End Engineering Design
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FMP	fishery management plan
FR	Federal Register
FTA countries or nations	countries or nations with which the United States has free trade agreements
FWS	U.S. Fish and Wildlife Service
G2	G2 LNG, LLC
gal/d	gallons per day
GHG	greenhouse gas
GMFMC	Gulf of Mexico Fishery Management Council

gpm	gallons per minute
GWP	global warming potential
H_2S	hydrogen sulfide
HAP	Hazardous Air Pollutant
HAZID	Hazard Identification Report
HAZOP	Hazard and Operability Review
HCA	high consequence area
HDD	horizontal directional drill
HMA	Human Machine Interface
hp	horsepower
IBA	Important Bird Area
IEA	International Energy Agency
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
ISA	International Society for Automation
JPA	Joint Permit Application
KMLP	Kinder Morgan Louisiana Pipeline, LLC
kV	kilovolt
LAC	Louisiana Administrative Code
LaDOTD	Louisiana Department of Transportation and Development
LCLNG	Lake Charles LNG Company, LLC
LDEQ	Louisiana Department of Environmental Quality
L_{dn}	day-night average sound level
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
L_{eq}	equivalent sound level
LFL	Lower Flammable Limit
LNG	liquefied natural gas
LNHP	Louisiana Natural Heritage Program
LOR	Letter of Recommendation
LPDES	Louisiana Pollutant Discharge Elimination System
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act of 1976
MAOP	maximum allowable operating pressure
MBTA	Migratory Bird Treaty Act
MCL	Maximum Contaminant Level
MLV	mainline valve
MMBtu/hr	million British thermal units per hour
MMPA	Marine Mammal Protection Act
MOU	Memorandum of Understanding
MP	milepost
MPI	Maritime Pilot's Institute
MR	mixed refrigerant
m/s	meters per second
MSS	maintenance, startup, and shutdown

MTPA	million tonnes per annum
MTSA	Marine Transportation Security Act
MW	megawatt
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum of 1988
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
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act of 1966
nm	nautical mile
NMFS	National Oceanic and Atmospheric Administration's National Marine Fisheries Service
NMSZ	New Madrid Seismic Zone
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent to Prepare an Environmental Impact Statement for the Planned Calcasieu Pass Project and Request for Comments on Environmental Issues, and Notice of Public Scoping Meeting
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	noise-sensitive area
NSPS	New Source Performance Standards
NSR	New Source Review
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
O&M	operations and maintenance
O_3	ozone
OBE	Operating Bases Earthquake
OCM	Louisiana Department of Natural Resources Office of Coastal Management
OEP	Federal Energy Regulatory Commission's Office of Energy Projects
OSHA	Occupational Safety and Health Administration
Pb	lead
PEM	palustrine emergent
PERC	Powered Emergency Release Coupling
PFO	palustrine forested
pga	peak ground acceleration
PHAST	process hazard analysis software tool

PHMSA	U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration
Plan	FERC Upland Erosion Control, Revegetation, and Maintenance Plan
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PNR	potential noise receptor
ppb	parts per billion
ppm	parts per million
ppmv	parts per million by volume
Procedures	FERC Wetland and Waterbody Construction and Mitigation Procedures
Project	Venture Global Calcasieu Pass, LLC's Calcasieu Pass Project
Project-specific Plan	Venture Global's Upland Erosion Control, Revegetation, and Maintenance Plan
Project-specific Procedures	Venture Global's Wetland and Waterbody Construction and Mitigation Procedures
PSD	Prevention of Significant Deterioration
psi	pounds per square inch
psig	pounds per square inch gauge
PSS	palustrine scrub shrub
PTE	potential to emit
Q/D	ratio of distance to kilometers
RHA	Rivers and Harbors Act of 1899
RICE	reciprocating internal combustion engines
RPT	Rapid Phase Transition
RV	recreational vehicle
Sasol	Sasol North American, Inc.
SCT&E	Southern California Telephone and Energy LNG, LLC
Secretary	Secretary of the Commission
SEL_{CUM}	cumulative sound exposure level
SEP	Surface Emissive Power
SCPT	Seismic Cone Penetration Test
SH	state highway
SHPO	State Historic Preservation Office
SIL	Significant Impact Level
SIP	State Implementation Plan
SMC	Significant Monitoring Concentration
SMR	single mixed refrigerant
SOLAS	International Convention for the Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
SO_2	sulfur dioxide
SO_x	sulfur oxides
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan
SSE	Safe Shutdown Earthquake

Supplemental NOI	Supplemental Notice of Intent to Prepare an Environmental Impact Statement for the Proposed TransCameron Pipeline Project and Calcasieu Pass Terminal, and request for Comments on Environmental Issues Related to New Route Amendments and Project Changes
SWEL	Still Water Elevation Level
SWLA	southwest Louisiana
SWPPP	Stormwater Pollution Prevention Plan
TAW	Water Retaining Structure
TDS	Total Dissolved Solid
TEMA	Tubular Exchanger Manufacturers Association
Terminal	liquid natural gas export terminal
tpy	tons per year
TransCameron Pipeline	TransCameron Pipeline, LLC
Tribes	federally recognized tribes
Trunkline	Trunkline Gas Company, LLC
TWS	temporary workspace
UFL	Upper Flammable Limit
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
Venture Global Calcasieu Pass	Venture Global Calcasieu Pass, LLC
Venture Global	Venture Global LNG, Inc.
VOC	volatile organic compound
Vs	shear wave velocity
WSA	Waterway Suitability Assessment

EXECUTIVE SUMMARY

INTRODUCTION

On September 4, 2015, Venture Global Calcasieu Pass, LLC (Venture Global Calcasieu Pass) filed an application with the FERC in Docket No CP15-550-000 under section 3 of the Natural Gas Act (NGA) and under Title 18 of the Code of Federal Regulations, Parts 153 and 380 (18 CFR 153 and 380), to construct and operate a liquefied natural gas terminal (Terminal). Similarly, on the same day TransCameron Pipeline, LLC (TransCameron Pipeline) filed an application with the FERC in Docket No. CP15-551-000 under section 7 of the NGA and 18 CFR 153 and 380 to construct, operate, and maintain two pipeline laterals (the 23.4-mile-long East Lateral and the 19.2-mile-long West Lateral). On June 28, 2016, Venture Global filed an amendment to its application to remove the West Lateral pipeline as well as make minor workspace adjustments along the East Lateral pipeline (Pipeline). Both Venture Global Calcasieu Pass and TransCameron Pipeline are wholly owned subsidiaries of Venture Global LNG, Inc. (Venture Global). The two companies are referred to collectively in this draft environmental impact statement (EIS) as Venture Global, where appropriate. Venture Global Calcasieu Pass seeks approval under the NGA to construct and operate the terminal and TransCameron Pipeline seeks a Certificate of Public Convenience and Necessity (Certificate) to construct and operate a natural gas pipeline.

The purpose of the EIS is to inform FERC decision-makers, the public, and the permitting agencies about the potential adverse and beneficial environmental impacts of the proposed Project and its alternatives, and recommend mitigation measures that would reduce adverse impacts to the extent practicable. We[1] prepared this EIS to assess the environmental impacts associated with construction and operation of the Project as required under the National Environmental Policy Act (NEPA) of 1969, as amended. Our analysis was based on information provided by Venture Global, and further developed from data requests, field investigations, scoping, literature research, and communications with federal, state, and local agencies, and individual members of the public.

The 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.[2]

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 (Terminal) in Cameron Parish, Louisiana; and 2) the construction of facilities necessary to provide natural gas supplies to the proposed facility, including one new pipeline, meter station, three mainline valves, pig launcher, and pig receiver (Pipeline). The Project would produce 12 million metric tons per annum of LNG for export.

PUBLIC INVOLVEMENT

On October 10, 2014, the FERC accepted Venture Global's request to begin a pre-filing Docket No. PF15-2-000 to place information related to the Project into the public record. The pre-filing process

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

[2] A cooperating agency is an agency that has jurisdiction over all or part of a project area and must make a decision on a project, and/or an agency that provides special expertise with regard to environmental or other resources.

ended on September 4, 2015, when Venture Global filed its application with the 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 the FERC.

On January 20, 2015, the FERC issued a Notice of Intent to Prepare an Environmental Impact Statement for the Planned Calcasieu Pass Project and Request for Comments on Environmental Issues, and Notice of Public Scoping Meeting (NOI). On August 2, 2016, the FERC issued a Supplemental Notice of Intent to Prepare an Environmental Impact Statement for the Proposed TransCameron Pipeline Project and Calcasieu Pass Terminal, and Request for Comments on Environmental Issues Related to New Route Amendments and Project Changes (Supplemental NOI) to describe Venture Global's removal of a pipeline segment (known as the West Lateral pipeline) and minor workspace adjustments along the Pipeline. The NOI and Supplemental NOI were sent to over 700 and 800 interested parties respectively. Publication of each NOI established a 30-day public comment period. We received a total of nine comments in response to the NOIs.

Substantive environmental issues identified through this public review process are addressed in this EIS.[3]

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 are recommending additional mitigation measures to minimize or avoid these 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 Terminal facilities would disturb 413.2 acres of land, and 65.8 acres of water. Of this total, 314.0 acres of land, which includes 29.3 acres converted to open water, would be impacted by operation and maintenance of the Terminal facilities, and 64.8 acres of water would be affected by operation and maintenance of the turning basin. The remaining 99.2 acres of land would be temporarily affected during construction. An additional 415.4 acres would be leased by Venture Global Calcasieu Pass at the Terminal site, but would not be affected by construction.

Construction of the 23.4-mile-long Pipeline would disturb 370.0 acres of land, including temporary workspaces, access roads, meter stations/mainline valves, and contractor yards. Approximately 136.5 acres of land would be affected by operation of the Pipeline based on a 50-foot-wide permanent right-of-way.

GEOLOGY

In general, the potential for geologic hazards such as earthquakes, soil liquefaction, landslides, or a seismically generated tsunami or seiche to significantly affect construction or operation of the proposed Project facilities is low because the conditions for these hazards generally do not exist or the risk is very low. However, some hazards such as hurricanes, flooding, and long-term sea level rise could affect the Project during operation, particularly the Terminal. To protect the Terminal from these hazards, Venture Global Calcasieu Pass would design and construct the Terminal at an elevation to minimize potential

[3] The transcripts of the public scoping meeting and all written comments are part of the FERC's public record for the Project and are available for viewing in e-library under the pre-filing docket number.

impacts from flooding and sea level rise. Further, Venture Global Calcasieu Pass would construct an earthen berm on the west side of the site, and a floodwall on the east, north, and south sides of the site to minimize impacts associated with potential storm surge. The Pipeline would be protected from floodwaters, waves, and wind because it would be buried and coated. TransCameron Pipeline would design and construct the aboveground meter station at an elevation to minimize the potential impacts from flooding and sea level rise.

Based on the geologic conditions and setting, and the proposed mitigation and design criteria, we conclude that the Project would not significantly impact or be impacted by geologic conditions.

SOILS AND SEDIMENTS

Construction of the Project could affect soil resources by increasing the potential for erosion, compaction, and rutting. About 56.3 acres of soils in the Terminal site area are considered highly susceptible to erosion, while less than 1 acre of soils crossed by the pipeline is considered highly susceptible to erosion. Approximately 144 acres of soil impacted by construction of the Terminal and 291.8 acres of soil impacted by construction of the Pipeline would be prone to compaction. Venture Global would not impact prime farmland soils by construction or operation of the Terminal facility, and 23.5 acres of soils crossed by the Pipeline are prime farmland soils.

Venture Global would implement the mitigation measures contained in the Project-specific *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) to control erosion, enhance successful revegetation, and minimize any potential adverse impacts on soil resources. With implementation of the proposed mitigation measures and Project-specific plans, we conclude that impacts on soil resources would not be significant and would be adequately minimized.

WATER RESOURCES

Impacts on groundwater could occur during construction and operation activities at the Terminal site and Pipeline. However, pilings (associated with the Terminal construction) are not anticipated to be driven deep enough to have a direct impact on the underlying aquifer, and the other construction activities would involve shallow, temporary, and localized excavations that would not significantly affect groundwater. Spills or leaks of hazardous materials (e.g., fuel, lubricants) from equipment could also result in impacts on groundwater. However, with the implementation of the measures in the Project-specific Plan and Procedures and SPCC Plan, impacts on groundwater resources from construction and spills/leaks would be minimized to the extent possible.

Venture Global Calcasieu Pass would use existing municipal water supply sources and/or on-site groundwater wells to provide a portion of the required industrial and potable fresh water for the Terminal’s construction and operation. Seawater would be withdrawn from the Calcasieu River Ship Channel for LNG tank hydrostatic tests on the Terminal site property and pipeline construction would also use surface water sources (e.g., for hydrostatic testing, horizontal direction drilling [HDD] mud, and dust control). Because specific details for the Terminal’s long-term freshwater supply have not been finalized, we recommend that, prior to the end of the draft EIS comment period, Venture Global Calcasieu Pass complete additional aquifer testing, consult with the Louisiana Department of Environmental Quality (LDEQ), and finalize the source locations for the Terminal’s fresh water supply.

The turning basin would be within a Navigable Waterway under section 10 of the Rivers and Harbors Act of 1899 and a Water of the United States under the Clean Water Act of 1972. The primary impacts on water quality within this area would be from dredging and the suspension of sediments in the water column. These effects would be minor because they would be temporary and limited to the immediate area. Venture Global Calcasieu Pass would hydraulic dredge the turning basin with a suction cutter head to minimize turbidity and water quality impacts. Venture Global Calcasieu Pass evaluated the sediments to be dredged in accordance with the EPA/USACE testing manual and did not identify any evidence of contaminants.

Terminal facilities would permanently fill eleven waterbodies within the Terminal property boundary, resulting in 2.6 acres of permanent impact. Impacts on these surface waters would be mitigated through Venture Global Calcasieu Pass's Compensatory Mitigation Plan and Beneficial Use of Dredged Material Plan (CMP/BUDM).

Impacts from stormwater runoff and hydrostatic testing would not be significant because stormwater would be managed in accordance with the EPA requirements, and the Project-specific Plan and Procedures.

During operation of the Project, approximately 12 to 13 LNG carriers would call on the Terminal per month, each of which would discharge ballast water into the Calcasieu River Ship Channel during LNG loading. All LNG carriers are required to comply with federal ballast regulations to avoid and minimize impact of ballast water on the aquatic environment (USCG regulations at 33 CFR 151.2025). Further, Venture Global Calcasieu Pass would ensure that any visiting vessels possess documentation to demonstrate compliance with ballast water regulations and best management practices prior to allowing any ballast water to be discharged into the marine berthing area. Therefore, we conclude that significant impacts on surface waters would not occur as a result of ballast water discharge.

Construction of the Pipeline would cross 123 waterbodies, including 50 centerline line crossings and 73 crossings within the construction workspace but beyond the centerline. Thirty-five of the centerline crossings would be completed by the push method and one would be crossed by open-cut method. TransCameron Pipeline would conduct eight HDD operations (crossing 14 waterbodies) along the Pipeline. Use of the HDD method would avoid disturbance of the stream beds, banks, and riparian vegetation. In the event of an inadvertent release of drilling mud during an HDD crossing, TransCameron Pipeline would implement its HDD Contingency Plan. No active public or private drinking water supply wells are within 150 feet of the Pipeline; however, three active monitoring wells are approximately 80 feet north of the Pipeline's construction workspace near Milepost 4.8.

With implementation of the HDD method, HDD Contingency Plan, CMP/BUDM, Project-specific Plan and Procedures, and our recommendations, we conclude that impacts on water resources would be adequately minimized and not significant.

WETLANDS

Construction of the Terminal would result in the permanent loss of 140.8 acres of wetlands as a result of permanent fill placement and excavation of wetlands for the marine facilities, which largely would convert wetlands to open water as part of the proposed berthing area and turning basin. Nearly half of this permanent impact affects palustrine emergent wetlands, followed by palustrine scrub shrub, and estuarine emergent wetlands. Approximately 85 percent of the permanent wetland impact is from the Terminal site with the remaining 15 percent from access roads and marine facilities. Additionally, Venture Global Calcasieu Pass would require 45.6 acres of temporary wetland impacts within the Terminal site. Venture Global Calcasieu Pass designed the Terminal facilities to minimize wetland impact and would follow its Project-specific Procedures to further minimize impacts on wetlands. To mitigate unavoidable impacts on wetlands, Venture Global would comply with its CMP/BUDM Plan.

Construction of the Pipeline facilities would affect a total of 323.9 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 1.4 acres of this impact would result in permanent wetland loss as a result of fill placement for MLVs, meter stations, and permanent access roads. Following construction, the remaining disturbed areas would be restored and the permanent right-of-way maintained, in accordance with TransCameron Pipeline's Project-specific Procedures.

With the implementation of the Project-specific Procedures, CMP/BUDM, and our recommendations, we conclude that impacts on wetlands due to construction and operation of the Project have been minimized to the extent practicable and would be not be significant.

VEGETATION

Construction and operation of the Terminal facilities would permanently impact approximately 314 acres of vegetation, resulting in the loss or conversion of 304.8 acres of marsh, 0.2 acre of water, and 9.0 acres of non-marsh/other land.

Construction of the Pipeline would affect about 346.3 acres of vegetation, of which 1.5 acres would be permanently lost as it would be associated with aboveground facility sites and permanent access roads. Of the remaining 345.1 acres, 329.8 acres would be temporarily affected and 15.3 acres would be avoided by HDD. 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 or expanded 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 forest) was identified by the LDNR as potentially present in the Project area. During field surveys, TransCameron Pipeline observed that much of the Coastal Live Oak-Hackberry Forest areas no longer exist, as they have been heavily cleared to support cattle grazing and/or affected by storms and hurricanes. A small area of hackberry, with no associated live oak, identified as persisting (approximately 2–3 acres) would be permanently impacted by Terminal site construction. Because this natural community has been reduced to a remnant of what is recorded by the Louisiana Natural Heritage Program (LNHP), and current land use practices prevent natural regeneration of mature oak-hackberry forest cover, no mitigation is proposed.

Seven state-designated rare plant species are identified by the LNHP as potentially occurring within the Project area. Five occurrences were identified within the Terminal site; two of these locations would not be impacted by construction and three locations would be unavoidable and would be impacted by construction. Venture Global would conduct surveys to determine the presence or absence of the identified species; therefore, we recommend that, prior to the end of the draft EIS comment period, Venture Global file with the Secretary its plan to conduct outstanding surveys for state-designated rare plant species, correspondence from the LNHP, and any mitigation Venture Global would implement.

To minimize impacts of the Project on vegetative communities, Venture Global would construct and operate the Terminal and Pipeline in accordance with its Project-specific Plan and Procedures. With the implementation of the proposed mitigation measures and our recommendations, 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 Terminal and Pipeline could cause displacement, stress, and direct mortality of some individuals, construction and operation of the Terminal would not have significant long-term impacts on wildlife species due to the degraded wildlife habitat value provided by the site and the proposed mitigation for wetland impacts. Operation of the 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 Calcasieu River Ship Channel, most wildlife in the area are acclimated to the noise and artificial lighting associated with these activities. In addition, Pipeline operations require little lighting, activities, or other disturbances that would affect wildlife. Therefore, we conclude that Terminal and Pipeline operational impacts on wildlife would be minimized and not significant. Venture Global Calcasieu Pass and TransCameron Pipeline would implement the Project-specific Plans and Procedures to restore habitat following construction.

The vegetative communities in the Project area provide potential habitat for migratory bird species, including songbirds, waterbirds, and raptors. Much of the habitat associated with the 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 consists of wetlands, which provide habitat for waterfowl and other migratory birds. At the Terminal site and where practicable along the Pipeline, Venture Global Calcasieu Pass and TransCameron Pipeline would conduct clearing outside the migratory bird nesting window of March 1 to September 15. Where clearing cannot occur outside of the nesting window, Venture Global Calcasieu Pass and TransCameron Pipeline would conduct preconstruction surveys of the Project area. If active nests are detected, they would be avoided until young have fledged.

The Louisiana Department of Wildlife and Fisheries (LDWF) indicated that colonial waterbird nesting colonies occur within the Project area. The LDWF and FWS provided guidelines for preconstruction site visits and, if warranted, distance and timing restrictions. Because Venture Global has not yet committed to these measures, we recommend that it not begin construction activities until it conducts nesting bird colony surveys, utilizing appropriate survey methods, timeframes, and locations as determined in consultation with the LDWF and FWS. The LDWF noted four state wildlife species of concern in the Project area. We recommend that Venture Global consult with LDWF regarding surveys and additional mitigation measures for rare wildlife species with potential habitat in the Terminal and Pipeline Project area, and file that information for review and approval prior to construction.

With our recommendations and the implementation of the measures recommended by the FWS and LDWF, we conclude that impacts on wildlife, including migratory birds and colonial waterbirds, would be avoided or minimized.

Aquatic Resources

Construction of the Terminal berthing area and turning basin would require dredging/excavation of 94.1 acres (mostly in tidal estuarine habitat), driving steel pilings in water with vibratory and impact pile drivers, and installing docks and berthing structures. Potential impacts from these activities include increased sedimentation, turbidity, and noise levels, which could adversely affect aquatic resources. 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 Calcasieu River Ship Channel. In addition, Venture Global Calcasieu Pass would use a hydraulic dredge with a suction cutter head, which would minimize increased turbidity levels. 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 and maintenance dredging. We conclude that sedimentation and turbidity impacts on aquatic resources from dredging 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 Calcasieu Pass is considering 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. Because Venture Global Calcasieu Pass has not yet committed to any specific mitigation measures, we recommend it file a plan, prior to the end of the draft EIS comment period, to mitigate the effects of noise from pile driving activities in consultation with the National Marine Fisheries Service (NMFS), the FWS, and the LDWF.

During construction of the Pipeline, use of the HDD method to cross 14 waterbodies would avoid or minimize impacts on fisheries, fish habitat, and other aquatic resources, unless an inadvertent release of drilling mud were to occur. Should an inadvertent release occur, TransCameron Pipeline would implement the measures outlined in its HDD Contingency Plan to minimize potential impacts on aquatic resources. The use of push and open-cut crossing method for the remaining waterbodies would result in temporary loss or modification of aquatic habitat, increase sedimentation and turbidity, and alteration of vegetative cover. The majority of fish species present within the waterbody 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 and downstream of the crossing location. However, TransCameron Pipeline would implement the measures outlined in its Project-specific Procedures to minimize impacts on waterbodies and aquatic resources during Pipeline construction. In addition, we recommend that Venture Global consult with the LDWF regarding its proposed instream construction windows. Once construction is complete, streambeds and banks would be restored to their preconstruction conditions and contours to the maximum extent practicable. Operation of the Pipeline facilities would not affect aquatic resources. With implementation of the mitigation measures described above, we anticipate that the Pipeline would have minimal, localized, and not significant impacts on aquatic resources.

Terminal construction would impact approximately 83.3 acres of essential fish habitat (EFH) associated with the permanent filling of 3.4 acres of EFH for the marine berm and 79.9 acres of dredging/excavation of EFH along the shoreline and ship channel that would permanently convert the existing EFH to deeper water EFH habitat. Construction of the Pipeline would permanently fill approximately 1.3 acres of wetland that is considered EFH and would temporarily impact 56.9 acres of wetlands and other waterbodies considered EFH. These temporary construction impacts are expected to be 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, the SPCC Plan, and the HDD Contingency Plan. Therefore, we conclude that construction of Project would adversely affect EFH, but these adverse effects would be temporary. Permanent adverse effects on EFH would be offset by compensatory mitigation. We are requesting that the NMFS consider the EIS as our Essential Fish Habitat Assessment.

THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

Sixteen federally listed threatened and endangered species may occur in the Project area, including five sea turtles, one fish, one aquatic mammal, seven whales, and two birds. 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* the sixteen federally listed threatened and endangered species. 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 ESA 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 LDNR. To ensure compliance with this federal requirement, we recommend that Venture Global file the consistency determination with the Secretary, prior to any Terminal construction.

The majority of the Terminal facilities would be within agricultural and herbaceous land (31 percent), developed land (15 percent), and emergent wetland (44 percent) that is surrounded by open water and land that is currently occupied by or proposed for similar industrial activities. The proposed 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 Terminal. There are both existing and planned industrial developments within the vicinity of the Terminal. Due to the industrial use of adjacent land and the previously disturbed nature of the surrounding area, impacts on land use from the Terminal would be minor.

Terminal construction may temporarily impact recreational activities, including wildlife viewing, beach use, boating, recreational vehicle (RV) use, and fishing. The Davis Road Public Boat Launch and the Cameron Jetty Fishing Pier and RV Facility are within 0.25 mile of the proposed Terminal. A portion of Davis Road would be permanently closed for construction and operation of the Terminal facility. The boat launch would be removed as a result of the Terminal. The fishing pier and RV facilities would no longer be accessible by road. Cameron Parish Police Jury intends to relocate and develop new recreation locations in the Project area. Venture Global Calcasieu Pass is supporting the Cameron Parish Police Jury in its efforts to continue the public use of the Jetty Pier, and has entered into a Cooperative Endeavor Agreement (CEA) with Cameron Parish Police Jury to allow for continued public use of the facilities as Venture Global Calcasieu Pass develops the Terminal. To further this effort, we recommend that Venture Global Calcasieu Pass file with the Secretary any updates for the CEA and any updated correspondence with the Cameron Parish Police Jury. Dredging and excavation activities in the Calcasieu River Ship Channel may also temporarily impact recreational boat traffic throughout the 35-month construction period. During this time, material and equipment deliveries may delay or impede recreational boat traffic due to increased ship/barge traffic within the Calcasieu River Ship Channel. We have determined the Project would have some adverse impacts on recreation, including boating and fishing along the Calcasieu River Ship Channel and Gulf of Mexico. However, these impacts would be minimized with Venture Global Calcasieu Pass' proposed mitigation measures and our recommendation.

The presence of the Terminal and associated increased lighting would have an influence on visual resources. The location of the Terminal would be visible to users of the Calcasieu River Ship Channel, the fishing pier and RV facility, existing industrial businesses in the area, and visitors to nearby beaches. However, most of the activities and structures within the Terminal site would be obscured by the proposed perimeter berm and wall and the surrounding developed areas along the Calcasieu River Ship Channel are currently heavily lit by industrial facilities during the night-time hours.

The Pipeline is located entirely on private lands, and no public lands are within 0.25 mile of the site. There are currently no existing residences within 50 feet of the Pipeline and no planned commercial or industrial developments within 0.25 mile of the Pipeline. Land use impacts associated with the Pipeline would include disturbance of existing land use, the creation of new easements, and the conversion of 1.3 acres of land to a permanent aboveground facility. TransCameron Pipeline would restore all other lands affected by Pipeline construction to preconstruction contours, and would thus not result in a change in a significant change in land use. Therefore, impacts on land use from the Pipeline would be temporary and minor.

The Pipeline would cross the Creole Nature Trail National Scenic Byway twice. However, because Pipeline construction would be temporary, and the right-of-way would be restored to preconstruction conditions, there would be no long-term impact on the Creole Nature Trail National Scenic Byway. Therefore, the Pipeline would not adversely impact recreation or special use areas.

Construction and operation of the Pipeline may impact visual resources by altering the terrain and vegetation patterns during construction or right-of-way maintenance and from the presence of new aboveground facilities. The Pipeline would be buried and the right-of-way would be restored to preconstruction contours. Most of the vegetation disturbed is herbaceous and TransCameron Pipeline would allow it to return to preconstruction vegetation conditions; therefore, there would no long-term impact on visual resources from the Pipeline. TransCameron Pipeline would also install a meter station and MLV along the pipeline right-of way. The meter station and MLV would be adjacent to existing industrial facilities. Therefore, the meter station and MLV would not have a significant impact on visual resources.

SOCIOECONOMICS

Construction of the Project would result in minor positive impacts due to increases in construction jobs, payroll taxes, purchases made by the workforce, and expenses associated with the acquisition of material goods and equipment. Operation of the Project would have a positive effect on the local governments' tax revenues due to the increase in property taxes that would be collected. Construction of the Project would not have a significant adverse impact on local populations, employment, provision of community services, or property values. There would not be any disproportionately high or adverse environmental and human health impacts on low-income and minority populations from construction or operation of the Project.

Due to the rural nature of Cameron and Jefferson Davis Parishes, the currently available transient housing would not likely be sufficient to accommodate the maximum peak non-resident workforce, which would result in temporary impacts on housing availability in the Project area during peak construction. In recognition of a growing need for temporary worker housing, the southwest Louisiana Economic Development Alliance created a strategic plan for temporary housing for the local parishes. If all of the proposed housing projects were to be constructed, an additional 13,348 housing units would be available in the Project area, which would be more than sufficient to accommodate the Project needs.

Vehicle traffic is anticipated to temporarily increase substantially during construction of the Terminal due to worker vehicles, construction vehicles, and trucks taking materials and equipment to and from the site. To minimize the increase, Venture Global Calcasieu Pass would transport materials by barge to nearby existing aggregate storage and handling facilities prior to completion of the construction berth. Venture Global Calcasieu Pass would also address worker and material transport through off-site parking, shuttles, and infrastructure. To minimize disruption to local traffic flow and communities and to ensure that construction-related road use proceeds in a safe and efficient manner, we recommend that, prior to construction of the Terminal, Venture Global Calcasieu Pass file with the Secretary its updated Traffic

Management Plan for off-site parking and use of shuttles. Construction of the Pipeline would result in only minor, temporary impacts on traffic in the Project area, and operation would not result in any significant impacts on traffic or roadways.

A marine traffic study found that there was sufficient capacity in the Calcasieu River Ship Channel for an increase in vessels over the current vessel traffic and projected future increase in vessels. During construction, Venture Global Calcasieu Pass estimates that major material supplies and equipment would be delivered to marine construction support facilities with existing docks located close to the Terminal facilities; during operations, approximately 150 LNG vessels would call per year. The USCG issued the Letter of Recommendation for the Project, which stated that the Calcasieu River Ship Channel is considered suitable for LNG marine traffic in accordance with its guidance. During operations, security zones for LNG carriers in transit and use of exclusion zones would impact recreational and commercial fishing vessels within the Calcasieu River Ship Channel because they would be required to stay out of the security zone while the LNG carrier passes. After the moving security zone passes, recreational boaters and fishermen could return and continue their prior activities. Because the LNG vessels would be joining an existing convoy system, and consist of an additional three vessels a week, the Project would create only a slight increase in impacts on recreation and commercial fishing along the Calcasieu River Ship Channel.

CULTURAL RESOURCES

Compliance with section 106 of the National Historic Preservation Act of 1966 (NHPA) is complete for the Project. Surveys and evaluations are also complete. The State Historic Preservation Office (SHPO) concurred that no significant archaeological or historic resources would be affected by the proposed Project and SHPO made a determination of No Effect based on survey results.

AIR QUALITY AND NOISE

Air quality would be affected by construction and operation of the Project. Though air pollutant emissions would be generated by operation of equipment during construction of the Project facilities, most air emissions associated with the Project would result from the long-term operation of the Terminal. Cameron Parish is designated as unclassifiable for ozone (O_3), particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$), and nitrogen dioxide (NO_2). For all other criteria pollutants, Cameron Parish is considered to be in attainment.

The Project would not lead to impacts on any special national or regional natural, scenic, recreational, or historic value areas for which the Prevention of Significant Deterioration (PSD) regulations provide special protection. New facilities are required to obtain an air quality permit from the LDEQ, 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. TransCameron Pipeline 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 not identified the specific measures it would implement to control fugitive dust emissions during construction at the Terminal. Therefore, to ensure procedures are clear for compliance purposes, we recommend that Venture Global file a Fugitive Dust Control Plan, for review and approval prior to construction at the Terminal.

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

Mobile sources of operational emissions would include cars, trucks, and marine vessels associated with the 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 O_3 used the EPA's AERMOD to predict maximum short-term and annual concentrations. The modeling analysis and "culpability analysis" 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.

The PSD increment assessment was performed for annual NO_2, 24-hour and annual $PM_{2.5}$, and 3-hour sulfur dioxide, which are the pollutants for which modeled concentrations exceeded their respective Significant Impact Levels and for which both NAAQS and PSD increments have been established. All predicted concentrations are less than the corresponding PSD increments. Therefore, the Project would not cause or contribute to any PSD increment violations.

Venture Global performed additional assessments, based on the results of the NAAQS, of potential impacts from air emissions on Class I areas; 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 O_3 concentrations in the surrounding area, relative to the 8-hour O_3 NAAQS. The analysis determined that the addition of the modeled Project impact on background concentrations would not exceed either the 70 parts per billion 2015 O_3 NAAQS. Therefore, the Project would not cause or contribute to a violation of the O_3 NAAQS.

Pile driving, dredging, and internal combustion engines associated with Terminal construction would generate noise. Pile driving could produce peak sound levels perceptible above the background sound levels at the two nearest noise sensitive areas. Dredging activities are estimated to produce noise levels of approximately 80 decibels on the A-weighted scale (dBA) at a distance of 50 feet. Because pile driving and dredging activities could occur on a 24-hour per day basis, an increase in nighttime noise at the noise receptors can be expected. As a result, we recommend that Venture Global Calcasieu Pass file with the Secretary, prior to the end of the draft EIS comment period, a pile driving and dredging noise analysis identifying the existing and projected noise levels at the two noise sensitive areas. If noise levels would exceed a day-night average sound level (L_{dn}) of 55 dBA at either noise sensitive area, we further recommend Venture Global Calcasieu Pass file a mitigation plan and monitor the noise levels during the construction phase. Noise generated by other construction activities is not anticipated to be significant, and the proposed berm and floodwall around the Terminal would minimize the construction noise once they are constructed. Fans for heat exchangers, electric motor units, compressor units, and power plant generation units (among other facilities) would produce long-term Terminal operational noise.

Some of the Terminal facilities would be elevated up to 20 feet above the current ground level (e.g., compressor piping and air coolers) with limited intervening screening such as from the proposed berm or floodwall. With implementation of the mitigation measures identified in the noise analysis, the resulting noise at the noise sensitive areas would meet our criteria of an L_{dn} of 55 dBA. In order to ensure implementation of these measures, we recommend that Venture Global Calcasieu Pass file with the Secretary a noise survey after placing each phase of liquefaction blocks into service and after placing the entire 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 would be temporary and would vary as construction progresses along the corridor. Noise levels from HDD operations could exceed FERC's criteria of 55 dBA L_{dn} at some of the noise sensitive areas along the Pipeline. A number of best management practices are proposed by TransCameron Pipeline to help reduce the noise from the HDD activities. However, because HDD noise levels could still exceed FERC's criteria, we recommend that TransCameron Pipeline file with the Secretary an HDD noise analysis identifying the existing and projected noise levels at each noise sensitive area within 0.5 mile of the HDD entry and exit pits, as well as a mitigation plan to reduce projected noise levels. Minimal noise impacts are expected with Pipeline operation and would be limited to pipeline blowdown events during inspections or maintenance of the system. These events typically last between 20 minutes and 2 hours. Impacts would be infrequent and of limited duration, reducing the potential for long-term impacts.

Based on the analyses conducted and our recommendations, we conclude that operation of the Terminal and Pipeline would not result in significant noise impacts on noise sensitive areas.

RELIABILITY AND SAFETY

The proposed Project would be designed, constructed, operated, and maintained to meet or exceed USCG Safety Standards in 33 CFR 105 and 127, the DOT Minimum Federal Safety Standards in 49 CFR 192 and 193, and other applicable federal and state regulations. Based on our technical review of the preliminary engineering design, we conclude that, with the incorporation of our recommendations, the Front End Engineering Design presented by Venture Global Calcasieu Pass would include acceptable layers of protection or safeguards to reduce the risk of a potentially hazardous scenario from developing into an event that could impact the off-site public. Furthermore, we have made a number of recommendations to be implemented during construction and operation of the Terminal to enhance reliability and safety and further mitigate the risk of impact on the public. The proposed Pipeline would be constructed and operated in accordance with the DOT and other applicable standards; therefore, we have determined that the Pipeline would represent a minimal increase in risk to the nearby public.

In an October 5, 2017 letter to FERC staff, the DOT stated that it had no objection to Venture Global Calcasieu Pass' methodology for determining the candidate design spills used to establish the Part 193 siting requirements for the proposed Terminal. The USCG reviewed the suitability of the Calcasieu River Ship Channel, and issued a Letter of Recommendation (LOR) and LOR Analysis stating that the Calcasieu River Ship Channel should be considered suitable for the type and frequency of the LNG marine traffic associated with the proposed Project.

Based on the engineering design analysis, implementation of our recommendations, the design spill methodology reviewed by DOT for the Terminal, the LOR issued by the USCG for the LNG marine traffic in the Calcasieu River Ship Channel, and the regulatory requirements for the Pipeline and Terminal, we conclude that the Project would not result in significant increased public safety risks.

CUMULATIVE IMPACTS

Our analysis of cumulative impacts includes other projects in the vicinity of the proposed Calcasieu Pass Project that could affect the same resources as the proposed Project in the same approximate time frame. We conclude that, for most resources, the Project's contribution to cumulative impacts on resources affected by the Project would not be significant, or that the potential cumulative impacts of the Calcasieu Pass Project and the other projects considered would be minor or insignificant. Concurrent construction of the proposed Project and other projects in the area would result in increased workers in the area, which could result in a short-term impact on housing, particularly in Cameron Parish. Temporary housing, planned housing units (13,348) and the expectation that a majority of the workforce would be sourced from the local region would avoid significant cumulative impacts to housing. Concurrent construction and operation of the Project would also increase traffic, which could result in deficiencies in area roadway capacities. We conclude that the implementation of the proposed mitigation measures and our recommended mitigation measures would adequately reduce these impacts.

Concurrent construction and operation of the Calcasieu Pass Project and the other projects in the area would have a beneficial cumulative effect on revenues for the state and the local parishes due to expenditures for services and materials for the projects, increased expenditures by local workers, and expenditures by the non-local workforce and any family members accompanying the non-local workers. The parishes would also receive a substantial increase in property taxes from the projects.

The Calcasieu Pass Project, along with the other identified within the geographic scope and in combination with past and future emissions from all other sources, would contribute to increase the atmospheric concentration of greenhouse gases (GHGs) and incrementally contribute to future climate change impacts. However, we cannot determine the cumulative physical impacts on the environment caused by climate change, and therefore cannot determine whether the Project's contribution to cumulative impacts on climate change would be significant.

ALTERNATIVES CONSIDERED

We evaluated several alternatives to the proposed Project, including the No-Action Alternative, system alternatives for the proposed LNG facility and the proposed Pipeline, alternative Terminal configurations, alternative dredge disposal sites, alternative Pipeline routes, and process alternatives to liquefy LNG. 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 Terminal included 9 operating LNG import terminals with approved, proposed, or planned expansions to provide liquefaction capabilities and 17 approved, proposed, or planned stand-alone LNG projects. We cannot speculate or conclude that excess capacity would be available to accommodate the proposed action's purpose and need. Therefore, construction of this proposed Project as part of another site would likely require an expansion or new facility similar to the proposed facilities, resulting in environmental impacts similar to the proposed Project. Therefore, these systems alternatives would not offer a significant environmental advantage over the proposed Project.

We evaluated the proposed 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 proposed Project.

Two alternatives were considered for the beneficial reuse of dredged materials. One was the Oyster Lake Marsh Creation and Nourishment Project and a second alternative was the No Name Bayou Marsh

Creation Project. While these two alternative projects were considered as the most viable options, they have since secured government funding and have progressed through the planning stages of receiving other spoil material, thereby reducing the likelihood of spoil material from the Project being accepted at these sites.

One alternative pipeline route was evaluated during the early stages of the project application process. The original route that was proposed by TransCameron Pipeline was approximately 20.6 miles long, also trending due east between the Terminal site and the interconnect location. Although that route was shorter than the proposed Pipeline, it runs along the coast and has some significant disadvantages. Approximately 5 percent of the alternative would be within 200 feet of the upper beach line along the Gulf of Mexico, with no natural or man-made barrier to protect it from coastal storm erosion. Construction in this location would be closer to nesting shorebirds and turtles, including federally listed species. In addition, approximately 91 percent of this route would cross contiguous wetlands and would require 99 fewer surface water crossings than the proposed route, but would cross one major waterbody. This route was generally a greenfield route, with only 18 percent collocated along existing linear corridors (compared with the proposed route's 86 percent). We determined that the alternative would not provide a significant environmental advantage to the proposed Pipeline. We have not identified any other alignments that would offer significant environmental advantages, irrespective of engineering feasibility or cost.

There are numerous process alternatives to liquefying natural gas. In addition to efficiency, other criteria of importance include availability of natural gas, cost of construction and operation, and land use requirements. Several liquefaction technologies are currently available on the market and were considered by Venture Global Calcasieu Pass, including Propane Mixed Refrigerant (C3-MR) Process, Cascade Process, AP-X Process, Dual Mixed Refrigerant (DMR) Process, Nitrogen Expansion Process, PRICO® SMR Process, OSMR® Process, and IPSMR® Process. We have determined that none of the alternative processes offered any significant environmental advantages over the proposed IPSMR® Process.

CONCLUSIONS

We determined that construction and operation of the Project would result in adverse environmental impacts, but all impacts would be reduced to less-than-significant levels. This determination is based on a review of the information provided by Venture Global Calcasieu Pass and TransCameron Pipeline 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 to cross 14 waterbodies which would avoid direct impacts on these resources.

- Venture Global Calcasieu Pass and TransCameron Pipeline would mitigate wetland impacts associated with the construction and operation of the proposed Terminal and the Pipeline in accordance with the project-specific CMP/BUDM.

- The FERC staff would complete the process of complying with section 7 of the Endangered Species Act.

- The FERC staff has completed consultation under section 106 of the National Historic Preservation Act and implementing regulations at 36 CFR 800 prior and determined that no historic properties would be affected by the Project.

- Venture Global Calcasieu Pass and TransCameron Pipeline would comply with all applicable air and noise regulatory requirements during construction and operation of the Project.

- Venture Global Calcasieu Pass and TransCameron Pipeline 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; CMP/BUDM; and by implementing the Project-specific Plan and Procedures.

- Venture Global Calcasieu Pass would install a 31.5 foot storm surge wall around the perimeter of the Terminal to the north, east, and south and a 26-foot high berm on the west perimeter.

- The design spill methodology reviewed by DOT for the Terminal, the LOR issued by the USCG for the LNG marine traffic in the Calcasieu River Ship Channel, and the regulatory requirements for the Pipeline and 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 the FERC authorization.

In addition, we developed recommendations that Venture Global Calcasieu Pass and TransCameron Pipeline should implement to further reduce the environmental impacts that would otherwise result from construction and operation of the Project. Several recommendations require Venture Global to file updated information with the Secretary prior to the end of the draft EIS comment period. This information is necessary to ensure the final EIS is complete and provides the most up-to-date information on Venture Global Calcasieu Pass' ongoing efforts to minimize the impacts of the Project. For the remainder of recommendations, 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 are recommending 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 draft 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 Venture Global Calcasieu Pass, LLC's Calcasieu Pass Project (Project) in Cameron Parish, Louisiana.

On September 4, 2015, Venture Global Calcasieu Pass, LLC (Venture Global Calcasieu Pass) filed an application with the FERC in Docket No CP15-550-000 under section 3 of the Natural Gas Act (NGA) and under Title 18 of the Code of Federal Regulations, Parts 153 and 380 (18 CFR 153 and 380), to construct and operate a liquefied natural gas terminal (Terminal). Similarly, on the same day TransCameron Pipeline, LLC (TransCameron Pipeline) filed an application with the FERC in Docket No. CP15-551-000 under section 7 of the NGA and 18 CFR 153 and 380 to construct, operate, and maintain two pipeline laterals (the 23.4-mile-long East Lateral and the 19.2-mile-long West Lateral). On June 28, 2016, Venture Global filed an amendment to its application to remove the West Lateral pipeline as well as make minor workspace adjustments along the East Lateral pipeline (Pipeline). Both Venture Global Calcasieu Pass and TransCameron Pipeline are wholly owned subsidiaries of Venture Global LNG, Inc. (Venture Global). The two companies are referred to collectively in this EIS as Venture Global, where appropriate. Venture Global Calcasieu Pass seeks approval under the NGA to construct and operate the Terminal and TransCameron Pipeline seeks a Certificate of Public Convenience and Necessity (Certificate) to construct and operate a natural gas pipeline. This application was noticed in the *Federal Register* (FR) on September 24, 2015.

The FERC is the lead federal agency for the preparation of this EIS, and as such, we[4] prepared this EIS to assess the potential environmental impacts resulting from construction and operation of the Project in accordance with the National Environmental Policy Act of 1969 (NEPA). The Council on Environmental Quality regulations for implementing NEPA (40 CFR 1500–1508), and the FERC regulations for implementing NEPA (18 CFR 380).Several agencies cooperated in the development of this EIS. A cooperating federal agency has jurisdiction by law or special expertise with respect to environmental impacts associated with the proposal and is involved in the NEPA analysis. Cooperating agencies for the Project include: the U.S. Army Corps of Engineers (USACE), U.S. Coast Guard (USCG), U.S. Department of Transportation (DOT), U.S. Environmental Protection Agency (EPA), and U.S. Department of Energy (DOE). FERC consulted with the cooperating agencies throughout the pre-filing and application review phases of the Project. The cooperating agencies provided input on the Project during several conference calls and an interagency meeting held on February 6, 2015. The cooperating agencies had the opportunity to comment on the preliminary draft EIS. FERC consulted with those agencies about their comments and incorporated them into this EIS.

Figure 1.1-1 shows the general location of the proposed facilities, and figure 1.1-2 shows the proposed Terminal site, including five temporary construction support facilities—Liberty, Martin, Baker Hughes, DeHvCo, and Mudd. These proposed construction support facilities are addressed throughout this EIS.

1.1 REGULATORY BACKGROUND

On September 27, 2013, Venture Global received approval from the DOE's Office of Fossil Energy (DOE/FE) in FE Docket No. 13-69-LNG to export up to 5.0 million tonnes per annum (MTPA) of LNG to countries or nations with which the United States has free trade agreements (FTA countries or nations) over

[4] "We," "us," and "our" refer to the environmental staff of the FERC's Office of Energy Projects.

a period of 25 years. On October 10, 2014, Venture Global received approval from the DOE/FE in FE Docket No. 14-88-LNG to export an additional 5.0 MTPA of LNG to FTA nations over a period of 25 years. On June 17, 2015, Venture Global received approval from the DOE/FE in FE Docket No. 15-25-LNG to export an additional 2 MTPA of LNG to FTA nations over a 25 years. Venture Global also requested authorization from the DOE/FE to export these volumes of LNG to non-FTA nations, which is pending. With the current combined approvals from DOE/FE, Venture Global is authorized to export a total of 12 MTPA of LNG, which is equivalent to about 620 Bcf/yr.[5]

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[5] After completing pre-Front End Engineering and Design (pre-FEED), Venture Global determined that the peak potential liquefaction output will be as much as 12.0 MTPA. Accordingly, Venture Global submitted a new application to the DOE/FE to export an additional 2.0 MTPA of LNG. The peak liquefaction capacity of 12.0 MTPA is equivalent to 620 Bcf/yr of natural gas while the nameplate liquefaction capacity of 10.0 MTPA would be equivalent to 516.6 Bcf/yr under a lean gas supply scenario.

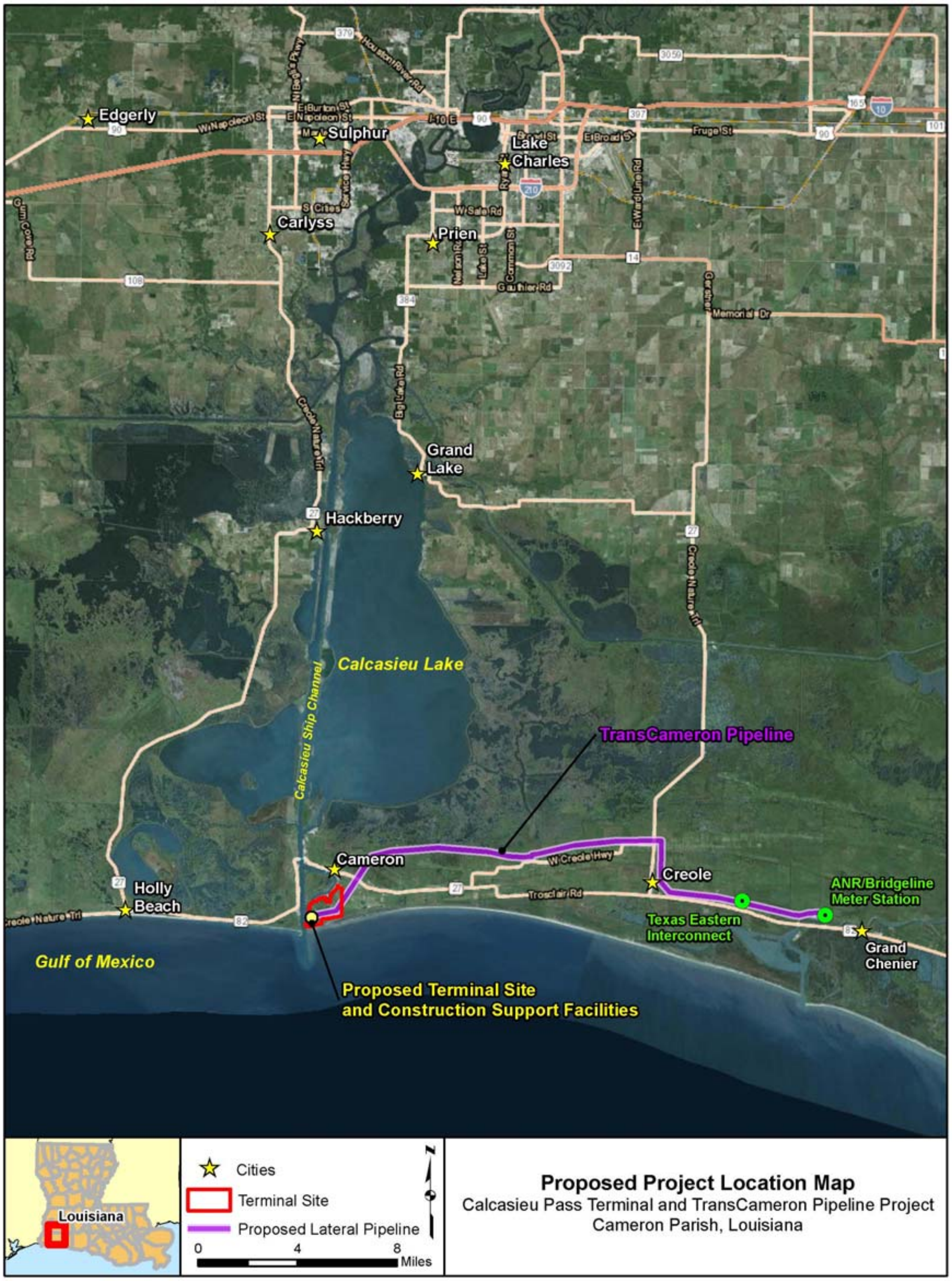

Figure 1.1-1 Proposed Calcasieu Pass Terminal and TransCameron Pipeline Location Map

Figure 1.1-2 Proposed Calcasieu Pass Terminal Site

1.2 PROJECT PURPOSE AND NEED

Venture Global states its Project's purpose is to produce LNG for export via ocean-going LNG carriers under the authorities granted it by the DOE/FE.

Under section 3 of the NGA, the FERC considers, as part of its decision to authorize natural gas facilities, all factors bearing on the public interest. Specifically, regarding whether to authorize import or export natural gas facilities, the FERC shall authorize the proposal unless it finds that the proposed facilities would not be consistent with the public interest.

Under section 7(c) 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 them. The Commission bases its decisions on technical competence, financing, rates, market demand, natural gas supply, environmental impact, long-term feasibility, and other issues concerning the proposed Project.

The Project has a water-dependency purpose as it relates to the liquefaction and subsequent exportation of domestic natural gas. LNG carriers would transport LNG to worldwide markets. The Project requires a marine berth for loading of LNG carriers for waterborne transport of LNG.

1.3 PURPOSE AND SCOPE OF THE EIS

The EIS describes the affected environment as it currently exists, the environmental consequences of the Project, and compares the Project's potential impacts with various alternatives. The EIS also presents our conclusions and recommended mitigation measures. The Commission will use the EIS as an element in its review of Venture Global's application to determine whether to authorize the Project.

Our principal purposes in preparing this EIS are to:

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

Topics addressed in this EIS include 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; transportation and traffic; cultural resources; air quality and noise; reliability and safety; and cumulative impacts. The EIS describes the affected environment of the facilities under the Commission's jurisdiction (i.e., the proposed Terminal and Pipeline) as it currently exists based on available information and the environmental consequences of construction and operation of the Project. It also compares the project's potential impact to that of various alternatives. Further, the EIS presents our conclusions and recommended mitigation measures. Minor non-jurisdictional facilities would also be constructed in association with the Project (see section 1.5).

Our description of the affected environment is based on a combination of data sources including desktop resources such as scientific literature and regulatory agency reports as well as field data collected by Venture Global.

When considering the environmental consequences of constructing and operating the Project, the duration and significance of potential impacts are described according to the following four levels:

- ***Temporary*** – impacts generally occur during construction, with the resources returning to preconstruction conditions almost immediately after construction;
- ***Short-term*** – impacts could continue for approximately 3 years following construction;
- ***Long-term*** – impacts would require more than 3 years to recover, but eventually would recover to preconstruction conditions; and
- ***Permanent*** – impacts could occur as a result of activities that modify resources to the extent that they may not return to preconstruction conditions during the life of the Project, such as with the construction of an aboveground facility.

1.3.1 Federal Energy Regulatory Commission

The FERC is the federal agency responsible for authorizing interstate pipeline facilities, LNG facilities on interstate pipeline systems, and LNG import and export terminals. The Commission would consider the findings in this EIS during its review of Venture Global's application. The identification of environmental impacts related to the construction and operation of the Project, and the mitigation of those impacts, as disclosed in this EIS, would be components of the Commission's decision-making process. The Commission would issue its decision in an Order. If the Project is approved, the Order would specify that the LNG terminal, Pipeline, and related facilities can be constructed and operated under the authority of Section 3 and Section 7 of the NGA. The Commission may accept the application in whole or in part, and can attach engineering and environmental conditions to the Order that would be enforceable actions to assure that the proper mitigation measures are implemented during construction and prior to the Project going into service.

1.3.2 U.S. Army Corps of Engineers

The USACE has jurisdictional authority pursuant to section 404 of the Clean Water Act (CWA) (Title 33 of the United States Code [USC], section 1344 [33 USC 1344]), which governs the discharge of dredged or fill material into waters of the U.S., and section 10 of the Rivers and Harbors Act (RHA) (33 USC 403), which regulates any work or structures that potentially affect the navigable capacity of a waterbody. The USACE must comply with the requirements of NEPA before issuing permits under these statutes. In addition, when a section 404 discharge is proposed and a standard permit is required, the USACE must consider whether the proposed section 404 discharge represents the least environmentally damaging practicable alternative pursuant to the CWA section 404(b)(1) guidelines. The USACE must also carry out its public interest review process before a standard permit can be issued. Although this EIS addresses environmental impacts associated with the Project as they relate to the USACE's jurisdictional permitting authority, it does not serve as a public notice for any USACE permits or take the place of the USACE's permit review process.

The proposed Project will also be regulated by the USACE under Section 14 RHA (408) due to the location on a USACE Federally maintained channel, necessitating a 33 USC 408 (Section 408) review. Section 14 RHA (Section 408) authorizes the Secretary of the Army to grant permission to any private, public, tribal, or other federal entities for the temporary or permanent alteration or use of a USACE Civil Works project, if the Secretary determines that the alteration or use will not be injurious to the public interest and will not impair the usefulness of the project. Projects requiring 408 permission and/or decisions, typically also entail endorsements/acceptance from the local sponsor(s), Port(s), and/or pilots associations.

1.3.3 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 Magnuson-Stevens Fishery Conservation and Management Act of 1976 (Magnuson-Stevens Act) (16 USC 1801), the Magnuson Action of 1950 (50 USC 191), the Ports and Waterways Safety Act of 1972, as amended (33 USC 1221, et seq.), and the Maritime Transportation Security Act of 2002 (46 USC 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 tanks. The USCG also has authority for LNG facility security plan reviews, approval and compliance verification as provided in 33 CFR 105, and siting as it pertains to the management of vessel traffic in and around LNG facilities to a point 12 nautical miles (nm) seaward from the coastline (to the territorial seas).

As required by its regulations, the USCG is responsible for issuing a Letter of Recommendation (LOR) and a LOR Analysis as to the suitability of the waterway for LNG marine traffic following a Waterway Suitability Assessment (WSA) that is submitted by Venture Global Calcasieu Pass. Following submittal to the USCG of its initial Letter of Intent, Venture Global Calcasieu Pass performed both a Preliminary- and Follow-On WSA as required by 33 CFR 127.007 and the USCG's Navigation and Vessel Inspection Circular – *Guidance Related to Waterfront Liquefied Natural Gas (LNG) Facilities* (NVIC 01-11). After reviewing the information in the Letter of Intent and WSA, and completing an evaluation of the waterway in consultation with a variety of state and local port stakeholders, the USCG issued its LOR on January 6, 2016 recommending that the Calcasieu River Ship Channel be considered suitable for LNG marine traffic associated with the proposed Project. Refer to section 4.12.8 of this draft EIS for additional information on the WSA and LOR.

1.3.4 U.S. Department of Transportation

The DOT has authority to enforce safety regulations and standards related to the design, construction, and operation of natural gas pipelines, under the Natural Gas Pipeline Safety Act under 49 CFR 192, Transportation of Natural or Other Gas by Pipeline: Minimum Federal Safety Standards.

The DOT's Pipeline and Hazardous Materials Safety Administration (PHMSA) has prescribed the minimum federal safety standards for LNG facilities in compliance with 49 USC 60101. These standards are codified in 49 CFR 193 and apply to the siting, design, construction, operation, maintenance, and safety of LNG facilities. The National Fire Protection Association (NFPA) Standard 59A (2001 Edition), *Standard for the Production, Storage, and Handling of Liquefied Natural Gas*, is incorporated in 49 CFR 193 by reference, with regulatory preemption in the event of a conflict. PHMSA also participates in vetting Venture Global's design spill methodology for compliance with 49 CFR 193 and NFPA 59A. In accordance with the 1985 Memorandum of Understanding (MOU) between the FERC and the DOT regarding the execution of each agency's respective statutory responsibilities, of LNG facilities.

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 marine carrier 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 respective regulations covering LNG facility siting, design, construction, and operation.

1.3.5 U.S. Environmental Protection Agency

The EPA has delegated water quality certification, under section 401 of the CWA, to the jurisdiction of individual state agencies (in this case the Louisiana Department of Environmental Quality [LDEQ]). The EPA also oversees the issuance of a National Pollutant Discharge Elimination System (NPDES) permit by the state agency, under section 402 of the CWA, for point-source discharge into waterbodies. In addition to its authority under the CWA, the EPA has jurisdictional authority under the Clean Air Act of 1970 (CAA) to control air pollution by developing and enforcing rules and regulations for all entities that emit toxic substances into the air. Under this authority, the EPA has developed regulations for major sources of air pollution and has delegated the authority to implement these regulations to state and local agencies. State and local agencies also develop and implement their own regulations for non-major sources of air pollutants.

In addition to its permitting responsibilities, the EPA is required under section 309 of the CAA to review and publicly comment on the environmental impacts of major federal actions, including actions that are the subject of EISs, and responsible for implementing certain procedural provisions of NEPA (e.g., publishing Notices of Availability of draft and final EISs to establish statutory timeframes for the environmental review process).

1.3.6 U.S. Department of Energy

The DOE/FE must meet its obligation under section 3 of the NGA to authorize the export of natural gas, including LNG, unless it finds that the export is not consistent with the public interest. By law, under section 3(c) of the NGA, applications to export natural gas to countries with which the United States has free trade agreements that require national treatment for trade in natural gas are deemed to be consistent with the public interest and the Secretary of Energy must grant authorization without modification or delay. As of June 17, 2015, Venture Global has received approval for all submitted applications to the DOE for export to FTA countries.

The purpose and need for the DOE/FE action for the current proposal is to respond to the applications for authority to export LNG from the Project to non-FTA countries filed by Venture Global with the DOE/FE (FE Docket Nos. 13-69-LNG, 14-88-LNG, and 15-25-LNG). In the case of LNG export applications to non-FTA countries, section 3(a) of the NGA requires the DOE/FE to conduct a public interest review and to grant the authorization unless the DOE/FE finds that the proposed exports would not be consistent with the public interest. The DOE/FE is conducting its review under section 3(a) of the NGA to evaluate Venture Global's applications for authorization to export up to 12 MTPA (620 Bcf/yr) of domestic natural gas as LNG for a 25-year period.

Additionally, NEPA requires the DOE/FE to consider the environmental impacts of its decisions on non-FTA export applications. In this regard, the DOE/FE is a cooperating agency in preparing this EIS. The DOE/FE has stated it will not make a decision on applications to export LNG to non-FTA countries until the DOE/FE has met all of its statutory responsibilities. In accordance with 40 CFR 1506.3, after an independent review of the final EIS, DOE/FE may adopt it prior to issuing a Record of Decision on Venture Global's application for authority to export LNG to non-FTA countries.

1.4 PUBLIC REVIEW AND COMMENT

1.4.1 Pre-filing and Public Scoping

Venture Global requested to enter the FERC pre-filing process for the Project on October 7, 2014. On October 10, 2014, the Commission staff granted Venture Global's request to use the pre-filing process and assigned Docket No. PF15-2-000 to the Project. The pre-filing process ended on September 4, 2015, when Venture Global submitted its application to the 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 the FERC.

During the pre-filing process, we conducted biweekly conference calls with Venture Global to discuss Project progress and identify and address issues and concerns that had been raised. Interested agencies were invited to participate on these calls. Summaries of the biweekly conference calls are available for viewing on the FERC eLibrary (http://elibrary.ferc.gov/idmws/search/fercgensearch.asp) under Docket No. PF15-2.

On December 11, 2014, FERC staff participated in a site visit to the proposed Terminal. Venture Global notified stakeholders and published a notice in the local newspapers of an open house. More than 100 interested parties attended the open house information session, which included landowners, agencies, other interested stakeholders, and FERC staff in Cameron, Louisiana. The open house provided stakeholders the opportunity to learn about the Project and ask questions in an informal setting. On January 20, 2015, the FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Calcasieu Pass Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Meeting* (NOI). The NOI was sent to over 700 interested parties including federal, state, and local officials; agency representatives; conservation organizations; local libraries and newspapers; and property owners at the Terminal site and along the Pipeline route (including a formerly proposed West Lateral segment which has since been removed from the Project). There was a 30-day comment period on the NOI that ended on February 19, 2015.

We received six comments in response to the NOI. Of these six comment letters received, one was a congressional letter expressing support for the Project, four were from federal or state agencies, and one was from a non-governmental organization.

On February 5, 2015, FERC staff participated in a field review of the lateral pipelines. That same day, the FERC conducted a public scoping meeting in Cameron, Louisiana to provide an opportunity for the public to learn more about the Project and provide comments on environmental issues to be addressed in the EIS. Twelve people provided verbal comments at the scoping meeting. A transcript of the scoping meeting was entered into the public record for the Project.[6]

On February 6, 2015, the FERC held an interagency scoping meeting to solicit comments and concerns regarding the Project from other jurisdictional agencies. Representatives from three state and federal agencies were present including the FERC, EPA, and Louisiana Department of Natural Resources (LDNR).

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[6] The transcript can be viewed on the FERC eLibrary under Accession Number 20150205-4005.

On May 15, 2015, the FERC issued a Project update to inform the public and agencies of the status of the FERC review process.[7]

On September 4, 2015, Global filed an application with the FERC, in Docket Nos. CP15-550-000 and CP15-551-000, to construct and operate the Terminal and Pipeline System (originally consisting of two laterals – the approximately 23.5-mile-long East Lateral and the approximately 19.2-mile-long West Lateral) to provide feed natural gas to the Terminal.

On June 28, 2016, Venture Global filed an amendment to its application to remove the West Lateral pipeline as well as make minor workspace adjustments along the East Lateral. Since filing the original application on September 4, 2015, Venture Global determined that the proposed East Lateral pipeline would provide sufficient capacity and flexibility to transport supplies from the interconnected U.S. natural gas grid to its proposed facility, and that capacity on the West Lateral is not needed.

On August 2, 2016, the FERC issued a *Supplemental Notice of Intent to Prepare an Environmental Impact Statement for the Proposed TransCameron Pipeline Project and Calcasieu Pass Terminal, and request for Comments on Environmental Issues Related to New Route Amendments and Project Changes* (Supplemental NOI). The main project changes listed in the Supplemental NOI included the elimination of the West Lateral Pipeline and reduction of Terminal site area. Other changes included minor work space and layout modifications, redesign and relocation of facilities, and removal of addition of facilities. The Supplemental NOI was sent to over 800 interested parties including federal, state, and local officials; agency representatives; conservation organizations; local libraries and newspapers; and property owners at the Terminal site and along the Pipeline route. Landowners along the formerly proposed West Lateral were included in the mailing to notify them of the removal of that part of the Project. There was a 30-day comment period on the Supplemental NOI that ended on September 1, 2016. We received three comments in response to the Supplemental NOI.

One comment was from the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS), Office of Sustainable Fisheries stating the agency's concerns regarding essential fish habitat (EFH) were still valid despite project modifications and that additional information would be necessary for a complete EFH assessment. Another letter was from the Louisiana Department of Wildlife and Fisheries (LDWF) wherein they provided their comments on the modified project, and the third was a letter from the EPA recommending that FERC utilize the "*Promising Practice Report*" in its consideration and analysis of Environmental Justice requirements.

On November 16, 2016, Venture Global hosted a second open house information session for landowners, agencies, and other interested stakeholders in Cameron, Louisiana. The open house provided stakeholders the opportunity to learn about changes to the Project and ask questions in an informal setting. Notification of the open house was mailed to stakeholders and published in local newspapers. More than 80 interested parties attended the open house, including landowners, elected officials, management officials, state and federal officials, and media and civic organization representatives.

Table 1.4.1-1 lists the environmental issues that were identified during the scoping processes described above, as well as comments received in response to our Notice of Application issued on September 18, 2015. Table 1.4.1-1 also indicates the section of this EIS in which each issue is addressed. Primary issues raised by the commenters related to potential impacts on water quality and wetlands,

[7] This document, as well as all public documents and comments submitted as part of the Project pre-filing and application processes, are available through the FERC eLibrary (http://elibrary.ferc.gov/idmws/search/fercgensearch.asp) under Docket No. PF15-2.

biological resources and habitats including protected species and EFH, invasive species, air quality, hazardous materials, cultural resources, socioeconomics, climate change, and sea level rise.

This draft EIS has been mailed to agencies, individuals, and organizations on the mailing list in appendix A and was filed with the EPA for issuance of a Notice of Availability in the Federal Register (FR).

TABLE 1.4.1-1

ISSUES IDENTIFIED AND COMMENTS RECEIVED DURING THE SCOPING PROCESS FOR THE CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

Issue/Specific Comment	EIS Section Addressing Comment
General	
Right of eminent domain	4.8.2.1
Project Design	
Incorporation of potential sea level rise/increased flooding in site design	4.12.5
Permits and Authorizations	
Permits/authorizations and compliance	1.6, Table 1.6.8-1
Alternatives	
Site alternatives	3.3
Pipeline Route Alternatives	3.6
Water Resources and Wetlands	
Impacts on surface waters, including water supply and water quality	4.3.2.2
Identification of impaired waters in the project area and impacts	4.3.2.1, 4.3.2.2
Impacts on groundwater	4.3.1.4
Consistency with stormwater permitting requirements	1.6
Impacts on wetlands, including avoidance, minimization mitigation	4.4.2
Placement of culverts in access roads in wetlands	4.4.2
Impact on marsh salinity	4.4.2.2
Project plans for dredging and dredged material disposal	2.6.3.3, 2.6.3.4
Wildlife and Aquatic Resources	
Presence of/Impacts on essential fish habitat (EFH)	4.6.3
Include fisheries resources	4.6.2
Impacts on migratory birds, including noise and light	4.6.1.3
Impacts on colonial nesting birds	4.6.1.3
Impacts on chenier habitat	4.6.1.3
Importance of wetlands as habitat for fisheries resources	4.6.2.1
Impact of liquefaction (cooling) system discharge on fish resources	4.6.2.1
Impact of noise from Terminal on wildlife	4.6.1.2
Vegetation and Special Communities	
Impacts on saltflat grass	4.5.4.2
Impacts on woolly honeysweet	4.5.4.2
Impacts on coastal live oak-hackberry forest	4.5.4.1
Introduction of invasive species	4.5.3
Threatened and Endangered Species	
Identify and assess impacts on threatened and endangered species and critical habitat in the project area, and other species of concern	4.6.1.3, 4.7.1
Concerns with impacts on endangered birds	4.7.1
Measures to avoid/minimize impacts on protected sensitive species	4.5.4.2, 4.6.1.3, 4.6.2.1, 4.7

TABLE 1.4.1-1

ISSUES IDENTIFIED AND COMMENTS RECEIVED DURING THE SCOPING PROCESS FOR THE CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

Issue/Specific Comment	EIS Section Addressing Comment
Land Use, Recreation, and Aesthetics	
Compliance with land use plans in project area	4.8.1.2
Potential impacts of hazardous wastes from Terminal	4.12.3
Impact on RV park and jetty pier, including recreational fishing	4.8.1.3
Transportation and Traffic	
Safe navigation in the Calcasieu River Ship Channel	4.9.12.1
Shoreline erosion from increased ship traffic	4.1.5.5, 4.2.1.1, 4.3.2.2, 4.6.2.1
Socioeconomics	
Environmental justice	4.9.11
Job creation	4.9.1, 4.9.2
Economic benefits to parish	4.9
Impacts on commercial fishermen	4.9.7
Cultural Resources	
Government-to-government/tribal consultation	4.10.1
Impact on cultural and historic resources	4.10
Air Quality	
Ambient air conditions	4.11.1.2
Project emissions	4.11.1.4, 4.11.1.5, 4.11.1.6
Greenhouse gases	4.11.1.2, 4.11.1.3
Indirect and Cumulative Impacts	
Potential for project to induce increased natural gas production	4.13.1.1

RV = recreational vehicle

1.5 NON-JURISDICTIONAL FACILITIES

Under Section 7 of the NGA, the FERC is required to consider, as part of a decision to authorize jurisdictional facilities, all facilities that are directly related to a proposed project where there is sufficient federal control and responsibility to warrant environmental analysis as part of the NEPA environmental review for the proposed project. Some proposed 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 proposed facilities, or they may be merely associated as minor components of jurisdictional facilities that would be constructed and operated as a result of authorization of the proposed facilities.

The jurisdictional facilities for the Project include the Terminal and Pipeline and are discussed extensively throughout this EIS. Three non-jurisdictional facilities were identified in association with the proposed Project: an electric utility connection, a water connection, and a potential recreational facility. These non-jurisdictional facilities would be constructed in compliance with applicable federal and state regulations.

1.5.1 Short-Term Electric Utility Connection

The Project would require a short-term utility connection to the Entergy Corporation's existing electric distribution line along Davis Road. The utility connection would be within the proposed construction workspace at the Terminal site. No additional area would be disturbed to complete this connection. The local electric supply would be utilized only during construction of the Terminal. Venture

Global Calcasieu Pass would construct a 720 megawatt (MW) gas-fired power plant as part of the Project, which would be considered part of the jurisdictional facilities. Once the Terminal's power plant is operating, the connection to the local utility would be discontinued. This electrical connection would have no environmental impacts beyond what is included in the impacts of the jurisdictional facilities discussed in this EIS.

1.5.2 Water Line Connection

The Project would require a connection to an existing water line owned and operated by Cameron Parish Water Works Division along Davis Road. The water line connection would be within the proposed construction workspace at the Terminal site. No additional area would be disturbed to complete this connection. This water line connection would have no environmental impacts beyond what is included in the impacts of the jurisdictional facilities discussed in this EIS.

1.5.3 Recreational Facility

The existing Davis Road provides access to the Cameron Jetty Pier Facility at its southern terminus. The proposed Project will remove a portion of Davis Road thereby making the Jetty Pier inaccessible via its current alignment. The Davis Road Public Boat Launch and the Cameron Jetty Fishing Pier and RV Facility are located within 0.25 mile of the Terminal site. Access to these facilities would be removed to allow for construction and operation of the Terminal site. Venture Global Calcasieu Pass is supporting Cameron Parish in its efforts to continue the public use of the Jetty Pier and is coordinating with the Parish in review of plans to develop alternate access to these facilities (e.g., a water shuttle service), and to potentially relocate the RV Facility to another location north of the Terminal site. The location of the road reroute and access changes have not yet been finalized.

1.6 PERMITS, APPROVALS, AND REGULATORY REVIEWS

As federal agencies, the FERC and USACE are required to comply with a number of regulatory statutes including, but not limited to NEPA, section 7 of the Endangered Species Act of 1973 (ESA), the Magnuson-Stevens Act, the RHA, section 106 of the 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 document.

Major permits, approvals, and consultations for the Project are identified in table 1.6.8-1 and discussed below. Venture Global would be responsible for obtaining all permits and approvals required to construct and operate the Project, regardless of whether they appear in this table. The FERC encourages cooperation between applicants and state and local authorities, but this does not mean that state and local laws may prohibit or unreasonably delay the construction or operation of facilities approved by the FERC. Any state or local permits issued with respect to jurisdictional facilities must be consistent with the conditions of any authorization issued by the FERC.

1.6.1 Endangered Species Act

Section 7 of the ESA, as amended, states that any project authorized, funded, or conducted by any federal agency (e.g., FERC) 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 USC section 1536(a)(2)(1988)). The FERC, or Venture Global as a non-federal representative, is required to consult with the U.S. Fish and Wildlife Service (FWS) and NMFS to determine whether any federally listed or proposed endangered or threatened species or their designated critical habitat occur in the vicinity of the Project. If the FERC determines that these species or habitats may be impacted by the Project, the FERC is required to prepare a Biological Assessment (BA) to identify the nature and extent of adverse impact, and to recommend measures to avoid or reduce potential impacts on the habitat and/or species (see section 4.7.1, Federally Listed Threatened and Endangered Species, of this EIS for the status of our compliance with section 7 of the ESA).

1.6.2 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a federal fisheries management plan. The Magnuson-Stevens Act requires federal agencies to consult with the NMFS on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely impact EFH (Magnuson-Stevens Act section 305(b)(2)). Although absolute criteria have not been established for conducting EFH consultations, NMFS recommends consolidating 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, the FERC has prepared an EFH Assessment included in section 4.6.3, Essential Fish Habitat, of this EIS.

1.6.3 Rivers and Harbors Act

The RHA pertains to activities in navigable waters as well as harbor and river improvements. Section 10 of the RHA prohibits the unauthorized obstruction or alteration of any navigable water of the U.S. Construction of any structure or the accomplishment of any other work affecting course, location, condition, or physical capacity of waters of the U.S. must be authorized by the USACE (see section 4.3.2.2, Surface Water Impacts and Mitigation, for the status of compliance with the RHA).

1.6.4 Clean Water Act

The CWA, as amended, regulates the discharges of pollutants into waters of the U.S. and regulates quality standards for surface waters. Both the EPA and the USACE have regulatory authority under 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 U.S. 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 U.S. and is under the jurisdiction of the USACE. The status of NPDES and section 404 permitting requirements are further addressed in sections 4.3.2.2, Surface Water Impacts and Mitigation, and 4.4, Wetlands, of this EIS.

Section 401 of the CWA requires that an applicant for a federal permit who conducts any activity that may result in a discharge to waters of the U.S. 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.

1.6.5 Clean Air Act

The CAA, as amended, regulates air emissions from stationary and mobile sources, and defines the EPA's responsibilities for protecting and improving the nation's air quality and the stratospheric ozone (O_3) layer. Among other things, the law authorizes the EPA to establish National Ambient Air Quality Standards

(NAAQS) to protect public health and public welfare, sets limits on certain air pollutants, and limits emissions of air pollutants coming from sources such as industrial facilities. The EPA has delegated the authority to implement these regulations to the LDEQ, Air Permits Division in Louisiana.

LDEQ is responsible for issuing Title V operating permits in accordance with 40 CFR 70 and as incorporated into Louisiana Administrative Code (LAC) 33:III.507. On November 8, 2010, the EPA signed a rule that finalizes reporting requirements for the petroleum and natural gas industry under 40 CFR 98. Air quality is further addressed in section 4.11.

1.6.6 National Historic Preservation Act

Section 106 of the NHPA, as amended, requires the FERC to take into account the impacts of its undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. Historic properties include precontact or historic sites, districts, buildings, structures, objects, or properties of traditional religious or cultural importance listed in or eligible for listing in the National Register of Historic Places (NRHP). In accordance with the regulations for implementing section 106, at 36 CFR 800.2(a)(3), the FERC staff is using the services of the applicant to prepare information, analyses, and recommendations. However, we remain responsible for all findings and determinations. We have and will follow the process of complying with section 106 outlined in Part 800 by consulting with the Louisiana Department of Culture, Recreation and Tourism, Division of Archaeology (Louisiana State Historic Preservation Office or SHPO), identifying historic properties in the area of potential effect and assessing potential project effects. Section 4.10 of this EIS summarizes the status of our compliance with the NHPA.

1.6.7 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 they would meet their obligations and responsibilities in managing their coastal areas. In the State of Louisiana, the LDNR's Office of Coastal Management (OCM) is the agency responsible for administering its Coastal Zone Management Program (CZMP). Because section 307 of the CZMA requires federal agency activities to be consistent to the maximum extent practicable with the enforceable policies of a CZMP, the FERC is using Venture Global's assistance to seek a determination of consistency with Louisiana's CZMP. Sections 4.8.1.5, Coastal Zone Management, and 4.8.2.5, Coastal Zone Management, of this EIS summarize compliance with the CZMA.

1.6.8 National Flood Insurance Act

The National Flood Insurance Act of 1968 (NFIA) created the National Flood Insurance Program and delegated authority to manage the program to the Federal Emergency Management Agency (FEMA). The purpose of the NFIA was to make flood insurance available, improve floodplain management, and develop maps of flood hazard zones. State and local governments must implement floodplain management regulations consistent with the federal criteria outlined in 44 CFR 60, *Criteria for Land Management and Use*. Participating local governments in flood-prone areas, as designated by FEMA, agree to adopt and enforce ordinances that meet or exceed FEMA requirements to reduce the risk of flooding. Additional information regarding flood risks and compliance with the NFIA is provided in section 4.1.5.6, Flooding, and 4.12.5, Technical Review of the Preliminary Engineering Designs, of this this EIS.

TABLE 1.6.8-1

MAJOR PERMITS, APPROVALS, AND CONSULTATIONS FOR THE CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

Agency	Regulation/Permit/Approval	Project Applicability	Authorization/Interaction Required	Submission Date/Status
Federal				
Federal Energy Regulatory Commission (FERC)	Authorization under section 3(a) of the NGA Certification under section 7(c) of the NGA	Terminal and Pipeline	Authorization and Certificate	Submittal of Application: September 4, 2015
U.S. Army Corps of Engineers (USACE)	Section 404 of the CWA	Terminal and Pipeline	Section 404/10 Individual Permit and section 408 Approval/Coordination	Joint Permit Application (JPA) submitted August 28, 2015; Revised JPA submitted July 8, 2016; Revised JPA submitted on September 8, 2017
	Section 10 of the Rivers and Harbors Act	Terminal and Pipeline	Permit	JPA submitted on August 28, 2015; Revised JPA submitted July 8, 2016; Revised JPA submitted on September 8, 2017
	Section 408 authorization for work in federal project waters and federally navigable waters (33 USC section 408)	Terminal and Pipeline	Approval/ coordination for dredge material disposal	Request for section 408 authorization (with JPA): August 28, 2015; Submittal of Revised JPA: July 8, 2016; Submittal of Revised JPA: September 8, 2017
U.S. Coast Guard (USCG)	33 CFR 105; 33 CFR 127; Maritime Transportation Security Act Waterfront Facilities Handling LNG and Liquefied Hazardous Gas (33 CFR 127), which includes Letter of Intent submission (33 CFR 127.007), Waterway Suitability Assessment consultation, and LOR from the USCG (33 CFR 127.009)	Terminal	LOR	LOR received January 6, 2016
U.S. Fish and Wildlife Service, Southeast Region (FWS)	Section 7 of the ESA; Migratory Bird Treaty Act; Fish and Wildlife Coordination Act	Terminal and Pipeline	Threatened and Endangered Species Consultation	Concurrence received by Venture Global September 16, 2016; updated November 1, 2016. FERC is consulting with FWS
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS)	Section 7 of the ESA; Marine Mammal Protection Act; section 305 of the Magnuson-Stevens Act; Fish and Wildlife Coordination Act	Terminal and Pipeline	Marine Threatened and Endangered Species Consultation; EFH Consultation	Initial letter sent August 5, 2015. Consultation is ongoing

TABLE 1.6.8-1

MAJOR PERMITS, APPROVALS, AND CONSULTATIONS FOR THE CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

Agency	Regulation/Permit/Approval	Project Applicability	Authorization/Interaction Required	Submission Date/Status
U.S. Department of Energy, Office of Fossil Energy (DOE/FE)	Section 3 of the NGA	Terminal	Authorizations to export LNG to FTA countries	Authorizations received September 23, 2013, October 10, 2014, June 17, 2015, and July 21, 2016
			Authorization to export LNG to non-FTA countries	Requests filed May 2013; May 2014, and February 2015. Authorization Pending
U.S. Department of Transportation (DOT) – Federal Aviation Administration (FAA)	14 CFR 77 – Notice of Proposed Construction Possibly Affecting Navigable Air Space	Terminal	Notice	Determination of No Hazard to Air Navigation received February 1, 2017
U.S. DOT Pipeline and Hazardous Materials Safety Administration (PHMSA)	49 CFR 193 NFPA 59A (2001 Edition)	Terminal	Letter of Opinion	Letter of Opinion received October 4, 2017
Native American Tribes				
Alabama-Coushatta Nation of Texas	Consultation	Terminal and Pipeline	Project Notification and Comments	Introductory letter September 2014; no response
Chitimacha Tribe of Louisiana	Consultation	Terminal and Pipeline	Project Notification and Comments	Introductory letter September 2014; Response of no impact received March 2015
Jena Band of Choctaw Indians	Consultation	Terminal and Pipeline	Project Notification and Comments	Introductory letter September 2014; Tribe requested survey reports April 2015; reports sent through January 2017
Coushatta Tribe of Louisiana	Consultation	Terminal and Pipeline	Project Notification and Comments	Introductory letter September 2014; no response
Tunica-Biloxi Indians of Louisiana	Consultation	Terminal and Pipeline	Project Notification and Comments	Introductory letter September 2014; no response
Choctaw Nation of Oklahoma	Consultation	Terminal and Pipeline	Project Notification and Comments	Introductory letter September 2014; Tribe requested government-to-government consultation April 2015; no objection letter received March 2016 (for Phase II marine survey report)
Mississippi Band of Choctaw Indians	Consultation	Terminal and Pipeline	Project Notification and Comments	Introductory letter September 2014; Response of no impact received March 2015

TABLE 1.6.8-1

MAJOR PERMITS, APPROVALS, AND CONSULTATIONS FOR THE CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

Agency	Regulation/Permit/Approval	Project Applicability	Authorization/Interaction Required	Submission Date/Status
State				
Louisiana Department of Environmental Quality (LDEQ)	Section 401 of CWA	Terminal and Pipeline	Water Quality Certification	Application submitted August 28, 2015; Revised application submitted July 8, 2016; Revised application submitted on September 8, 2017; Anticipated in 2018 (Concurrent with USACE)
	Hydrostatic Test Water Discharge (Louisiana Revised Statute 30:2001 et seq.)	Terminal and Pipeline	General Permit	NOI submittal anticipated Late 2018/Early 2019 (for LNG tanks) and Late 2018/Early 2019 (for pipeline)
	Section 402 of CWA	Terminal	Industrial Wastewater Discharge Permit	Anticipated application submittal: Late 2019/Early 2020; Permit anticipated Late 2019/ Early 2020
	LPDES General Stormwater Discharge Permit for Large Construction/SWPPP (LAC 33, Chapter IX)	Terminal and Pipeline	Approval	Anticipated submittal of NOI: 2018
	Title V and Prevention of Significant Deterioration Air Permits 40 CFR 70	Terminal	Air Quality Permit	Application submitted August 31, 2015; Submittal of Title V and PSD permit addendum: February 15, 2017; Anticipated receipt of Title V and PSD permit: 2018
Louisiana Department of Natural Resources (LDNR)	Louisiana Revised Statute 49:214.25	Terminal and Pipeline	Coastal Use Permit	JPA submitted August 28, 2015; Revised JPA submitted July 8, 2016; Addendum II submitted February 15, 2017. Submittal of Revised JPA: September 8, 2017. Permit anticipated concurrent with USACE permit (see above)
Louisiana Department of Wildlife and Fisheries (LDWF)	Threatened and Endangered Species Consultation	Terminal and Pipeline	Consultation	Concurrent with LDNR Coastal Use Permit issuance
Louisiana Department of Culture, Recreation, and Tourism – Division of Archaeology	NHPA	Terminal and Pipeline	Cultural Resources Comments	Comments received January 20, 2015 through June 27, 2016

TABLE 1.6.8-1

MAJOR PERMITS, APPROVALS, AND CONSULTATIONS FOR THE CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

Agency	Regulation/Permit/Approval	Project Applicability	Authorization/Interaction Required	Submission Date/Status
Louisiana State Land Office, Division of Administration	Water Bottoms Permit Louisiana Revised Statute 41:1131 and 41:1701 through 1714)	Terminal	Permit	Submittal of permit application: Summer 2017 Anticipated receipt of permit: 2018
Local				
Cameron Parish Police Jury	Development Permit	Terminal and Pipeline	Permit	Anticipated application submittal: late 2017/early 2018; Permit anticipated late 2017/early 2018

Note: The JPA is a combined permit application that covers CWA Section 404, Rivers and Harbors Act Section 10, LDNR Coastal Zone Consistency, and CWA 401 Water Quality Certification (the USACE forward a copy of the JPA to LDEQ for this certification).

PSD = Prevention of Significant Deterioration; SWPPP = Stormwater Pollution Prevention Plan

2.0 PROPOSED ACTION

Venture Global Calcasieu Pass proposes to construct and operate an LNG export facility in Cameron Parish, Louisiana adjacent to the Calcasieu River Ship Channel. The facility would receive natural gas from North American sources, liquefy the natural gas, and store and export the LNG. The Project would process about 620 Bcf/yr of natural gas.

Additionally, TransCameron Pipeline would construct and operate a new 42-inch-diameter natural gas lateral pipeline from the Terminal site to an interconnect point east of the site. The Pipeline would transport natural gas from three major interstate natural gas pipeline transmission systems to the Terminal site for liquefaction and export.

Figure 1.1-1 provides a general location map of the proposed facilities, and the proposed site boundary is depicted on figure 1.1-2. Maps of the overall project facilities, and detailed maps of the Pipeline and Pipeline access roads, are found in appendices B-1, B-2, and B-3. The following sections describe the proposed facilities associated with the Project, construction procedures and schedule, environmental compliance and monitoring procedures, and land requirements.

2.1 TERMINAL FACILITIES

The Terminal would include liquefaction facilities, LNG storage facilities, a 720 MW electric generating plant, a marine terminal consisting of a turning basin and LNG carrier berths, LNG piping, transfer lines, loading facilities, and other infrastructure.

2.1.1 Gas Gate Station

Natural gas entering the Terminal through the lateral Pipeline would pass through a gas gate station within the Terminal property. The proposed gas gate station would consist of:

- liquid separators and filters;
- metering facilities;
- connection to gas supply for the fuel gas system;
- flow control and pressure regulators;
- gas analyzers;
- isolation and emergency shutdown (ESD) valves; and
- gas booster compressors (as required).

2.1.2 Pretreatment Facilities

The pretreatment process is designed to remove trace constituents from the feed gas to enable the liquefaction process to proceed and to meet customer specifications for LNG quality. Natural gas characteristically contains very small quantities of heavy hydrocarbons, carbon dioxide (CO_2), hydrogen sulfide (H_2S), and water. The presences of these constituents has no significant effect on operation efficiency when the gas is used as an energy source, but can negatively affect liquefaction equipment and product purity during LNG production. Proposed pretreatment facilities include three pretreatment blocks fed by common boost compressors, each including:

- an acid gas pretreatment system to remove CO_2 and H_2S; and
- a gas dehydration system to remove water.

2.1.3 Liquefaction Facilities

During scoping a member of the public asked if the Terminal's cooling system would be open or closed. The liquefaction system is an air-cooled mixed-refrigerant (MR) cycle (i.e., Closed System) with minimal water withdrawal or discharges. The system would include nine integrated pre-cooled single mixed refrigerant (SMR) liquefaction blocks. The plant includes a set of refrigerant storage vessels that serve all liquefaction units. Each block would consist of:

- two SMR liquefaction units. Each SMR liquefaction unit includes:
  - a multi-stage MR compressor;
  - MR vapor and liquid separator vessels;
  - brazed aluminum heat exchanger (BAHX); and
  - multiple fin-fan units to provide air cooling for partial condensing of compressor discharge;
- refrigerant make-up system;
- removal unit for heavy hydrocarbons (pentane and heavier); and
- distribution piping between the refrigerant storage site and liquefaction blocks.

Venture Global would treat any waste water through the waste water treatment system prior to discharge.

2.1.4 LNG Storage Facilities

On-site storage of LNG would consist of the following:

- two full-containment LNG storage tanks, each with a usable capacity of approximately 200,000 cubic meters (m^3);
- LNG impoundment basin;
- four LNG storage tank send-out pumps and one LNG recirculation pump per storage tank; and
- approximately 5,000 feet of aboveground cryogenic piping between the tank, LNG pumps, and the two LNG loading docks.

2.1.5 Boil-off, Flash, and Gas Relief Systems

Venture Global Calcasieu Pass proposes the following:

- multiple electric-motor driven boil-off gas compressors for recovering vapors generated from tank and pipeline heat leak, displaced gas from ship filling, and liquefaction flash gas (recovered gases would be used as fuel by the Project's electric power generation facility); and
- a flare and associated piping for venting of purge gas during plant start-up and venting/flaring of gas during emergency operational situations.

2.1.6 Turning Basin

Venture Global Calcasieu Pass proposes to develop a 1,500-foot by 3,000-foot turning basin by dredging and excavating, as necessary, adjacent to the Calcasieu River Ship Channel and along the current shoreline of the LNG berthing area at the Terminal site.

2.1.7 LNG Berthing Area

Venture Global Calcasieu Pass proposes two LNG berthing docks in a common recessed berthing area. Each dock would be designed to handle LNG carriers between 120,000 to 210,000 m^3 cargo capacity and feature:

- one loading platform, which would include:
  - three LNG loading arms;
  - one vapor return arm;
  - service crane;
  - berthing fenders;
  - mooring hooks and tension system;
  - berthing monitoring systems;
  - fire protection equipment with fire water monitor towers;
  - LNG cryogenic piping and spill collection troughs;
  - causeway for land access; and
  - gangway for ship access
- four berthing dolphins;
- six mooring dolphins;

- walkways connecting the dolphins and the loading platform; and
- LNG spill collection system.

2.1.8 Power Generation and Electric Supply

Venture Global Calcasieu Pass proposes to generate power at the Terminal site, requiring the following facilities:

- a 720 MW natural gas-fired combined cycle gas turbine electric generation facility, featuring air-cooled steam condensers and electric substation;
- uninterruptible power supply system;
- two black-start diesel-fired electric generators (and one spare), each providing 4 MW of power;
- nine emergency backup power generators ranging from 350 to 1,025 kilowatts;
- diesel fuel storage tanks with a capacity of 65,580 gallons for the generators listed above;
- fuel gas system; and
- low capacity local utility interconnection for electric power during construction.

2.1.9 Systems and Buildings

The Terminal site would also include the following systems and buildings necessary for the safe and efficient operation of the Terminal.

Safety and Security Systems:

- ESD valves to prevent escalation of hazards from accidents or equipment failure;
- spill and leak containment and alarm systems for LNG and other liquids;
- flammable gas, fire, and spill detection systems in combination with manual alarm call points; and
- fire protection systems in buildings with:
  - heat detection;
  - smoke detection;
  - manual alarm call points;
- firewater delivery systems (electrical and diesel pumps) with combined fresh water and seawater loop and hydrants; and
- inert gas for critical electrical/electronic risk in substations and control room.

Utility Systems

- instrument and service air system;
- nitrogen system;
- hot oil system;
- water supply system for potable use, amine make-up, power island boiler make-up, and construction;
- sanitary sewer system;
- stormwater drainage and containment system; and
- communication systems.

Buildings

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

Civil Facilities and Common Infrastructure

- elevation and augmentation of soils;
- piles and/or stone columns;
- earthen berm on Terminal site perimeter;
- main plant roads (graveled);
- temporary concrete batch plant; and
- temporary equipment storage and laydown areas.

2.1.10 Construction Support Facilities

The Project would require the use of five temporary construction support facilities. These facilities include the Liberty Support Facility, the DeHyCo Support Facility, the Baker Hughes Support Facility, the Mudd Support Facility, and the Martin Support Facility. The use of these existing facilities would support many activities and would require some maintenance and repair to ensure the docks at the support facilities are capable to serve their intended role in support of the Project. No dredging would be required for these maintenance and repair activities. Necessary federal, state, and local authorizations for these activities would be obtained through the appropriate agencies. Use of the existing dock facilities associated with the Construction Support Facilities (Liberty Support Facility, Martin, and DeHyCo) may require repair or maintenance as necessary to prepare the docks for receipt of heavy equipment anticipated for the Project. Venture Global Calcasieu Pass anticipates that the marine dock repair work will be addressed in a separate permit application and authorized by the LDNR through a coastal use permit and by the USACE through a general permit and is thus not included in this application.

2.2 PIPELINE FACILITIES

2.2.1 Natural Gas Pipeline

TransCameron Pipeline proposes to construct a natural gas lateral Pipeline to bring feed gas to the Terminal site. The lateral Pipeline would be 42 inches in diameter with a transmission capacity of approximately 2.1 billion cubic feet per day and a maximum allowable operating pressure (MAOP) of 1,200 pounds per square inch gauge (psig). The 23.4-mile-long lateral Pipeline would bring feed gas from interconnections with ANR Pipeline Company (ANR), Texas Eastern Transmission, LP, and Bridgeline Holdings, LP (Bridgeline) to the Terminal site.

2.2.2 Appurtenant Facilities

TransCameron Pipeline proposes to construct the following facilities to enable operation of the proposed lateral Pipeline:

- one meter station with pressure regulating valves for receipts from ANR and Bridgeline near Grand Chenier Station in Cameron Parish, Louisiana;
- three mainline valves (MLVs) on the Pipeline;
- one pig launcher[8] at the meter station; and
- one pig receiver at the gas gate station on the Terminal site.

2.3 OPERATIONAL DESIGN

2.3.1 Pretreatment Process

Natural gas entering the Terminal site at the gas gate station would be piped to the pretreatment facilities, where two processes would occur: 1) acid gas removal to remove CO_2 and H_2S from the gas, and 2) dehydration to remove water. The acid gas removal system would use an amine solution in a contactor tower to reduce the CO_2 content to less than 50 parts per million (ppm) by volume and the H_2S content to less than 3 ppm by volume. The dehydration unit would be downstream of the acid gas removal unit and would remove water from the feed gas leaving the amine tower. Water would be removed using a molecular sieve vessel that would reduce content to less than 5 ppm by volume.

[8] A pipeline "pig" is a device used to clean or inspect the pipeline. A pig launcher/receiver is an aboveground facility where pigs are inserted or retrieved from the pipeline.

2.3.2 Liquefaction, Storage, and Export

The Project would liquefy and export 10.0 MTPA of LNG, with capacity up to 12 MTPA possible under peak conditions. TransCameron Pipeline would deliver pipeline-quality natural gas from existing market hubs and pipeline networks in southern Louisiana to the Terminal through the interconnects described above. The gas would arrive at the Terminal at a design pressure of approximately 674 psig. At the gas gate station, the gas would be split into two streams, one for process feed to the liquefaction plant and the other for fuel gas supply to the electric power generation facility. Gas going to the liquefaction plant would be boosted, as necessary, by electric motor-driven compressors to achieve 775 psig minimum before pretreatment.

The pipeline-quality gas arriving at the Terminal would be primarily methane (CH_4) (94 to 97 percent), but would also include longer chain (heavier) hydrocarbons such as ethane, propane, butane, and others. In addition, the gas would include small quantities of nitrogen, oxygen, CO_2, and water. To ensure proper liquefaction, the process feed gas would be treated beforehand to remove the CO_2 and water. This process would take place in three pretreatment units. The treated gas would enter each liquefaction block through the heavy hydrocarbons removal system prior to being liquefied in the two SMR units in each liquefaction block and then piped into storage tanks. LNG would then be pumped from the storage tank(s), through cryogenic transfer lines and dockside loading arms to ocean-going LNG carriers for export. The pumping rate would be about 12,000 m^3 per hour. A vapor return arm would route displaced gas back to the storage tanks.

2.3.3 Liquefaction Process

As gas enters the liquefaction plant, air-cooled heat exchangers would cool the gas to near ambient temperature to remove the heat of compression. Pre-treated gas would enter the heavy hydrocarbon removal unit where it would be chilled to a point where most of the heavy components condense and can be separated by distillation. These removed heavy hydrocarbons would then be recovered and used by the Project's electric power generation plant as fuel.

The pre-treated gas would then enter the liquefaction unit, where it would be de-superheated, condensed to a liquid, then sub-cooled to near -260 degrees Fahrenheit (°F) BAHXs, which are enclosed and insulated with perlite in cold boxes. Refrigeration for this process would be produced by a specially designed single loop MR system. The refrigerant, a mixture of hydrocarbon gases (e.g., CH_4, ethylene, propane, butane, and pentane) and nitrogen, would be pressurized by a multi-stage electric motor-driven compressor then partially condensed in air-cooled heat exchangers. The resultant cooled and pressurized vapors and liquids would then be 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 MR streams and the natural gas liquefaction stream would be created by flashing cold MR to lower pressures then passing those colder MR streams in counter current to the streams to be cooled in the BAHXs. As the lower pressure MR is warmed to near ambient temperature, it would be returned to the suction-side of the compressors to complete the cycle.

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

When the LNG exits the cold-box, it would be depressurized and delivered to the LNG storage tanks near ambient pressure. The LNG would then be pumped from the storage tanks onto ocean-going LNG carriers for export through cryogenic transfer piping.

2.3.4 LNG Carriers

The LNG berthing docks would be designed to handle LNG carriers of 120,000 to 210,000 m^3. LNG carriers would access the Terminal from the Gulf of Mexico through the existing 400-foot-wide Calcasieu navigation channel. An incoming LNG carrier would then turn in an approximately 1,500-foot by 3,000-foot turning basin proposed as part of the Project. The LNG carrier would berth at one of the two berthing docks with its bow facing the Gulf of Mexico. LNG carriers would follow set routes between the LNG Terminal and the 30-mile marker within the outer boundary of the U.S. Exclusive Economic Zone (EEZ).

Venture Global Calcasieu Pass would transfer LNG from storage to the two LNG berthing docks by about 5,000 feet of aboveground cryogenic piping. Three LNG loading arms per berthing dock would be used to load LNG into the carriers, while vaporized natural gas would return to the storage tanks via a single vapor return arm per berthing dock and additional piping.

2.3.5 Utilities

During construction, Venture Global Calcasieu Pass would require utility connections for electricity and water for temporary construction activities and use by onsite construction personnel. Electricity would be provided by the local electric distribution utility (Entergy Corporation) and discontinued following construction.

During start-up and operation, Venture Global Calcasieu Pass proposes to generate electrical power at the Terminal site, using a combined cycle gas turbine power island sized to provide a reliable supply of up to 720 MW of electricity. The main use of the produced electrical power would be by 18 multi-stage MR compressor electric motor drivers for the liquefaction facilities. Other plant loads would include LNG pumps, boil-off and boost compressors, and fan motors for air cooling during the liquefaction process. Venture Global Calcasieu Pass would operate the turbine in simple-cycle mode for up to 2 years, to provide electrical power to the facility to support the sequential start-up of the Terminal’s multiple liquefaction block configuration and commence operations when the initial liquefaction blocks are commissioned.

For both construction and operation, the Terminal facilities may access local utility connections for water supply. Venture Global Calcasieu Pass is also currently evaluating existing municipal and new groundwater source options for the estimated 600,000 gallons per day (gal/d) of water that would be required at the Terminal, mainly for industrial process uses (e.g., LNG amine system and power island feed water), but also for potable use. Water would be supplied by Cameron Parish through an interconnect on the Terminal site with an existing 10-inch-diameter municipal pipeline that services the Cameron Jetty Pier Facility to the south. Sea water would be used for firewater if the firewater pumps are activated. Under normal operating conditions, Venture Global Calcasieu Pass would pressurize the firewater system with freshwater from the Terminal Utility Water Tank.

2.4 LAND AND WATER REQUIREMENTS

2.4.1 Terminal Facilities

Construction of the Terminal facilities would disturb 413.2 acres of land, and 64.8 acres of open water. Of this total, 314.0 acres of land, which includes 28.3 acres converted to open water, would be impacted by operation and maintenance of the Terminal facilities, and 64.8 acres of water would be affected by operation and maintenance of the turning basin. The remaining 99.2 acres of land would be temporarily affected during construction and restored to previous use. An additional 415.4 acres would be leased by Venture Global at the Terminal site, but would not be affected by construction. Table 2.4.1-1 lists the land and water requirements for the Terminal facilities.

TABLE 2.4.1-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
SUMMARY OF LAND REQUIREMENTS FOR THE TERMINAL FACILITIES

Terminal Facilities	Temporary Workspace (acres)	Operational Area (acres)	Total Area (acres)
Venture Global Property			
Terminal Site [a]	0.0	269.2	269.2
Northeast Access Road	0.0	13.0	13.0
Southwest Service Road	0.0	1.0	1.0
Marine Facilities	0.0	29.3	29.3[c]
Martin Access Road	0.0	1.5 [b]	1.5
Subtotal	**0.0**	**314.0**	**314.0**
DeHyCo Access Road [d]	0.1	0.0	0.1
Eastern TWS	59.7	0.0	59.7
Floodwall TWS	23.0	0.0	23.0
Southwest TWS	2.5	0.0	2.5
Northeastern TWS	5.2	0.0	5.2
Northwestern TWS	1.2	0.0	1.2
Pipeline System within Venture Global Property	7.5	0.0	7.5
Venture Global Property Terminal Workspace Subtotal	**99.2**	**314.0**	**413.2**
Land Avoided (Not Disturbed)		0.0	415.4
Venture Global Property Subtotal			**828.6**
Construction Support Facilities			
Liberty Support Facility	22.1	0.0	22.1
Martin Support Facility	10.5	0.0	10.5
DeHyCo Support Facility	9.1	0.0	9.1
Mudd Support Facility	7.1	0.0	7.1
Baker Hughes Support Facility	2.6	0.0	2.6
Construction Support Facilities Subtotal	**51.4**	**0.0**	**51.4**
TOTAL	**150.6**	**314.0**	**464.6**

[a] Includes area of Terminal Site (all areas at/within the floodwall/berm footprint, berm ramps, and administration/security building complex, associated parking outside of the wall/berm, and Northwest Access Road); area also includes Pipeline System workspace within the Venture Global Property.

[b] The Martin Access Road is a temporary road that will have permanent impacts. This acreage is included in operational area and not in TWS to account for permanent impact of this temporary construction road.

[c] Includes 28.3 acres of land converted to open water.

[d] The remaining acreage impacts on the DeHyCo Access Road are accounted for in the permanent Terminal Site (administration/security building) impacts and Northwestern TWS.

2.4.1.1 Construction Support Facilities

Venture Global Calcasieu Pass anticipates leasing five existing marine industrial facilities for support during construction. Anticipated activities at these facilities include module loading, heavy equipment loading, material barge deliveries (e.g., piles, aggregate, riprap, concrete-coated line pipe), concrete batch plants, storage, laydown, warehousing, parking, a point of embarkation/debarkation for construction personnel crossing the Calcasieu River Ship Channel by private ferry, and administrative offices. The Construction Support Facilities include the 22.1-acre Liberty Support Facility, the 10.5-acre Martin Support Facility, the 9.1-acre DeHyCo Support Facility, the 2.6-acre Baker Hughes Support Facility, and the 7.1-acre Mudd Support Facility (see figure 1.1-2). These properties are on previously disturbed lands and are currently, or previously, used as an offshore commercial marine support facility.

2.4.1.2 Access Roads

Venture Global Calcasieu Pass would improve an existing service road to develop a permanent access road to the Terminal site (Northeast Access Road). This road would be approximately 4,160 feet long and would be the primary road for heavy trucks delivering materials and equipment to the Terminal site. Improvements to the existing road would include straightening the road alignment, widening the road surface, and installing separate travel lanes for egress and ingress. The road would be widened to 125 feet for approximately 0.6-mile from the intersection of the Martin Access Road to the Terminal's perimeter berm, and to 75 feet in width for approximately 0.4-mile from the Liberty Support Facility to the intersection of the Martin Access Road. The Northeast Access Road would encompass 13.0 acres.

Venture Global Calcasieu Pass would also construct a new permanent service road (Southwest Service Road) at the Terminal to provide restricted access to Cameron Parish's Jetty Pier Facility. The Jetty Pier Facility is a public recreational facility on the Gulf shoreline south of Venture Global's Property. The provision of the service road results from discussions with local parish authorities who identified a need for land-based restricted access to the Jetty Pier Facility for public safety purposes. The road would be approximately 7,700-foot-long, 36-foot-wide gravel road, and would be outside the perimeter wall and routed around the eastern and southern edge of the Terminal Site, reconnecting to the existing Davis Road south of the wall/berm near the southern boundary of the Venture Global Property. The Southwest Access Road would encompass approximately 1.0 acre. For more information on the Jetty Pier Facility, see section 4.8.

Two additional temporary access roads would be used during construction to connect the Martin Support Facility (Martin Access Road) and the DeHyCo Support Facility (DeHyCo Access Road) to the Terminal facility. The DeHyCo Access Road would temporarily impact approximately 0.1 acre and the Martin Access Road would temporarily impact approximately 1.5 acres.

2.4.2 Pipeline Facilities

Table 2.4.2-1 summarizes the land requirements for the Pipeline and associated facilities. Based on route design and a 110-foot-wide construction right-of-way, the approximately 23.4-mile-long Pipeline would require 370.9 acres of construction workspace. TransCameron Pipeline proposes this right-of-way width in both uplands and wetlands, stating that the width is necessary to allow for a safe work area due to the large size (overall outside diameter of 54 inches, which includes a 6-inch concrete coating around the 42-inch-diameter pipe) of the pipeline. TransCameron Pipeline's operational right-of-way would be 50 feet wide. Typical construction right-of-way configurations are provided in appendix C.

TABLE 2.4.2-1

LAND REQUIREMENTS FOR THE TRANSCAMERON PIPELINE

Facility	Land Impacted by Construction (acres)[a]	Land Impacted During Operation (acres)[b]
Pipeline	275.4	135.0
Additional Temporary Workspace	74.5	0.0
Meter Station and Mainline Valves	1.3	1.3
Access Roads	9.9	0.2
Contractor Yards/Staging Areas	9.8	0.0
Total	**370.9**	**136.5**

[a] This is the total land impacted and includes temporary workspace from construction and permanent land impacts from operation.

[b] Operation impacts include the permanent pipeline easement.

The Pipeline route is collocated with three foreign natural gas pipelines for approximately 86 percent (20.1 miles) of its total length. In these areas, the permanent right-of-way would abut the right-of-way of the adjacent existing pipeline, and the temporary right-of-way would be on the opposite side from the existing foreign pipeline right-of-way. Therefore, the proposed construction right-of-way would not overlap with existing rights-of-way.

Additional temporary workspace (ATWS) would also be utilized in areas requiring specialized construction techniques, such as wetland and waterbody crossings as well as HDD entry and exit points and wetland push stations. Following completion of construction, temporary workspace (TWS) and ATWS would be restored to preconstruction conditions.

The ANR/Bridgeline Meter Station would be constructed at an interconnection point with these pipelines and adjacent to fenced and graveled natural gas processing facilities (requiring use of 1.3 acres of these facilities during operation).

TransCameron Pipeline would construct three MLVs along the Pipeline, including one at milepost (MP) 0.0 at the ANR/Bridgeline Interconnect, one near MP 8.3, and one at the Terminal site. Because MLVs would be constructed within the Terminal site, interconnect site, and the permanent pipeline right-of-way, the construction and operation impacts are accounted for elsewhere. The pig launcher would be constructed at the meter station location; the pig receiver would be constructed at the Terminal site. No additional land is required for the pig launcher/receiver at either the ANR/Bridgeline Interconnect or the Terminal site.

TransCameron Pipeline would use 15 existing public and private roads and 9 new access roads to access the Pipeline lateral during construction and operation. Fourteen of the proposed access roads would be stabilized by the placement of timber mats during construction. The two proposed permanent access roads would consist of aggregate fill. In total, TransCameron Pipeline would require 9.9 acres of land for access roads during construction, of which approximately 0.2 acre would be used for permanent roads during operation. Temporary and permanent access roads are listed in table 4.8.2.1-3 in section 4.8.2.1.

2.5 ENVIRONMENTAL COMPLIANCE TRAINING AND INSPECTION

The FERC may impose conditions on any Certificate or authorization it grants for the Project. These conditions include additional requirements and mitigation measures recommended in this EIS to minimize the environmental impact that would result from construction and operation of the Project (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. Venture Global would be required to incorporate all environmental conditions and requirements of the FERC Certificate, authorization, and associated construction permits into the construction documents for the Project.

Venture Global provided a Project-specific *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures), together referred to as Project-specific Plan and Procedures.[9] Additionally, Venture Global has developed a *Spill Prevention, Control, and Countermeasure Plan* (SPCC Plan) for both the Terminal site and Pipeline. Our review of these documents is discussed in sections 4.2 and 4.3.

Venture Global would implement the environmental compliance and monitoring requirements of its Project-specific Plan and Procedures during construction of the Terminal site and Pipeline. Venture Global would also incorporate compliance and monitoring requirements from federal, state, and local permits obtained for the Project. To ensure environmental compliance, Venture Global would review Project-specific environmental conditions with prospective contractors to incorporate such conditions into construction bid documents.

Venture Global would employ two or more environmental inspectors (EIs) for the Project; at least one for the Terminal site and at least one for the Pipeline. The EIs' duties would include ensuring compliance with environmental conditions, construction procedures, techniques and plans, landowner agreements, and permit conditions and requirements. The EIs would also verify construction workspaces prior to use, confirm that all sensitive resources are properly marked, and ensure proper installation and maintenance of all erosion control devices. The EIs would have peer status with all other inspectors, would have the authority to enforce permit and FERC environmental conditions, to issue stop-activity orders, and impose corrective actions to maintain environmental compliance. In addition to monitoring compliance, the EIs would assist with environmental training for Project personnel regarding environmental conditions and Project-specific plans.

In addition to the EIs, FERC staff would conduct periodic compliance inspections during all phases of construction. Following the inspections, we would enter inspection reports into the Commission's public record. Other agencies may conduct inspections as well. Representatives of these agencies could require the implementation of additional and/or corrective environmental measures. These representatives could also issue work stoppages, impose fines, and recommend additional actions in response to environmental compliance failures.

2.6 CONSTRUCTION PROCEDURES

The Project facilities would be designed, constructed, tested, operated, and maintained in accordance with applicable laws, regulations, and standards that are intended to protect the public by preventing or mitigating LNG and natural gas pipeline failures or accidents, and ensure safe operation of the facilities. With respect to the liquefaction, storage, and export infrastructure at the Terminal site, these standards and regulations include the DOT's *Federal Safety Standards for Liquefied Natural Gas Facilities* (49 CFR 193), the NFPA *Standard for the Production, Storage and Handling of LNG* (Standard 59A), the 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). For the Pipeline, safety requirements

[9] Venture Global's Project Specific Plan and Procedures can be viewed on eLibrary under Accession Number 20150904-5415.

include the DOT regulations at 49 CFR 192, *Transportation of Natural or Other Gas by Pipeline: Minimum Federal Safety Standards* and the LDNR, Office of Conservation pipeline safety regulations found in LAC Title 43, Part XIII.

2.6.1 Construction Schedule and Workforce

Venture Global Calcasieu Pass anticipates that construction of the Terminal would take approximately 35 months, while the Pipeline would take about 10 months inclusive of mobilization and final clean up.

During peak construction at the Terminal site, an estimated 1,410 on-site workers would be required. However, the number of workers present at different stages of construction would vary significantly. Initial mobilization would involve up to 500 workers. As site activity increases, the workforce would average 1,275. The pipeline construction would require an additional workforce peaking at 200.

In total, the Project's initial workforce would number 250–650, with a workforce of about 1,610 during peak construction, and an average workforce of 1,425 over the full construction period for the Terminal site and Pipeline.

2.6.2 Environmental Complaint Resolution

Venture Global developed a Landowner Communication Plan[10], which we have reviewed. The Landowner Communication Plan includes Landowner Complaint Resolution procedures that Venture Global would use to address any problems or complaints received from landowners affected during construction and operation of the Project. The Landowner Communication Plan provides a telephone number, website, and email address for landowners to communicate to Venture Global and indicates that Venture Global would respond to any complaints or concerns within 48 hours of being contacted by a landowner. It also includes directions for contacting FERC's landowner helpline in the event that an appropriate response has not been received from Venture Global. Venture Global would file a tabular summary of all landowner complaints in its periodic environmental reports.

2.6.3 Terminal Site Construction

2.6.3.1 Site Preparation and Temporary Construction Facilities

The Terminal site would require significant area-wide improvements, including clearing, grubbing, grading, soil stabilization, and filling to increase the ground elevation prior to on-site foundation development and plant construction. Floodplain maps produced by the FEMA indicate that the Terminal site is in an area with significant flood hazard potential. Site-specific topographic studies determined that site elevation is generally between 2 and 5 feet above mean sea level (amsl) and an average elevation of 3.5 feet amsl. Through grading and potential import of fill material, the elevation at the Terminal site would be raised to 5 feet amsl or greater in the liquefaction area and 4 feet amsl or greater in the construction laydown area. The source for potential import materials has not been determined. Venture Global

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[10] The Landowner Communication Plan is included as attachment 2-A to the December 23, 2015 Response to December 4, 2015 Environmental Information Request submittal number 20151223-5113 in Docket CP15-550-000 available at https://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=14081481.

Calcasieu Pass is considering the use of commercially available aggregate materials, including gravel, oyster shell, and crushed stone.[11] An earthen berm would be constructed on the west side of the site, and a steel pile floodwall on the east, north, and south sides of the site, to protect the facility from storm surge and potential wave activity. The berm material may be sourced from on-site excavation of the LNG berthing area, if suitable, or imported from offsite locations. The floodwall would be a combination wall with steel pipe king piles and intermediate steel sheet piling to provide the structural capacity for protection of the enclosed plant infrastructure. Venture Global Calcasieu Pass would install a 31.5 foot storm surge wall around the perimeter of the Terminal to the north, east, and south and a 26-foot high berm on the west perimeter.

Soils at the Terminal site would likely require improvement and stabilization to provide a load-bearing surface during construction Improvement techniques depend primarily on soil stratigraphy, structure loading, settlement tolerance, and acceptable future maintenance. Soil improvement techniques may include (but are not limited to) cement mass mixing and preloading. Soil mixing can be performed using either wet or dry mixing techniques. Once crane loading and operational areas are set during final design, detailed calculations would be performed to determine the depth of ground improvement required to support crane loading and operational areas, if deemed necessary. Deep soil mixing / mass mixing methods (depending on the soft clay layer thickness) can be used to improve subsurface soils to support anticipated loads. In addition, improvement of shallow subsurface soils would provide increased lateral capacity for deep foundations. Detailed performance specifications would be developed for the selected soil improvement techniques during final design. Venture Global Calcasieu Pass would install additional soil improvements by the installation of wick drains and stone columns. Potential aggregate materials, discussed above, and geotextile layers would be used to level and finish workspaces. These aggregate materials would initially be delivered via truck until the marine dock is installed, and then materials would arrive at the site by barge.

Venture Global Calcasieu Pass would install necessary temporary facilities at the Liberty Support Facility, the Martin Support Facility, the DeHyCo Support Facility, the Baker Hughes Support Facility, and the Mudd Support Facility. The temporary construction facilities would include administrative offices, sanitary facilities, parking areas, and ancillary facilities associated with early construction activities.

Topographic grading plans would be designed to ensure efficient and environmentally protective stormwater drainage. The Terminal site would be sloped to direct discharges toward 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. Venture Global Calcasieu Pass would install stormwater controls, including placement of gravel or other suitable material to provide a stable, well-drained surface. Throughout construction, Venture Global Calcasieu Pass would follow the erosion and sedimentation control procedures described in its Project-specific Plan and Procedures, and Venture Global Calcasieu Pass' Stormwater Pollution Prevention Plan (SWPPP).

2.6.3.2 Plant Facilities

The main liquefaction components, located at the Terminal Site, will be 9 integrated single mixed refrigerant (SMR) blocks, with each block consisting of two liquefaction units. The SMR blocks (herein referred to as liquefaction blocks or blocks) and their support facilities are collectively referred to as the Liquefaction Plant. LNG from the Project will be loaded onto oceangoing LNG carriers and shipped to

[11] As stated in Venture Global's Joint Permit Application, it is possible that a relatively small amount of dredge material might be retained on the Terminal site for construction, either for berm construction or for ground elevation increase. However, for purposes of calculation, Venture Global assumed that all 5 million cubic yards of dredge material would be pumped offsite.

project customers. In addition to the Liquefaction Plant described above, Venture Global Calcasieu Pass would construct two 200,000 cubic meter (m^3) aboveground LNG storage tanks, two LNG berthing docks within a common LNG berthing area, and a 720 megawatt (MW) electric power generation facility to provide continuous power for the Terminal Site facilities. The design life of the LNG Terminal is 30 years. All Project components will be sited, constructed, operated, and maintained in accordance with applicable federal, state, and local regulations. The proposed construction procedures for the plant facilities follow generally acceptable procedures for other major site facilities requiring pile foundations and transportation of large equipment by truck and/or barge.

Foundation construction for the liquefaction plant would commence with the installation of piles to provide a firm base for the structures supporting the 9 liquefaction blocks. Each LNG storage tank would be constructed on a reinforced concrete base slab. This base slab will rest on grade and would be supported on foundation piles. The piles located at the center base slab would be positioned in an equally spaced grid pattern. The outer piles would be arranged in circumference under the inner and outer tank walls.

Pile specifications would be based on guidance in the FERC's most recent draft seismic guidelines (FERC, 2007) and section 7.2.2 of NFPA Standard 59A (2001). After the piles have been positioned using pre-drilled holes and/or pile-driving, caps would be installed and the concrete pad poured. The piles would be delivered to the site by barge and/or truck.

The liquefaction blocks would be interconnected with the gas gate station and LNG storage tanks by buried and aboveground piping interconnects, the latter on steel-framed support racks.

Pipe spool fabrication would be undertaken at existing commercial facilities. Spools fabricated off-site would be delivered by truck and barge. Where possible, pipe racks would be modularized to minimize site work. Venture Global Calcasieu Pass would paint, coat, or insulate the pipe sections, as necessary, after welds have been tested according to applicable codes.

Certain larger equipment units, such as pretreatment systems, liquefaction cold-boxes, and refrigerant compressors, would be assembled as modules in several off-site existing commercial facilities within existing previously permitted or disturbed areas, some of which would likely be in Texas and Louisiana. This off-site modular approach allows equipment assembly in a more controlled environment than that encountered under the on-site "stick-built" approach. Following the assembly, these large modular units would be barged to the new utility dock on the Calcasieu Ship Channel, off-loaded, and transported to their respective foundations. Other equipment would be shipped to the Terminal site by truck. All equipment would undergo quality assurance/quality control inspection and testing at its place of origin and upon installation at the Terminal site.

Once foundations have been set, work on the liquefaction blocks, piping interconnect, and associated utility systems could occur within the same general timeframe, but would be coordinated such that various inter-dependent systems (e.g., electrical and instrumentation) could be installed and tested according to an appropriately sequenced schedule. After the equipment and piping has been set in place, cable systems would be installed. 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. Ultimately, Venture Global Calcasieu Pass would complete road paving, final site grading, seeding, and cleanup.

2.6.3.3 Dredging

Excavation and dredging in and adjacent to the Calcasieu River Ship Channel would be required for construction of the ship turning basin and LNG berthing area. The LNG berthing area would be recessed into the existing shoreline of the Terminal site. Venture Global Calcasieu Pass estimates that 29.3 acres would be excavated/dredged from the existing western shoreline of the Terminal site and 64.8 acres would be dredged from the eastern edge of the Calcasieu River Ship Channel to the existing western shoreline of the Terminal site to reach the required water depth of -44.3 feet NAVD88 (42 feet below Mean Low Gulf datum) for the turning basin and proposed berths, resulting in approximately 5.0 million *in-situ* cubic yards (y^3) of material excavated or dredged.

The excavation and dredging would be conducted using a combination of mechanical and hydraulic cutter-suction pipeline dredging methods. See section 4.3.2.2, Surface Water Impacts and Mitigation, and 4.6.2, Aquatic Resources, for more information on the proposed dredging and potential impacts. Venture Global Calcasieu Pass' proposed dredging will be reviewed by the USACE and LDNR's OCM, as well as LDEQ's section 401 water quality program. During this review, the agencies will evaluate the potential impact of the dredging, as well as the proposed beneficial use of the dredged material.

2.6.3.4 Dredged Material Disposal

Current plans for the dredged material disposal is to pump 716,000 yd^3 as a slurry for reuse at FWS-sponsored marsh restoration sites. For the remaining dredge material disposal, Venture Global Calcasieu Pass current proposal for the disposal of the remaining dredge material is nearshore placement along the West Beach adjacent to the Calcasieu Bar Channel. Venture Global Calcasieu Pass included its plans for dredged material reuse and placement in its application to the USACE and LDNR. This plan is discussed in section 4.3.2.2, Surface Water Impacts and Mitigation, of this EIS.

2.6.4 Pipeline Facilities

Based on the wetlands and wet soils site conditions, the push method and the HDD method would be the primary techniques used for construction of the lateral Pipeline. These methods are discussed in more detail below in sections 2.6.4.8 and 2.6.4.9. Traditional upland construction techniques, if used, would be limited to short lengths between push method and HDD method sections and at staging locations to complete the push method and HDD method sections. Table 2.6.4.2-1 lists TransCameron Pipeline's proposed construction methods by MP.

2.6.4.1 Right-of-Way Surveying

TransCameron Pipeline would identify and survey the Pipeline alignment prior to construction. This activity would include staking the pipeline centerline, foreign line crossings, workspace limits, and the boundaries of wetlands and other sensitive environmental areas. TransCameron Pipeline would flag or otherwise mark sensitive areas to avoid at this time. Lastly, TransCameron Pipeline would contact Louisiana's one-call system to identify buried utilities and prevent accidental damage during pipeline construction.

2.6.4.2 Clearing and Grading

Prior to clearing and grading, TransCameron Pipeline would install temporary erosion controls in accordance with the Project-specific Plan and Procedures. Clearing and grading operations would incorporate procedures to minimize vegetation removal from slopes, wetlands, and channel banks (as described in the respective section 4 discussions on vegetation, wetlands, and waterbodies). In addition, these procedures would prevent undue soil profile disturbance, restore preconstruction contours, and prevent topsoil erosion.

In upland areas, vegetation would be cut and removed from the construction workspace. Tree stumps would be cut to ground level and left in place, except where removal is necessary to create safe and level workspace. Cleared vegetation would be burned, in accordance with applicable state and local permitting, chipped, or hauled to an appropriate disposal facility. TransCameron Pipeline may use chipped material as erosion control mulch. No cleared vegetation would be placed in wetlands unless approved by appropriate agencies. After clearing, TransCameron Pipeline would grade upland sections of construction workspace, as necessary, to create a safe and level workspace. Extensive grading is not anticipated given the local topography of the pipeline routes. A majority of the pipeline route is proposed in emergent wetlands and would be crossed using the push method. Using this method, vegetation in the construction workspace would be flattened but would not be purposefully cleared, except for trench excavation.

TABLE 2.6.4.2-1

SUMMARY OF CONSTRUCTION TECHNIQUES FOR THE TRANSCAMERON PIPELINE

Milepost			
Beginning	End	Construction Technique	Pipeline Length (miles)
0.0	0.1	Open-cut	0.1
0.1	1.0	HDD	0.9
1.0	7.9	Push/Pull	6.9
7.9	8.3	HDD	0.4
8.3	8.5	Open-cut	0.2
8.5	10.1	HDD	1.6
10.1	18.9	Push/Pull	8.8
18.9	19.3	HDD	0.4
19.3	21.2	Push/Pull	1.9
21.2	21.6	HDD	0.4
21.6	22.9	Open-cut	1.3
22.9	23.5	HDD	0.6
		Total	**23.5**

HDD = horizontal directional drill

2.6.4.3 Trenching

Trenching involves excavating a pipeline ditch and would be accomplished with backhoes or similar excavation machinery. Trench sides would be sloped, depending on the stability of the soils, as required for safety and to minimize sloughing of topsoil into ditch. TransCameron Pipeline would deposit excavated material within the construction workspace, adjacent to the trench and on the opposite side from the excavation equipment. The trench would be excavated to a depth that would allow at least 3 feet of cover over the pipe. The bottom of the trench would be cut to accommodate the diameter of the pipe. The top width of the trench would depend on local soil conditions at the time of construction. TransCameron Pipeline does not anticipate the need for blasting or the need to import material for pipeline padding.

TransCameron Pipeline would minimize erosion and sedimentation during trenching in accordance with the Project-specific Plan and Procedures. These measures include minimizing the free flow of surface water into the trench and through the trench from upland areas into waterbodies. Erosion control measures would also be implemented as necessary for bank stabilization at waterbody crossing locations.

If trench dewatering is necessary, discharge to the ground generally is permitted where there is adequate vegetation along the right-of-way to function effectively as a filter medium. In areas adjacent to waterways or where there is minimal vegetation, straw bale filters, filtration bags, or other appropriate measures would be used to limit sediment dispersion. Trench dewatering would be performed in accordance with applicable permit specifications.

2.6.4.4 Stringing, Welding, and Installation

Stringing involves moving pipe joints into position along the prepared construction right-of-way. In upland areas, the joints would be moved by truck and loaders from the source areas and placed along the construction right-of-way, parallel to the trench line, for subsequent line-up and welding. Stringing activities would be coordinated with the trenching and pipe-laying crews. Certain pipe joints may be bent to conform to changes in the direction of the pipeline alignment and natural ground contours. Individual pipe joints would be bent to the desired angle in the field and/or pre-fabricated fittings may be used.

Welding would be performed in accordance with 49 CFR 192, Subpart E "*Welding of Steel in Pipelines*" and American Petroleum Institute Standard 1104. TransCameron Pipeline would visually and radiographically or ultrasonically inspect completed welds to determine integrity. If a weld does not meet defined requirements, it would be marked for repair or replacement. The weld joint areas would be coated and the entire pipe coating inspected and repaired as needed. Following successful integrity inspections, TransCameron Pipeline would lower the pipe into the trench using sideboom tractors or similar equipment and bedded with padding material (screened native material) prior to backfilling.

2.6.4.5 Backfilling and Grade Restoration

After the pipe is lowered into the trench and bedded with padding material, the trench would be backfilled with previously excavated material, using barge-mounted track hoes, amphibious equipment, bulldozers, loaders, and/or compactors. TransCameron Pipeline would dispose of any excess excavated material or components unsuitable for backfill in accordance with applicable regulations.

During backfilling, TransCameron Pipeline would restore the natural ground contours and restore surface drainage patterns as close to preconstruction conditions as practicable. In areas where TransCameron Pipeline has segregated topsoil, backfilling would involve the replacement of subsoil in the bottom of the trench, followed by the replacement of topsoil over the subsoil layer. In upland areas, a soil mound (crown) would be left over the trench to allow for soil settlement, unless the landowner requires otherwise.

2.6.4.6 Road Crossings

The lateral Pipeline would cross 18 roads, as identified in table 2.6.4.6-1. TransCameron would cross most public (paved) road crossings using the HDD method. TransCameron Pipeline would follow applicable state and local regulations and minimize traffic interruptions to the extent practicable. The minimum pipeline clearance for both paved and unpaved roads would be 5 feet under the roadbed and 4 feet under any drainage ditches. TransCameron Pipeline would install pipeline warning signs/markers at each crossing location.

TABLE 2.6.4.6-1 TRANSCAMERON PIPELINE ROAD CROSSINGS			
Road	Milepost	Road Surface	Proposed Crossing Method
Mermentau River Road	0.2	Paved	HDD
Project Access Road	3.5	Unpaved	Open-cut
Project Access Road	4.2	Unpaved	Open-cut
Unnamed Private Road	4.5	Unpaved	Open-cut
Project Access Road	4.9	Unpaved	Open-cut
E Creole Highway	8.1	Paved	HDD
W Creole Highway	8.6	Paved	HDD
Raymond Richard Road	9.9	Paved	HDD
Project Access Road	12.9	Unpaved	Open-cut
Oilfield Road	14.8	Paved	Open-cut
Project Access Road	15.2	Unpaved	Open-cut
Murphy Lane (Private)	15.5	Unpaved	Open-cut
Project Access Road	15.8	Unpaved	Open-cut
Project Access Road	17.8	Unpaved	Open-cut
Unnamed Private Road	18.0	Unpaved	Open-cut
Amaco Road	19.1	Unknown	HDD
Amaco Road	20.2	Unknown	Open-cut
Louisiana Highway 82	21.3	Paved	HDD

2.6.4.7 Waterbody and Wetland Crossing Construction Procedures

TransCameron Pipeline would cross delineated wetlands in accordance with its Project-specific Procedures. Open-cut pipeline construction across wetlands would be achieved through use of the push method (see section 2.6.4.9), which is described below and would reduce the potential impacts on wetland vegetation, hydrology, and soil structure.

During initial trenching operations, the 20-foot-wide amphibious excavator would be centered over the pipeline centerline; however, under certain construction situations, the excavator would be immediately adjacent to the trench, resulting in direct disturbance (excavation or compaction) of 30 to 50 feet in width. Work adjacent to the trench would likely occur in the following situations:

- during backfilling of the pipeline trench;
- at utility and access road crossings to assist in spoil pile management;
- during horizontal directional drill (HDD) activities to provide support for pipeline strings along the trench within the construction right-of-way; and
- during pipeline installation to assist in guiding pipe strings around alignment curves during push operations.

TransCameron Pipeline has requested approval to use a construction right-of-way width of 110 feet to accommodate the deeper pipeline ditch and amount of spoil temporarily sidecast. If a 75-foot-wide construction right-of-way were adopted (as is required by our Procedures), only 40 feet of workspace would be available for access and other work activities. The large equipment necessary for the installation of the proposed 42-inch-diameter Pipeline is anticipated to require at least 50 feet, plus 10 additional feet (60 feet total) of workspace on the access side of the right-of-way to allow for vehicle movement. The 110-foot-wide construction right-of-way proposed in wetlands would accommodate the construction equipment and trench spoil as well as promote safe construction. TransCameron Pipeline indicates that it would use the minimum area needed for each crossing.

Construction methods at waterbodies would vary according to physical and environmental characteristics of the crossings. Many of the waterbodies along the lateral Pipeline route are represented by channels running through low-lying wetland areas that may not be higher than the channel edge. In these situations, TransCameron Pipeline is proposing to use the push method.

One waterbody along the lateral Pipeline route, the Mermentau River, has a defined channel and is classified as "major" in accordance with the Project-specific Procedures (meaning it is greater than 100 feet wide). TransCameron would cross this waterbody by the HDD method (see section 2.6.4.9).

2.6.4.8 Open-Cut Crossing Method

The open-cut crossing technique is a "wet" crossing method that is completed while the waterbody continues to flow across the work area. The open-cut crossing method is typically used to cross non-sensitive minor and intermediate waterbodies (width greater than 10 feet but less than or equal to 100 feet between the water's edges). In general, an open-cut crossing is accomplished using methods similar to conventional upland open-cut trenching. The open-cut construction method involves excavation of the pipeline trench across the waterbody, installation of a pre-fabricated segment of pipeline, and backfilling of the trench with native material without affecting or diverting flow at the time of crossing. TransCameron Pipeline would use an excavator to excavate the trench within the water. TransCameron Pipeline would complete construction activities at these stream crossings within the timeframes indicated in the Project-specific Procedures, typically within 24 hours of initiation of the crossing for minor waterbodies and within 48 hours for intermediate waterbodies.

2.6.4.9 Horizontal Directional Drilling

For HDD crossings of wetlands and waterbodies, the first stage involves laying electric tracking wires by hand along the pipeline right-of-way between the proposed drill entry and exit locations. Only minimal ground and vegetation disturbance would result from this procedure. Following guide wire installation, a slant drill unit would be set up and a small-diameter pilot hole would be drilled under the waterbody along a prescribed profile. Electromagnetic sensors would be used to guide the drill bit.

Once the pilot hole is completed, it would be enlarged using successive reaming tools to accept the pipeline. The reaming tools would be attached to the drill string at the exit point of the pilot hole and rotated and drawn back to the drilling rig, thus enlarging the pilot hole with each pass. During this process, drilling mud consisting of bentonite clay and water would be continuously pumped into the hole to remove cuttings and to maintain the integrity of the hole. Once the hole has been sufficiently enlarged, a prefabricated segment of pipe would be attached behind the reaming tool on the exit side of the crossing and pulled back through the drill hole toward the drill rig, completing the crossing.

TransCameron Pipeline has developed and filed an HDD Contingency Plan outlining the procedures it would follow to minimize the potential for an inadvertent release of drilling mud and to undertake effective cleanup should a release occur. We have reviewed this plan and find that it adequately provides measures to minimize and/or remediate an inadvertent release. This plan is included as appendix D.

2.6.4.10 Push Method

Because a majority of the pipeline construction is in wetland and wet soil areas, TransCameron Pipeline proposes extensive use of the push method (see table 2.6.4.2-1). For the push method, TransCameron Pipeline proposes a 110-foot-wide construction right-of-way to allow temporary spoil storage on both sides of the trench. This would reduce storage pile height and prevent material from re-entering the trench prior to placement of the concrete-coated pipe.

Equipment on the construction right-of-way would be minimized and, when used, would be of the type having the least environmental impact in saturated ground conditions. This equipment includes mats, marsh buggies, airboats, amphibious equipment, tracked equipment, and barges. The contractor would use discretion in choosing the equipment that would create the least ground pressure for the specific application. TransCameron Pipeline's construction would comply with the Project-specific Procedures and applicable permit requirements.

During construction preparation, TransCameron Pipeline would identify suitable "push sites" that are near existing roads, have all weather access, and are preferably on higher ground. In addition, mats would provide for a firmer foundation for equipment storage and for pipe staging and pushing.

Once the push sites are established, the appropriate clearing equipment (amphibious or tracked) would be selected to prepare the right-of-way for the pipe. Where there is standing water, only enough clearing and trenching would be done to accommodate the pipe. Each excavator used would have a lateral reach sufficient to place spoil within the 110-foot-wide construction workspace. At the push site, various pipeline operations would take place, including welding, non-destructive testing, joint coating and coating repairs, and installation of floatation apparatus.

The double-jointed sections of pipe, which are typically concrete-coated 80-foot lengths, would be transported as needed by truck from the pipe staging area to the push sites. At the push sites, after the pipe joints are welded together, the weld joints coated, and the floats attached, the pipe string would be floated out into the pipeline trench. If necessary, a cable would be attached to the front of the pipe string and pulled from the other end of the right-of-way section to assist the push operation. There should be no vehicular traffic on the right-of-way during this operation, except to remove the floats once the pipe is in place. Trench backfilling would begin once the pipe is in place. No soils or fill would be imported from outside the workspace.

2.6.4.11 Hydrostatic Testing and Tie-ins

After construction and prior to placing the Pipeline and associated appurtenances in service, the completed Pipeline would be hydrostatically tested to ensure that the systems are leak proof and to provide the necessary safety margin for high-pressure operation. Approximately 1,347,387 gallons of water would be needed for hydrostatic pre-testing and 7,049,043 gallons of water would be needed for testing of the complete pipeline. Testing would be conducted in accordance with the Project-specific Plan and Procedures, and testing specifications, together with state hydrostatic test discharge permit conditions and DOT requirements set forth at 49 CFR 192.

The pipeline would be filled with water and kept at the requisite operating pressure throughout the test. After the completion of a satisfactory test, the water would be discharged over land into containment structures. TransCameron Pipeline would use valves and appropriate energy-dissipation devices, containment structures, or other measures to regulate discharge rates and to minimize erosion and sedimentation. TransCameron Pipeline would not add chemical agents to the test water.

2.6.4.12 Aboveground Appurtenant Facilities

At the Pipeline's aboveground facilities sites, construction would involve clearing and grading, placement of piles and a concrete pad foundation, installation of equipment, erection of equipment housing, installation of permanent perimeter fencing, and surface clean-up during which open areas within the fence line would be covered with gravel, oyster shell, limestone aggregate, or similar material. Where a pig launcher is installed, a concrete containment area would be constructed below the launcher's barrel.

2.6.5 Site Access and Traffic

Venture Global has developed and filed draft Traffic Management Plans to address worker and materials/equipment transportation for the Terminal site and Pipeline construction areas. The overall intent of the Traffic Management Plans is to minimize disruption of local traffic flow and communities and ensure that construction-related road use proceeds in a safe and efficient manner. Discussion of these plans is in section 4.9.12.1 (Terminal Facilities) and 4.9.12.2 (Pipeline Facilities) of this EIS.

2.6.6 Operations and Maintenance

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, as described previously in this section for liquefaction, storage, and export facilities. For the Pipeline they include, but are not limited to, the standards and regulations set forth by the DOT in Title 49 CFR 192 and the LDNR's pipeline safety regulations found in LAC Title 23, Part XIII.

Operating procedures would be prepared for the Project after final design is completed. Comprehensive training would be provided to ensure that all facility personnel are familiar with and adhere to safe procedures. These procedures would address safe startup, shutdown, cool down, and purging, as well as routine operation and monitoring. Venture Global would coordinate with and involve appropriate local officials to ensure effective integration with local communication and emergency response systems.

Venture Global estimates that the Project would require approximately 130 full-time personnel.

Maintenance of the Terminal and Pipeline would be conducted in accordance with applicable law, and procedures and programs developed by Venture Global. Venture Global would enter any maintenance done into a computerized maintenance management system and disseminate it to the appropriate personnel for follow-up. All operations and maintenance (O&M) 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 controls, and instrumentation.

Operational activities for the Pipeline would be limited to maintenance of the right-of-way and pipeline inspection, repair, and cleaning. Periodic aerial and ground inspections by company personnel would identify the following: soil erosion that may expose the pipe, vegetation that may indicate a leak in the line, conditions of the vegetative cover and erosion control measures, unauthorized encroachment on the right-of-way, excavation activities in the vicinity of the right-of-way, and other conditions that could present a safety hazard or require preventative maintenance or repairs. TransCameron Pipeline would also monitor and periodically inspect the pipeline cathodic protection system to ensure proper corrosion protection. TransCameron Pipeline would take appropriate corrective action for conditions observed during inspections.

TransCameron Pipeline would maintain vegetation on the permanent 50-foot-wide right-of-way by mowing, cutting, and trimming in accordance with the specifications set forth in the Project-specific Plan and Procedures. After construction, the right-of-way would be allowed to re-vegetate; however, large brush and trees would be periodically removed from the permanent right-of-way. No maintenance would be performed between the entry and exit locations of the HDDs.

The Pipeline facilities would be clearly marked at line-of-sight intervals and at crossings of roads, railroads, and other key points. TransCameron Pipeline would minimize the number of markers in actively cultivated fields. Wherever possible, markers would be located at fence lines or field margins. The markers would clearly indicate the presence of the Pipeline 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 area.

3.0 ALTERNATIVES

As required by NEPA and FERC policy, we evaluated alternatives to the Project and its various components to determine whether any such alternatives would be reasonable and have a significant environmental advantages compared with the proposed action. The range of alternatives analyzed included the No-Action Alternative; system alternatives for the proposed LNG facility and pipeline facilities; Terminal site location and layout design alternatives; alternative pipeline routes; LNG process alternatives; and dredge spoil disposal alternatives.

As part of the No-Action Alternative, we considered the effects and actions that could conceivably result if the proposed Project was not constructed. Under the analysis of system alternatives, we evaluated the ability of other existing, planned, or proposed (new or expanded) facilities to meet the project objectives of Venture Global. Our evaluation of alternative sites for the LNG facility focused on several locations in the project region. We also assessed alternative Terminal configurations, dredge disposal locations, and pipeline routes.

The principal criteria for considering and weighing the alternatives for the Project were:

- the ability of each alternative to reasonably meet Venture Global's primary objective of liquefying 12 MTPA of domestically produced natural gas for export as competitively priced LNG within a timeframe that would allow contractual obligations to be met;
- the technical and economic feasibility and practicality of each alternative; and
- the significance of each alternative's environmental advantages and disadvantages relative to the proposed undertaking.

Through environmental comparison and application of our professional judgment, each alternative is considered to a point where it becomes clear if the alternative could or could not meet the three evaluation criteria. Additional sources of information included Venture Global's field surveys, aerial photography, U.S. Geological Survey (USGS) topographic maps, National Wetlands 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 the proposed location and the alternatives (e.g., NWI data were used for wetland comparisons, rather than a combination of NWI and field survey data.). Our environmental analysis and this evaluation consider quantitative data (e.g., acreage or mileage) and uses common comparative factors such as total length, amount of collocation, and land requirements. In recognition of the competing interests and the different nature of impacts resulting from an alternative that sometimes exist (i.e., impacts on the natural environment versus impacts on the human environment), we also consider other factors that are relevant to a particular alternative and discount or eliminate factors that are not relevant or may have less weight or significance.

Venture Global participated in our pre-filing process during the preliminary design stage of the Project (see section 1.4.1). This process emphasized identification of stakeholder issues, as well as identification and evaluation of alternatives that could reduce environmental impacts. The alternatives were reviewed against the evaluation criteria in the sequence presented above. The first consideration for including an alternative in our analysis is whether or not it could satisfy the stated purpose of the project. An alternative that cannot achieve the purpose for the project cannot be considered as an acceptable replacement for the project.

Many alternatives are technically and economically feasible. Technically practical alternatives, with exceptions, would generally require the use of common construction methods. An alternative that would require the use of a new, unique or experimental construction method may not be technically practical because the required technology is not available or is unproven. Economically practical alternatives would result in an action that generally maintains the price competitive nature of the proposed action. Generally, we do not consider the cost of an alternative as a critical factor unless the added cost to design, permit, and construct the alternative would render the project economically impractical.

Alternatives that would not meet the Project's objective or were not feasible were not brought forward to the next level of review (i.e., the third evaluation criterion). Determining if an alternative provides a significant environmental advantage requires a comparison of the impacts on each resource as well as an analysis of impacts on resources that are not common to the alternatives being considered. The determination must then balance the overall impacts and all other relevant considerations. In comparing the impact between resources, we also considered the degree of impact anticipated on each resource. Ultimately, an alternative that results in equal or minor advantages in terms of environmental impact would not compel us to shift the impacts from the current set of landowners to a new set of landowners.

One of the goals of an alternatives analysis is to identify alternatives that avoid significant impacts. In section 4 of this EIS, we evaluate each environmental resource potentially affected by the Project and conclude that constructing and operating the Project would not significantly impact these resources. Consistent with our conclusions, the value gained by further reducing the (not significant) impacts of the Project when considered against the cost of relocating the route/facility to a new set of landowners was also factored into our evaluation.

3.1 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, the Project would not be developed and Venture Global's objective of providing the proposed liquefaction and transportation capacity for LNG export would not be realized. In addition, the potential adverse and beneficial environmental impacts discussed in section 4 of this EIS would not occur.

The development and production of gas from conventional and unconventional gas formations has increased in recent years throughout many areas of the United States and is projected to continue for decades. Natural gas is used in a variety of sectors (residential, commercial, electric power generation, industrial, transportation). With or without the No-Action Alternative, other LNG export projects could be developed in the Gulf Coast region or elsewhere in the United States, resulting in both adverse and beneficial environmental impacts. Terminal and Pipeline system expansions of similar scope and magnitude to the Project would likely result in environmental impacts of comparable significance, especially those projects in a similar regional setting.

The No-Action Alternative could require that potential end users make different arrangements to meet their needs. Although it is speculative and beyond the scope of this analysis to predict what actions might be taken by policymakers or end users in response to the No-Action Alternative, it is possible that renewable (e.g., solar power), other traditional energy sources (e.g., coal or fuel oil), or possibly traditional long-term energy sources (e.g., nuclear power) could be used in lieu of the project in certain circumstances. But the location and use (electricity, heating, industrial feed stock, etc.) would be speculative and the judgement of whether the impacts would be better or worse would be speculative without knowing what the natural gas would or could be supplanted with. In addition, alternative energy sources would not meet the Project objective of liquefying natural gas for export, and are beyond the scope of this EIS.

Therefore, we have dismissed the No-Action Alternative as a reasonable alternative to meet the objectives of the Project. Because the purpose of the Project is to prepare natural gas for export to foreign markets, the development or use of renewable energy technology would not be a reasonable alternative to the proposed action.

3.2 SYSTEM ALTERNATIVES

We reviewed system alternatives in the Gulf Coast region to evaluate the ability of other existing, modified, approved, planned, or proposed facilities to meet the stated objectives of the Project and to determine if a system alternative exists that would have a significant environmental advantage over those associated with the Project and be technically and economically feasible.[12] The status identified for each system alternative (e.g., planned, proposed, or approved) is current as of the time this EIS is being written, and is subject to change over time. By definition, implementation of a system alternative would make construction of all or some of the proposed facilities unnecessary; conversely, infrastructure additions or other modifications to the system alternative may be required to increase capacity or provide receipt and delivery capability consistent with that of the proposed facilities. Such modifications may result in environmental impacts that are less than, comparable to, or greater than those associated with construction and operation of the proposed facilities.

The purpose of the Project is to liquefy and export 12 MTPA of natural gas to FTA and non-FTA countries. System alternatives are alternatives to the proposed action that would make use of other existing or proposed systems, with or without modifications, to meet the stated objectives of a proposed project. In the case of the Project, it must also be compatible with Venture Global's DOE/FE authorizations/ applications for LNG export to FTA and non-FTA countries.

The alternatives examined included both existing LNG terminals with planned, proposed, or authorized expansions, as well as new LNG terminals planned, proposed, or authorized on greenfield sites. These potential system alternatives are identified in table 3.2-1 below. Our analysis was predicated on the assumption that each project has an equal chance of being constructed and would therefore be available as a potential alternative. However, market forces will ultimately decide which and how many of these facilities are built. We reviewed potential system alternatives in the Gulf region to meet the Project objectives of liquefying natural gas for export, in addition to utilizing pipeline systems in the same region to provide natural gas to the Project.

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[12] Proposed projects are projects for which the proponent has submitted a formal application to the FERC; planned projects are projects that are either in pre-filing or have been announced, but have not been proposed. Approved projects are projects that have received FERC authorization.

TABLE 3.2-1

LIQUEFIED NATURAL GAS EXPORT TERMINALS WITH PLANNED, PROPOSED, OR APPROVED LIQUEFACTION PROJECTS ALONG THE GULF COAST – SUMMARY PROFILE OF SYSTEM ALTERNATIVES

Project	MTPA	FERC Status	In-Service Target Date
EXISTING LNG TERMINAL EXPANSIONS			
Approved Projects			
Cameron LNG	14.9	Under construction	2018-2019
Freeport LNG	13.2	Under construction	2018-2019
Golden Pass LNG	15.6	Initial site preparation approved 9/19/17	2022
Lake Charles/Trunkline LNG	15.0	Construction awaiting FCC permit issuance	2019-2020
Sabine Pass LNG – Trains 1-4	16.0	Operational, first cargo shipped February 2016 (there is a partial shut-down now)	2016
Sabine Pass LNG – Trains 5, 6	9.0	Under construction	2019
Cameron LNG Expansion Trains 4, 5	9.9	Approval received 5/5/2016	2019
Proposed Projects			
Gulf LNG Liquefaction Company	10.0	Application filed 6/19/15	2022-2024
Freeport LNG Expansion Train 4	5.1	Application filed 6/29/17	2020
NEW LNG TERMINALS			
Approved Projects			
Corpus Christi LNG	15	Under construction	2018
Magnolia LNG	8.0	Approval received 4/15/16	2018
Delfin LNG Deepwater Port	9.2	Approval received 9/28/17	2017-2021
Proposed Projects			
Port Arthur LNG	10.0	Application filed 11/29/16	2023
Texas LNG	4.0	Application filed 3/31/16	2020
Annova LNG	6.95	Application filed 7/13/16	2019
Rio Grande LNG	27.0	Application filed 5/5/16	2020
Venture Global Plaquemines LNG	20.0	Application filed 3/1/17	2020
Driftwood LNG	26.0	Application filed 3/31/17	2022
Planned Projects			
Corpus Christi LNG Stage 3	10.0	Pre-filing initiated 6/9/15	2018-2019
Commonwealth LNG (aka Waller Point)	9	Pre-filing initiated 8/15/17	2022
Gulf Coast LNG	18.0	Pre-filing not initiated	2018
Fouchon	5	Pre-filing initiated 8/21/2017	2021/2023

Sources: FERC, 2016a; FERC, 2016b; Ratner et al., 2015.

[a] Although the peak design production capacity of Venture Global's proposed liquefaction facility is 12 MTPA of LNG, which has been approved for export by the DOE, the nameplate liquefaction capacity for the facility would be 10 MTPA. For the purposes of evaluating system alternatives, we have used the LNG volumes requested from or authorized by DOE for export, including 10 MTPA for the Project.

As identified in table 3.2-1, there are six operating LNG terminal sites along the Gulf Coast in the southeastern United States with approved, proposed, and/or planned expansion(s) to export to FTA countries (nine expansion plans total). We also identified 13 new LNG terminals approved, proposed, and/or planned on greenfield sites. Liquefaction and export facilities are under construction at the Sabine Pass LNG, Cameron LNG, Freeport LNG, and Lake Charles/Trunkline LNG Terminals and may be constructed at each of the other import terminals pending completion of regulatory review and permitting.

Each of the nine expansion projects[13] and 13 new LNG projects was evaluated as a potential system alternative to the Project.

Although it might be theoretically possible to locate Venture Global's proposed liquefaction facilities at most of the project locations by building additional infrastructure alongside previously announced facilities, the commercial, technical, environmental, and schedule impediments to such an undertaking preclude further analysis. Each proposed project is authorized or has applied from DOE to export to FTA countries. The Natural Gas Act, as amended, has deemed FTA exports to be in the public interest; therefore, we will not speculate or conclude that excess capacity is available to accommodate this Project's purpose and need. Consequently, the proposed export capacity at any other existing or proposed LNG facility would require an expansion or new facility similar to the proposed facilities, resulting in environmental impacts similar to the proposed Project. These systems alternatives therefore offer no significant environmental advantage over the proposed Project.

3.3 ALTERNATIVE TERMINAL FACILITY SITES

Venture Global Calcasieu Pass identified, five alternative sites, including the currently proposed site, for the proposed Terminal facility. The five sites are all potentially developable lots along the Calcasieu River Ship Channel or spurs to the channel. While we conclude that these sites are not feasible alternatives due to their limited size, we also conclude any alternative site identified in the Project area that would be sufficient in size would also be similar in landscape and have similar environmental impacts as the proposed Terminal facility location. Therefore, because our alternatives impacts analysis is resource and comment driven and we did not receive any scoping comments about the proposed site or recommended alternative sites, and we conclude that resource impacts would likely be similar from any site of adequate size along the Calcasieu River, we did not identify any additional alternatives for our review.

In its scoping comments, the EPA stated the EIS should provide a clear discussion of the reasons for elimination of alternative sites which are not evaluated in detail. Therefore, we have concluded the discussion below.

3.3.1 Site Descriptions

The locations of the five sites considered are depicted on figure 3.3.1.5-1 and descriptions are provided below. Therefore, we have included the discussion below.

3.3.1.1 Proposed Site – Calcasieu Pass, Cameron Parish, Louisiana

The proposed site is an 828.6-acre property approximately 1.5 miles south of the Town of Cameron in Cameron Parish, Louisiana. The southern border of the site is approximately 1,000 feet north of the Gulf of Mexico and the site has about 6,000 feet of frontage on the Calcasieu River Ship Channel. It is in a remote, industrial region over 1.3 miles from the nearest residence. This site has been historically impacted by the placement of fill, ditching, and cattle grazing activities. NWI mapping indicates that approximately 37 percent (303.4 acres) of the property contains mapped wetlands. The site is crossed by an existing municipal water supply line and Davis Road, which provides direct access to LA-27/SR-82.

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[13] Nine expansion projects are proposed at six LNG terminals; two expansion projects (Trains 1-4 and Trains 5&6) are proposed at Sabine Pass LNG and two expansion projects are proposed at Freeport LNG (one under construction and one planned for Train 4), and two expansion projects are located at the Cameron LNG terminal site.

3.3.1.2 Site A – Wakefield Road, Cameron Parish, Louisiana

Site A is a 49-acre parcel of privately owned land adjacent to Wakefield Road in Cameron Parish, Louisiana. The site is approximately 4 miles north of the Gulf of Mexico shoreline and has about 1,970 feet of frontage on the Calcasieu River Ship Channel. It is in an area zoned for heavy industrial use, and is close to several industrial businesses to the northeast and southwest. Approximately 48 percent (23.4 acres) of the site is mapped as NWI wetland.

3.3.1.3 Site B – North of Choupique Island, Calcasieu Parish, Louisiana

Site B is a 118-acre parcel of privately owned land north of the Calcasieu Point Landing and Choupique Island in Calcasieu Parish, Louisiana. The area is zoned for heavy industrial use. It is on a spur of the Calcasieu River Ship Channel, with a channel frontage of approximately 900 feet, and is over 24 miles north of the Gulf of Mexico shoreline. Approximately 2 percent (2.7 acres) of the site is mapped as NWI wetland.

3.3.1.4 Site C – South Carlyss, Calcasieu Parish, Louisiana

Site C is a 174-acre parcel of privately owned land bordered to the south and west by Global Drive in Calcasieu Parish, Louisiana. The site is on the Calcasieu River Ship Channel, approximately 23 miles north of the Gulf of Mexico shoreline, and has a shoreline frontage of approximately 1,540 feet. The area is zoned for heavy industrial use and the southeast corner and north central portion of the property are adjacent to active industrial and residential properties, respectively. Approximately 61 percent (105.8 acres) of the site is mapped as NWI wetland.

3.3.1.5 Site D – South Carlyss, Calcasieu Parish, Louisiana

Site D is a 164-acre parcel of privately owned land bordered to the south by Burton Shipyard Road in Calcasieu Parish, Louisiana. The parcel has approximately 3,355 feet of frontage along the Calcasieu River Ship Channel and is approximately 24 miles north of the Gulf of Mexico shoreline. Site D is in close proximity to residential communities on its north, northwest, and south-central boundaries, with 59 residences within 0.5 mile of the site. Approximately 47 percent (77.8 acres) of Site D is mapped as NWI wetland.

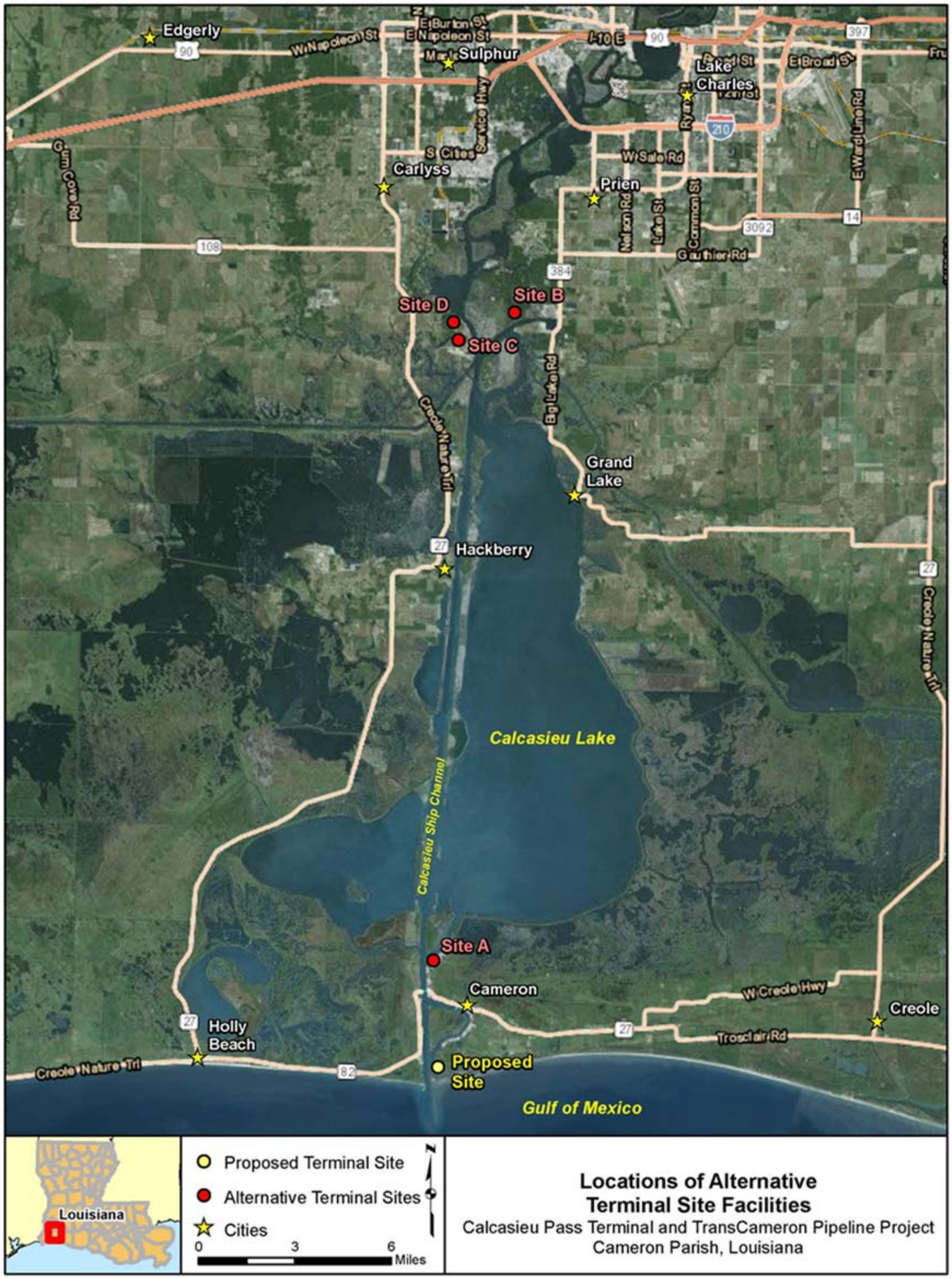

Figure 3.3.1.5-1 Locations of Alternative Terminal Site Facilities

3.3.2 Site Selection Analysis

To assess the suitability of each site, Venture Global analyzed site-specific criteria, marine operations, access to existing infrastructure, and permitting, which were then subdivided into site selection criteria.

1. The site-specific criteria are as follows:
   - availability of land for purchase or long-term lease;
   - compatibility with surrounding land use; and
   - suitable size and configuration of land to construct and operate the proposed LNG facility, including the required spacing between equipment and tanks, as specified by the NFPA 59A. The minimum land demand for the Terminal is approximately 250 acres.
2. The criteria of the marine operations objective include:
   - sufficient deep water shipping channel frontage for multiple LNG carriers (i.e., approximately 3,000 linear feet or more to accommodate two marine berths and a utility dock); and
   - proximity and access to the Gulf of Mexico.
3. The criteria for access to existing infrastructure include:
   - proximity to existing natural gas pipeline systems;
   - proximity to utilities (water and electricity); and
   - suitable road and highway access.
4. Criteria of the permitting objective include:
   - avoidance of non-attainment air quality zones; and
   - avoidance/minimization of wetland/waterbody impacts and/or viable mitigation alternatives.

Refer to table 3.3.2-1 below for a summary of the comparison results.

TABLE 3.3.2-1

CALCASIEU PASS TERMINAL ALTERNATIVE SITE LOCATION COMPARISON

Criteria	Site				
	Proposed	A	B	C	D
Site Specific					
Availability of land for purchase or lease	Yes	Yes	Yes	Yes	Yes
Compatibility with surrounding land use	Yes	Yes	Yes	Yes	Yes
Size of land (acres)	828	49	118	174	164
Sufficiency of land area and configuration	Yes	No	No	No	No
Marine Operations					
Calcasieu River Ship Channel frontage (linear feet)	6,000	1,970	900	1,540	3,355
Sufficiency of frontage	Yes	No	No	No	Yes
Distance from Gulf of Mexico shoreline (miles)	0.2	4	24	23	24
Infrastructure					
Proximity to natural gas pipelines	Yes	Yes	Yes	Yes	Yes
Proximity to utilities	Yes	Yes	Yes	Yes	Yes
Road and highway access	Yes	Yes	Yes	Yes	Yes
Permitting					
NWI wetlands mapped (acres) [a]	303.4	23	3	106	78
NWI wetlands mapped (percent of site)	37	48	2	61	47
NWI wetlands impacted by project (percent)	12%	100%	100%	100%	100%

[a] Acreages for all of the alternative Terminal sites represent National Wetlands Inventory (NWI) wetlands mapped by the U.S. Fish and Wildlife Service. Because the boundaries of jurisdictional wetlands may differ from NWI wetlands, the wetland acreage numbers provided in this table are different than those reported elsewhere in this Environmental Impact Statement for the proposed site.

3.3.2.1 Site Specific Analysis

As shown in table 3.3.2-1 above, all of the identified sites are available for purchase or lease. The proposed site would offer the most available land (828 acres) for construction of the Terminal facilities. Sites A, B, C, and D do not have sufficient land area for the proposed Project facilities. The restricted width of Site A and its limited size would make it difficult to site and construct the proposed project facilities; Site B has insufficient length (from north to south) to enable the Terminal facilities to be appropriately configured and located; and the boundary configuration for Site C would make siting of plant facilities impractical or impossible. Apart from the proposed site, Site D is the only site alternative with adequate channel frontage but does not have adequate acreage for the proposed Terminal layout demands.

All site alternatives are zoned for heavy industrial use or have no zoning limitations but are in industrial areas. Site D has 59 residences within 0.5 mile of the site, which could create siting challenges.

3.3.2.2 Marine Operations

As quantified in table 3.3.2-1, the proposed site would offer the most frontage along the Calcasieu River Ship Channel (6,000 feet), allowing adequate configuration of the proposed berthing and loading docks. Site D also offers sufficient frontage (3,355 feet) while Sites A, B, and C provide insufficient frontage for the Project's needs. Further, the proposed site is only 0.2 mile from the Gulf of Mexico shoreline, offering the shortest distance for LNG carriers to travel along the Calcasieu River Ship Channel, thereby minimizing ship traffic and potential impacts on the river's aquatic resources. Site D may require additional dredging, channel modifications, or cutting into the site to create a ship berth (which would further reduce the available size of the site to construct the facilities).

3.3.2.3 Infrastructure

All five sites offer similar advantages in terms of proximity to existing natural gas pipelines, utilities, and road/highway access.

3.3.2.4 Permitting

With respect to air permitting, all five alternative sites are outside of a non-attainment air quality zone. In terms of natural resources permitting, it is expected that these sites would have similar impacts as the Project's Terminal site, particularly relative to federally and state-listed species. Similarly, while there is some inter-site variation in habitat quantity and composition, there appear to be no strongly discriminating factors that would support prioritization of sites based on habitat quality or suitability for wildlife, including use by migratory birds.

With respect to wetlands, NWI information indicates that the construction of the Terminal facilities on the proposed site would impact the most wetland acreage, while Site B would impact the least.

3.3.2.5 Conclusion

None of the alternative sites are feasible due to their limited size. The Terminal requires at least 250 acres in size (and probably more given Venture Global's efforts to minimize impacts [described in section 3.4]), and all identified alternatives (other than the proposed site) are smaller than the minimum size required. The proposed Terminal site satisfies the Project's purpose and need and minimizes and mitigates impacts on wetlands and wildlife resources, as well as on nearby residences and businesses. In addition, any other alternative sites that may meet the Project objectives would likely have a similar level of impact on environmental resources as the proposed site. Therefore, we conclude that the proposed Terminal location is the preferred alternative that can meet the Project objectives.

3.4 ALTERNATIVE TERMINAL CONFIGURATIONS

Facility design and configuration within the Terminal site is subject to the siting requirements of 49 CFR 193 and other industry or engineering standards. Regulatory requirements stipulate that potential thermal exclusion and vapor dispersion zones remain on site, limiting the potential locations for specific pieces of equipment. Similarly, thermal radiation zones for flares require that the flare be set back a minimum distance from other equipment and property lines. The selected location of each of the components of the Terminal was based on the relevant regulations, codes, and guidelines.

Venture Global Calcasieu Pass' original September 4, 2015 application included a larger project footprint that was subsequently reduced to accommodate a smaller, more efficient facility design, in response to feedback from permitting agencies regarding environmental impacts. As a result of their March 21, 2016 Supplemental filing, June 28, 2016 Amendment, and July 14, 2016 Supplemental Information filing, Venture Global Calcasieu Pass reduced the Terminal site 393.7 acres to 269.2 acres, consequently reducing the impacts on wetlands on the Terminal site from 206.9 acres to 119.3 acres (this excludes the access road and marine terminal wetland impacts which remain unchanged).

We evaluated the proposed configuration and project specification changes in the March 21, June 28, and July 14, 2016 supplemental and addendum filings relative to impacts on wetlands and other sensitive resources. We did not identify 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 proposed Terminal configuration.

3.5 ALTERNATIVE DREDGE DISPOSAL LOCATIONS

Venture Global Calcasieu Pass is continuing to discuss dredge disposal options with various agencies, including the USACE, the LDNR OCM, and the LDEQ. During scoping, several commenters expressed concerned with dredge material disposal. An estimated 29.3 acres would be excavated/dredged from the existing western shoreline of the Terminal site and 64.8 acres would be dredged from the eastern edge of the Calcasieu River Ship Channel to the existing western shoreline of the Terminal site to reach the required water depth for the turning basin and proposed berths. This results in approximately 5 million *in-situ* y^3 of material excavated or dredged.

Venture Global Calcasieu Pass proposes to reuse 716,000 cubic yards (yd^3) as a beneficial use for marsh creation and restoration. Venture Global Calcasieu Pass is proposing nearshore placement along the West Beach adjacent to the Calcasieu Bar Channel for the remaining dredge material, as discussed in its Compensatory Mitigation Plan and Beneficial Use of Dredged Material Plan (CMP/BUDM). This placement would result in a submerged barrier that would protect the shoreline and would be the most cost effective and reliable approach given the short distance between the dredging location and restoration area. Venture Global's CMP/BUDM is provided in appendix E.

Venture Global also proposes mitigation banking to compensate for wetland impacts. The banking is proposed to take place at the South Fork Coastal Mitigation Bank, operated by Delta Land Services and about 20 miles north of the Terminal site. Should available mitigation banking options fall short of providing all the compensatory wetland mitigation required for the Project, Venture Global Calcasieu Pass and TransCameron Pipeline would redress the deficit by delivering sufficient beneficial use dredged material to the Cameron Prairie National Wildlife Refuge (CPNWR) for the FWS to restore an appropriate offset acreage of marsh. Venture Global met with FWS on January 13, 2016 to discuss the use of the CPNWR for compensatory mitigation.[14]

Two additional alternatives were considered for the beneficial reuse of dredged materials. One was the Oyster Lake Marsh Creation and Nourishment Project, a marsh restoration area identified in the 2012 Coastal Master Plan as Mud Lake Marsh Creation project. This project is proposed to beneficially use material to create and nourish 660 acres of saline marsh in the open water areas of Oyster Bayou, located west of the Terminal site. The second alternative was the No Name Bayou Marsh Creation Project which proposes to create and/or nourish 533 acres of saline marsh in an area of open water and fragmented marsh south of Calcasieu Lake. The project would be on both private and federal lands (National Wildlife Refuge), approximately 6 miles from the Project dredging area. While these two projects were considered as the most viable options, they have since secured government funding and have progressed through the planning stages of receiving other spoil material, thereby reducing the likelihood of spoil material from the Project being accepted at these sites. See section 4.3.2.2 for further information on the Project's proposed dredging CMP/BUDM.

[14] Documentation regarding correspondence with FWS on this about the CPNWR site can be viewed on the FERC eLibrary under Accession Number 20160919-5187; Data Response #21.

3.6 ALTERNATIVE PIPELINE ROUTES

Based in part on information provided by Venture Global, we evaluated pipeline alternatives to deliver natural gas to the Terminal. In their scoping comments, the EPA stated the EIS should provide a clear discussion of the reasons for elimination of alternative pipelines which are not evaluated in detail.

We did not identify any areas of concern that would warrant minor route variations. No significant environmental issues have been identified along the pipeline, and we did not receive any comments or concerns from stakeholders regarding minor route variations.

3.6.1 Lateral Pipelines Considered

The Project would include one new Pipeline lateral on the east side of the Terminal site, for the purpose of transporting feed gas to the Terminal site from existing ANR and Bridgeline natural gas pipelines. The feed gas receipt points from ANR and Bridgeline were selected by TransCameron Pipeline based on the proximity of their pipeline systems to the Terminal site, their available gas transportation capacity, the feasibility of interconnection, and the relative proximity of existing compression facilities. Route alternative considerations for interconnections with the two transmission companies are discussed below and are depicted on figure 3.6.1-1. A quantitative comparison of the alternative routes is provided in table 3.6.1-1.

As described in section 2.2.1, the proposed natural gas Pipeline would provide feed gas from the ANR and Bridgeline pipeline systems westward to the Terminal site. An interconnect location on ANR's existing pipeline system was selected in the vicinity of the Grand Chenier Facility and Mermentau River Compressor Station. Two pipeline routes were considered to transport feed gas from the interconnect to the Terminal site: the Alternative Lateral pipeline route and the Proposed Lateral pipeline route. Each route is described below.

The proposed Pipeline route is south of the Sabine National Wildlife Refuge and north of the Calcasieu River Ship Channel. The location is relatively constrained between these two features which limits available options; therefore, we did not identify additional pipeline route alternatives.

TABLE 3.6.1-1

TRANSCAMERON PIPELINE – ALTERNATIVE PIPELINE ROUTE COMPARISON

Environmental Feature (unit)	Pipeline Lateral	
	Alternative Route	Proposed Route
Total Length (miles)	**20.6**	**23.4**
NHD Surface Waters Crossed		
Canal/ditch or artificial path [a] (number)	23	0
Perennial streams/rivers (number)	1	3
Total (number)	**24**	**3**
Major NHD Waterbody Crossings [b] (number)	1	0
NWI Wetlands Crossed		
Total (miles)	**18.7**	**15.9**
ESRI Land Use/Land Cover		
Cultivated crops (miles)	0.0	0.2
Developed (miles)	0.8	0.9
Hay/pasture/herbaceous (miles)	1.1	2.8
Open water (miles)	0.7	0.7
Scrub/shrub (miles)	0.6	0.1
Total (miles)	**20.6**	**23.4**
Residences within 50 feet of HDD entry and exit points	1	0
Collocation with existing facilities (miles)	3.6	20.1

[a] "Artificial path" is a term assigned by the National Hydrography Dataset (NHD) that refers to flow/channels within large estuarine and marine deepwater habitats or other canal-like waterbody features.

[b] Major waterbodies are defined by the Federal Energy Regulatory Commission (FERC) as those with a width greater than 100 feet at the time of crossing.

Notes: Totals may not equal sum of addends due to rounding.

Surface water, wetland, and land use/land cover information was generated by desktop analysis during the early screening process using publicly available GIS data.

HDD = horizontal directional drill

Figure 3.6.1-1 Pipeline Route Alternatives

3.6.1.1 Alternative Lateral Pipeline Route

The Alternative Lateral Pipeline Route was the route originally conceived by TransCameron Pipeline to transport feed gas from the ANR pipeline system to the Terminal site. As depicted on figure 3.6-1, the alternative route would be approximately 20.6 miles long and would trend due east between the Terminal site and the interconnect location. Although the route would approximate the shortest land distance between the two locations and runs along the coast in a relatively unpopulated area, it has some significant disadvantages. The route would run along the shoreline; approximately 1.1 miles (5 percent) is within 200 feet of the upper beach line along the Gulf of Mexico, with no natural or man-made barrier to protect it from coastal storm erosion. This location may also put construction activities near nesting shorebirds and turtles, including federally listed species. Based on NWI mapping, approximately 91 percent of this route would cross contiguous wetland, with the only upland being toward the ends of the route. National Hydrography Dataset (NHD) mapping indicates 24 surface water crossings, including 23 canals/ditches or artificial paths and one perennial stream; of these, one crossing (Creole Canal) would be a major waterbody crossing. This route is generally a greenfield route, with only 18 percent (3.6 miles) collocated along existing linear corridors.

3.6.1.2 Proposed Lateral Pipeline Route

According to TransCameron Pipeline, the proposed route was developed to reduce environmental impacts compared to the alternative route. Although it would be 2.8 miles longer, for a total of 23.4 miles, it is collocated with existing pipelines for approximately 86 percent (20.1 miles) of its length. It is also farther from (between 0.4 and 2.3 miles north of) the shoreline than the alternative route, thereby avoiding potential environmental and engineering concerns related to construction close to the shoreline. NWI mapping indicates that 68 percent (15.9 miles) of this route crosses wetland areas, with upland areas interspersed along the length of the route rather than in isolated locations. This is approximately 3 fewer miles of wetlands crossings than the alternative pipeline route. The proposed route would also result in substantially fewer waterbody crossings than the alternative route, as noted in table 3.6.1-1.

3.6.1.3 Conclusion

The Proposed Lateral Pipeline Route offers significant environmental advantages compared to the Alternative Lateral Pipeline Route, particularly as it relates to collocation, additional setbacks from the shoreline, and reduced wetland impacts. Therefore, although it is a shorter route, we do not recommend the use of the Alternative Lateral Pipeline Route. Given the fairly uniform nature of land use and largely similar habitats in this constrained corridor, and lack of significant impacts or comments from the proposed route, we determined that evaluation of additional major route alternatives was not necessary. Therefore, we conclude that TransCameron's proposed Pipeline route is the preferred alternative that can meet the Project objectives.

3.6.2 West Lateral Pipeline Considered but Eliminated

As part of the original September 24, 2015 application, TransCameron Pipeline included a West Lateral pipeline as well as the proposed pipeline lateral described above. The West Lateral pipeline was subsequently removed from the Project as part of the June 28, 2016 application addendum. Venture Global determined that the proposed Pipeline lateral to the east of the Terminal site would provide sufficient flexibility and access to feed gas from the U.S. natural gas pipeline grid. The West Lateral pipeline included in the original application consisted of a pipeline route that would be collocated along an existing 6-inch Tennessee Gas pipeline for approximately 9.9 miles, with the remaining route generally paralleling State Highways (SH) 27 and 82. The western lateral would cross 17 NHD-mapped surface waterbodies, including 16 canal/ditches or artificial paths and one perennial stream. One of these crossings, the Calcasieu

River Ship Channel, would be a major waterbody crossing involving a complex HDD technique. Based on NWI mapping, approximately 73 percent (14.1 miles) of this route would cross wetlands. As noted in the June 28, 2016 application addendum, the removal of this pipeline reduced the Pipeline's footprint by 265.4 acres, including a 1.4 acre reduction in permanent wetland fill and a 98 acre reduction in wetland impact from the permanent ROW (i.e., non-filled wetland but permanently maintained). There is also no significant advantage to the West Lateral pipeline as an alternative to the proposed (east) Pipeline. Therefore, we conclude that TransCameron's proposed Pipeline route is the preferred alternative that can meet the Project objectives.

3.7 PROCESS ALTERNATIVES

There are numerous processes available to liquefy natural gas. One of the key criteria in liquefaction process selection is efficiency. When cooling/heating curves of the process gas and refrigerant match as closely as possible, a more efficient thermodynamic process results, requiring less power per unit of LNG produced. Improved efficiency also results in reduced air emissions. In addition to efficiency, other criteria of importance include availability of natural gas, cost of construction and operation, and land use requirements.

Venture Global considered several liquefaction technologies currently available by different companies to determine which would be best suited for the Project and the region. The eight technologies considered include the following:

- Propane Mixed Refrigerant (C3-MR) Process;
- Cascade Process;
- AP-X Process;
- Dual Mixed Refrigerant (DMR) Process;
- Nitrogen Expansion Process;
- PRICO® SMR Process;
- OSMR® Process; and
- IPSMR® Process (proposed)

The C3-MR, Cascade, AP-X, and DMR processes listed above are all multi-cycle processes used in large-scale LNG facilities with train capacities greater than 3.5 MTPA. However, each LNG train for the proposed Project would have a capacity of 1.0 MTPA, and would be developed based on a staged approach of smaller gas volumes. In contrast to the larger trains, the smaller scale IPSMR Process trains that Venture Global proposes would accelerate the timeline for producing LNG.

The nitrogen expansion process is suitable for small-scale LNG facilities, but it is less efficient and would require a more significant amount of energy than the MR process.

The SMR process is a very simple single cycle liquefaction process that has been used for small-scale LNG facilities for over 35 years; however, it has low thermal efficiency compared to other technologies. The OSMR® process optimizes the SMR process through the use of aero-derivative gas turbines, combined heat and power technology, and ammonia refrigeration; the use of these technologies results in a 30 percent efficiency improvement and therefore 30 percent lower GHG emissions than traditional LNG processes. The IPSMR® process also optimizes the SMR process, resulting in improved efficiency and lower GHG emissions, but it uses electric drives in its propane-MR processes rather than aero-derivative gas turbines. The electric drives are more efficient than the gas-fired turbines; therefore, heat rate efficiencies and local air emission impacts are also expected to be lower if the power source is removed or from a cleaner source than the gas fired turbines. The IPSMR® process also allows liquefaction units and modules to be constructed off-site, offering schedule optimization, plant construction efficiency, operational reliability, and flexibility.

Based on its improved efficiencies and modular nature, Venture Global Calcasieu Pass selected the IPSMR® process as the best suited design for this project. We have determined that none of the alternative processes offered any significant environmental advantages over the proposed IPSMR® process.

In conclusion, we have determined that the proposed Project, as modified by our recommended mitigation measures, is the preferred alternative that can meet the Project objectives.

4.0 ENVIRONMENTAL ANALYSIS

4.1 GEOLOGY

4.1.1 Geologic Conditions and Setting

4.1.1.1 Terminal Facilities

The Terminal would be within the West Gulf Coastal Plain section of the Gulf Coastal Plain physiographic province. The section has a minor slope toward the Gulf of Mexico and is underlain by Pleistocene and Holocene fluvial, tidal, and deltaic sediments. The minimum elevation at the Terminal is sea level, and the maximum elevation is about 12 feet amsl.

The Terminal site is within the Louisiana Chenier Plain physiographic area of the West Gulf Coastal Plain, characterized by sandy beach ridges (cheniers) and mud flats that promote marsh/swamp vegetation. The cheniers and mud flats run parallel to the Gulf of Mexico shoreline. The Louisiana Chenier Plain was created by the Mississippi River depositing deltaic sediments. These deltaic sediments consist of Holocene Coastal Marsh deposits made up of mud and organic matter thousands of feet thick. The specific geological unit that underlays the Terminal site is the Chenier Plain – Saline Marsh, which is part of the larger Holocene Coastal marshes formation. The Chenier Plain – Saline Marsh is underlain at great depth by tertiary bedrock.

Venture Global Calcasieu Pass has performed a comprehensive geotechnical investigation of the site. Soil profiles reveal general subsurface conditions at the Terminal site consist primarily of very soft to firm clays underlain by loose to medium dense silty sand followed by firm to very stiff clays interlayered with medium dense sand to dense sand in the upper 200 feet.

4.1.1.2 Pipeline Facilities

The Pipeline would be within the same physiographic province as the Terminal site described above, but would cross two geological units; the Chenier Plain – Saline Marsh unit, and the Chenier Plain – Fresh Marsh unit. Both units are considered part of the Holocene Coastal Marshes Formation, and are very similar in composition. The topography crossed by the Pipeline is similar to the topography of the Terminal site, generally low and level with low-lying intervening upland areas.

4.1.2 Mineral Resources

There are no surface mines in the vicinity of the Project. The predominant surface mineral mined in Louisiana is lignite, which is found in the northern part of the state. In Louisiana, salt is mined from underground salt domes. The closest salt domes to the Terminal site and Pipeline are approximately 7 miles and 5 miles, respectively.

The Terminal would be on the southern edge of the Calcasieu Pass Gas Field. Within the Terminal property boundary, there are 28 wells, all of which have been plugged and abandoned except for one well listed as orphaned. The orphaned well is 192 feet from the Northeast Access Road and would not be impacted by construction activities.

The Pipeline would cross the Cameron Oil and Gas Field, and the Calcasieu Pass Gas Field. According to the LDNR (2014), three wells are within the proposed Pipeline workspace. One of the wells has been plugged and abandoned. The remaining wells are classified as one active injection well and one injection well approval expired.

Venture Global would locate each existing well in the field prior to construction. Venture Global would coordinate with well operators to avoid impacts during construction and operation, generally ensuring workspace and facilities are located at a sufficient distance from the wells to preclude any direct disturbance. For plugged and abandoned wells, Venture Global would coordinate with the LDNR, which has regulatory authority for oil and gas wells in Louisiana.

Although the Project is not anticipated to affect any active or abandoned oil or gas wells and active or potential surface mines, if an unidentified well is encountered, Venture Global would coordinate with well operators and/or LDNR to develop measures to avoid or minimize impacts during construction and operation. Therefore, construction and operation of the Terminal and Pipeline facilities would not significantly affect mineral resources. Table 4.1.2-1 lists known wells within the workspace of the proposed facilities.

TABLE 4.1.2-1

OIL AND GAS WELLS WITHIN THE PROPOSED FACILITY WORKSPACE

Proposed Facility	Well Serial Number	Well Owner	Well Status
Terminal Site	95030	Inactive Operator	Plugged and Abandoned 06/18/1963
	100431	The Ballard & Cordell Corp	Plugged and Abandoned 01/24/1964
	178834	Ballard Exploration Co., Inc.	Plugged and Abandoned 11/21/1983
	205574	Terra Resources, Inc.	Plugged and Abandoned 08/13/1983
	215836	Smith Production Co.	Plugged and Abandoned 02/26/2002
	205499	Terra Resources, Inc.	Plugged and Abandoned 04/13/1987
	57338	Inactive Operator	Plugged and Abandoned 01/08/1955
	232443	Henry Production Co. Inc.	Plugged and Abandoned 04/12/2006
	222648	Smith Production Co.	Plugged and Abandoned 12/04/1998
	62290	Inactive Operator	Plugged and Abandoned 12/30/1956
	83649	Inactive Operator	Plugged and Abandoned 03/29/1961
	82660	The Ballard & Cordell Corp	Plugged and Abandoned 03/16/1981
	89275	Mosbacher Energy Company	Plugged and Abandoned 03/30/1983
	83605	The Ballard & Cordell Corp.	Plugged and Abandoned 03/16/1981
	85915	Mosbacher Energy Company	Plugged and Abandoned 03/30/1983
	227914	Henry Production Co. Inc.	Plugged and Abandoned 01/08/2008
	228222	Smith Production Co.	Plugged and Abandoned 07/29/2005
	216730	Smith Production Co.	Plugged and Abandoned 08/04/2005
	150534	Sklar & Phillips Oil Company	Plugged and Abandoned 09/24/1976
	230297	Sandalwood Exploration, L.P.	Plugged and Abandoned 01/29/2005
	84530	Wiley P. Ballard, Jr., et al	Orphaned
	190237	DMS Oil Company	Plugged and Abandoned 11/08/1988
	87030	Shenandoah Oil Corporation	Plugged and Abandoned 06/29/1979
	215835	Smith Production Co.	Plugged and Abandoned 09/30/1993
	144428	Coastal Oil & Gas Corp.	Plugged and Abandoned 10/14/1980
	207797	Clovelly Exploration Co., Inc.	Plugged and Abandoned 02/21/1988
	145093	Grey Wolf Drilling Co.	Plugged and Abandoned 04/03/1978
	154166	I H Delatte & Associates, Inc.	Plugged and Abandoned 04/01/1978
Pipeline	161128	Swift Energy Company	Plugged and Abandoned 08/12/1999
	973528	Pioneer Exploration, Ltd.	Injection well active effective 04/02/2008
	973758	Pioneer Exploration, LLC	Injection well active effective 04/26/2011

4.1.3 Paleontological Resources

A majority of surface exposures in Louisiana are Tertiary and Quaternary in age (less than 65 million years) with many of the surficial sediments being less than 10,000 years in age. These sediments, which are present in the Project area, were formed from erosional deposition and are underlain by Holocene age clay/mud deposits representing recent erosion and deposition. These environments are not nearly as conducive for the preservation of fossils as the marine environment. The geological composition of Louisiana causes marine fossils to be relatively uncommon in surface exposures (LGS, 2002). Therefore, the Holocene rock units that underlie the Project are not considered fossil-bearing. No sensitive paleontological resources have been identified within the Terminal site or Pipeline workspaces.

Therefore, no significant impacts are anticipated by constructing and operating the Terminal and Pipeline facilities.

4.1.4 Blasting

Blasting would not be required during construction. The Project areas at the Terminal site and Pipeline are underlain by unconsolidated sediments to depths greater than the excavation depth needed to construct the proposed facilities.

4.1.5 Natural Hazards

Geologic hazards that can potentially affect the Terminal facility and Pipeline include earthquake ground motions, faulting, soil liquefaction, subsidence, and slope stability. Other natural hazards of concern, as expressed by several scoping commenters, include hurricane winds, flooding, and long-term sea level rise. The Pipeline design to withstand natural hazards are generally discussed below. The LNG Terminal design to withstand natural hazards are generally discussed in section 4.12.

4.1.5.1 Earthquake Ground Motions and Faulting

Louisiana is within the Gulf Coast Basin tectonic province. The Gulf Coast Basin is characterized as having thick sedimentary rocks above basement rock structures. The province’s sedimentary strata thicken toward the south, with salt domes and relatively shallow listric growth faults that run parallel to the Gulf of Mexico Coastline and extend outside of Louisiana. Movement within the fault system has 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).

A low risk of seismic activity and faulting effects can be reasonably anticipated for the Project area. Since 1843, when records were first kept, there have been over 43 earthquakes with epicenters outside of the region, which have affected southern Louisiana. No recorded earthquake has been attributed to any specific mapped fault system. One of these earthquakes reached a magnitude as high as 4.4 on the Richter scale, and three reached a magnitude between 3.9 and 4.4, the effects of which could include “shaking of indoor items, rattling noises, significant damage unlikely” (USGS, 2013). The rest were below magnitude 3.9.

The New Madrid Seismic Zone (NMSZ) is approximately 420 miles northeast of the Project area. The NMSZ is located in southeastern Missouri, northeastern Arkansas, western Tennessee, western Kentucky, and southern Illinois (Missouri DNR, 2015). A series of large-magnitude earthquakes occurred in the NMSZ between 1811 and 1812. These earthquakes are estimated to have been between 7.1 and 7.5

on the Richter Scale. USGS seismic modeling of a 7.7 magnitude earthquakes for the NMSZ indicates that shaking would be minimal within the Project area (USGS, 2014b).

4.1.5.2 Soil Liquefaction

Soil liquefaction is the transformation of loosely packed sediment, or cohesionless soil, from a solid to a liquid state as a result of increased pore pressure and reduced effective stress, such as intense and prolonged ground shake from seismic events. While certain soils would be susceptible to liquefaction if there were large ground motions, the low seismic ground motions in the Gulf of Mexico would not cause soil liquefaction. Therefore, is not anticipated that soil liquefaction would present a significant hazard along the Pipeline.

4.1.5.3 Subsidence

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 groundwater. Subsidence in southern Louisiana is typically caused through sub-surface water extraction for agriculture, flood protection, or development. Subsidence has also been recorded occurring naturally through fault movements and compaction/consolidation of Holocene deposits. The level of regional subsidence anticipated along the Pipeline is unlikely to present a hazard because pipelines are inherently flexible.

4.1.5.4 Landslides

Due to the low relief across the Pipeline route, there is little likelihood that landslides or slope movement would affect the Pipeline.

4.1.5.5 Shoreline Erosion

Increased storm activities, shortage of sediment supply, and sea level rise have made shoreline erosion a major concern in southern Louisiana. The average shoreline erosion rate in Cameron Parish was 15 feet per year between 1998 and 2009 (Shepis et al., 2010).

Specific measures and factors would assist in protection of the Pipeline from future shoreline erosion. The Pipeline is proposed north of SH 27/82, would be buried with 3 feet of cover, would have a concrete coating to prevent the pipeline from floating, and would be at least 150 feet from the shoreline. In addition, TransCameron Pipeline would monitor the status of the pipeline cover and potential third party intrusions. During these routine inspections and the possibility of additional inspections after major storm events, the effects of accelerated shoreline erosion would be sufficiently monitored.

4.1.5.6 Flooding

According to FEMA mapping (2012) the Pipeline is within flood zone "AE". Zone AE is designated for 1-percent-annual-chance flood event and is also referred to as the base flood or 100-year flood.

4.1.6 Pipeline Mitigation Design Measures

The proposed lateral Pipeline would be buried, which would protect it from the direct physical force of flood waters, waves, and wind by virtue of their underground location and 6-inch concrete coating. The concrete coating would act as a buoyance countermeasure in flood prone areas.

The Project is in an area that could present potential challenges relative to natural hazards; however, these conditions can be effectively managed through sound engineering design or shown to be minimized through additional valuation. The Pipeline and appurtenant aboveground facilities would be constructed in accordance with the design requirements of the PHMSA. Refer also to section 4.12.5 for further information about geologic hazards at the Terminal site.

4.2 SOILS AND SEDIMENTS

4.2.1 Soil Types and Limitations

Soil types and characteristics at the Terminal site and along the Pipeline were identified and assessed using the Soil Survey Geographic database (USDA NRCS, 2013a and 2013b). Venture Global obtained additional information about soils and associated land uses from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), the Official Soil Series Descriptions (USDA NRCS, 2010), and the published soils survey for Cameron Parish (USDA, 1995). Soil characteristics for soils impacted by construction of the Terminal and Pipeline are presented in table 4.2.1-1.

TABLE 4.2.1-1

SOIL CHARACTERISTICS FOR THE TERMINAL SITE AND PIPELINE

Map Unit Name	Prime Farmland	Compaction Prone	Water Erosion	Wind Erosion	Revegetation Concerns
Aquents, frequently flooded (AN)	No	No	No	No	No
Creole mucky clay (CR)	No	Yes	No	No	No
Hackberry loamy fine sand (Hb) [a]	Yes	No	No	No	No
Hackberry-Mermentau complex, gently undulating (Hm)	No	Yes	No	No	No
Mermentau Clay (ME)	No	Yes	No	No	No
Peveto fine sand, 1 to 3 percent slopes (Pe)[a]	No	No	No	Yes	Yes
Udifluvents, 1 to 20 percent slopes (UD)	No	No	Yes	No	No
Water (W)	N/A	N/A	N/A	N/A	N/A

[a] Crossed by pipeline only.
N/A = not applicable

4.2.1.1 Terminal Facility

Construction of the Terminal would affect six soil types mapped by the NRCS (including water). Approximately 314.0 acres would be permanently disturbed from construction of the Terminal site including service roads and marine facilities. Table 4.2.1.1-1 summarizes the permanent and temporary acreage impacts for each soil mapping unit identified at the Terminal site, as well as the temporary acreage impacts associated with the support facilities.

TABLE 4.2.1.1-1

SOIL SERIES IMPACTED AT THE TERMINAL SITE AND SUPPORT FACILITIES

Map Unit Name	Permanent Impact (acres)	Temporary Impact (acres)	Total
Terminal Site			
Aquents, frequently flooded (AN)	4.7	0.0	4.7
Creole mucky clay (CR)	30.1	0.0	30.1
Hackberry-Mermentau complex, gently undulating (Hm)	189.1	0.0	189.1
Mermentau Clay (ME)	1.6	0.0	1.6
Udifluvents, 1 to 20 percent slopes (UD)	43.6	0.0	43.6
Northeast Access Road			
Hackberry-Mermentau complex, gently undulating (Hm)	9.2	0.0	9.2
Mermentau Clay (ME)	2.1	0.0	2.1
Udifluvents, 1 to 20 percent slopes (UD)	0.5	0.0	0.5
Southwest Service Road			
Aquents, frequently flooded (AN)	0.1	0.0	0.1
Hackberry-Mermentau complex, gently undulating (Hm)	0.3	0.0	0.3
Udifluvents, 1 to 20 percent slopes (UD)	0.5	0.0	0.5
Martin Access Road			
Hackberry-Mermentau complex, gently undulating (Hm)	0.6	0.0	0.6
Mermentau Clay (ME)	0.9	0.0	0.9
Udifluvents, 1 to 20 percent slopes (UD)	<0.1	0.0	<0.1
DeHyCo Access Road			
Udifluvents, 1 to 20 percent slopes (UD)	0.0	0.1	0.1
Eastern TWS			
Creole mucky clay (CR)	0.0	8.0	8.0
Hackberry-Mermentau complex, gently undulating (Hm)	0.0	51.7	51.7
Floodwall TWS			
Aquents, frequently flooded (AN)	0.0	2.6	2.6
Creole mucky clay (CR)	0.0	1.0	1.0
Hackberry-Mermentau complex, gently undulating (Hm)	0.0	12.5	12.5
Mermentau Clay (ME)	0.0	4.9	4.9
Udifluvents, 1 to 20 percent slopes (UD)	0.0	2.4	2.4
Southwest TWS			
Aquents, frequently flooded (AN)	0.0	1.6	1.6
Udifluvents, 1 to 20 percent slopes (UD)	0.0	0.9	0.9
Northeastern TWS			
Hackberry-Mermentau complex, gently undulating (Hm)	0.0	0.3	0.3
Mermentau Clay (ME)	0.0	5.0	5.0
Northwestern TWS			
Udifluvents, 1 to 20 percent slopes (UD)	0.0	1.2	1.2
Pipeline within Venture Global Property			
Hackberry-Mermentau complex, gently undulating (Hm)	0.0	7.5	7.5
Marine Facilities			
Aquents, frequently flooded (AN)	21.4	0.0	21.4
Udifluvents, 1 to 20 percent slopes (UD)	7.2	0.0	7.2
Water (W)	0.7	0.0	0.7

TABLE 4.2.1.1-1 SOIL SERIES IMPACTED AT THE TERMINAL SITE AND SUPPORT FACILITIES			
Map Unit Name	**Permanent Impact (acres)**	**Temporary Impact (acres)**	**Total**
Liberty Support Facility [b]			
Hackberry-Mermentau complex, gently undulating (Hm)	0.0	11.4	11.4
Mermentau Clay (ME)	0.0	1.5	1.5
Udifluvents, 1 to 20 percent slopes (UD)	0.0	9.2	9.2
Water	0.0	<0.1	<0.1
Martin Support Facility [b]			
Udifluvents, 1 to 20 percent slopes (UD)	0.0	10.5	10.5
Water	0.0	<0.1	<0.1
DeHyCo Support Facility [b]			
Udifluvents, 1 to 20 percent slopes (UD)	0.0	9.1	9.1
Water	0.0	<0.1	<0.1
Mudd Support Facility [b]			
Udifluvents, 1 to 20 percent slopes (UD)	0.0	6.3	6.3
Water	0.0	0.7	0.7
Baker Hughes Support Facility [b]			
Udifluvents, 1 to 20 percent slopes (UD)	0.0	2.6	2.6
Total	314.0 [a]	150.6 [a]	464.6 [a]

[a] Rounding discrepancy in total.
[b] A previously developed and disturbed site.

Publicly available information was reviewed to identify and evaluate the soils that would be most susceptible to impacts from construction of the Terminal. Major soil limitations within the Terminal site are discussed below.

Prime Farmland Soils

Prime farmland is defined in the National Soil Survey Handbook as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops (USDA NRCS, 2017). This designation includes cultivated land, pasture, woodland, or other lands that either are used for food or fiber crops, or are available for these uses. Urbanized land, built-up land, and open water are excluded from prime farmland. Prime farmland typically contains few or no rocks, is permeable to water and air, is not excessively erodible or saturated with water for long periods, and is not subject to frequent, prolonged flooding during the growing season. Soils that do not meet the above criteria may be considered prime farmland if the limiting factor is mitigated (e.g., by artificial drainage or irrigating). Impacts on prime farmland are of concern because of the potential for decreases in long-term agricultural productivity.

Compaction Potential

Compaction-prone soils are those soils characterized as having a surface texture of sandy loam or finer and a drainage class of somewhat poorly drained through very poorly drained. Soil compaction reduces the porosity and moisture-holding capability of the soil. Construction equipment traveling over wet soils can disrupt soil structure, reduce pore space, increase runoff potential, and cause rutting.

Venture Global Calcasieu Pass would impact approximately 144 acres of soils classified as compaction-prone by construction at the Terminal site (Mermentau clay, Creole mucky clay, and Hackberry-Mermentau complex, gently undulating). In regard to compaction potential at the Terminal site, compaction-prone soils are favorable around foundations and piles. These soils are present throughout much of the Terminal site location. Compacted soils could decrease the water infiltration abilities of the natural soil structure. Additional runoff due to the compacted soils would be managed in accordance with Venture Global's Project-specific Plan and SWPPP.

Erosion Potential

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

Soils within the Terminal site that are highly erodible by water are classified as Udifluvents, 1 to 20 percent slopes. Approximately 56.3 acres are identified as Udifluvents, 1 to 20 percent slopes, within the Terminal site. Construction activities at the Terminal site would include significant modifications to the land surface that would include grading, excavation, soil stabilization through additives such as lime or cement, deposition of fill materials, and installation of a surface layer of aggregate materials. During construction activities at the Terminal site, heightened erosion and sedimentation concerns are associated with potential stormwater runoff. Venture Global Calcasieu Pass would mitigate these concerns by adherence to Project-specific Plan and Procedures and the SWPPP, which includes installation of erosion controls, measures to minimize dust, and stabilization/revegetation.

Venture Global Calcasieu Pass would excavate, dredge, and slope the existing shoreline of the Calcasieu River Ship Channel during construction. The post-construction shoreline would be approximately 500 feet east of the current location. To prevent slumping of the dredged slope, maintain the berthing line position, and provide structural integrity support to the landside facilities, Venture Global Calcasieu Pass would reinforce the excavated shoreline with rip-rap armoring. Additional shoreline erosion could occur from an increase in large ship traffic within the Calcasieu River Ship Channel. Venture Global Calcasieu Pass has been consulting with the USCG on its Follow-on WSA to address impacts from passing ships. The proposed rip-rap armoring would minimize the potential for erosion where the shoreline would be excavated. The proposed Terminal would be located at the mouth of the Calcasieu River Ship Channel; therefore, the potential for additional erosion from ship traffic associated with the Terminal would be localized to this area.

Sediments

Sediments that would be impacted by construction of the Terminal site are primarily within the LNG Berthing Area. Dredging to an elevation of -44.3 feet (NAVD88), would result in approximately 5.0 million *in-situ* y^3 of dredged sediments from the Calcasieu Pass Ship Channel. Venture Global Calcasieu Pass is currently evaluating potential disposal and beneficial use options for the excavated and dredged material; see section 3.5, Alternative Dredge Disposal Location, and appendix E for details on the CMP/BUDM.

Sediments in the Calcasieu Pass Shipping Channel were documented based on the results of four soil cores excavated offshore in the channel (BH-M1–BH-M4). The sediment types reported in these bores are summarized below:

- BH-M1. Very Soft Clay from the mudline to a depth of -13 feet NAVD88, underlain by a Stiff Clay to the depth of dredging at elevation -44.3 feet NAVD88.

- BH-M2. Predominantly Sandy Clay and Stiff Clay from the mudline to the depth of dredging at elevation -44.3 feet NAVD88.

- BH-M3. Predominantly Silty Clay and Stiff Clay from the mudline to the depth of dredging at elevation -44.3 feet NAVD88.

- BH-M4. Predominantly Firm to Very Stiff Clay from a depth at elevation -8 feet NAVD88 to the depth of dredging at elevation -44.3 feet NAVD88; layers of Very Soft Clay, Stiff Silty Clay, and Stiff Sandy Clay from mudline to an elevation of -8 feet NAVD88.

Contaminated Soils and Sediments

Venture Global Calcasieu Pass conducted analysis to identify potential contaminated sediments in accordance with the EPA/USACE *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual,* commonly referred to as the *Inland Testing Manual,* issued February 1998. No contaminated sediments were identified at the proposed Terminal site. 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 construction workspace could carry unconfined debris or other materials. Venture Global would adhere to its SPCC Plan and SWPPP for construction activities to minimize the potential for spills and provide measures to clean up any inadvertent spills.

No hazardous waste sites were identified at the Terminal site. Venture Global Calcasieu Pass conducted several Phase I Environmental Site Assessments that did not reveal any evidence of spills, leaks, or releases such as distressed vegetation, stained or discolored soil, oil sheens, or unusual odors. Additionally, database searches did not reveal any known releases of petroleum products, hazardous materials, or hazardous waste on the Terminal site or adjacent properties. Therefore, the proposed Terminal site would not impact contaminated soils and sediments.

4.2.1.2 Pipeline Facilities

Construction of the Pipeline facilities would affect seven soil types mapped by the NRCS (including water). Approximately 234.4 acres and 136.5 acres would be temporarily and permanently disturbed from construction of the Pipeline, respectively. Table 4.2.1.2-1 summarizes the temporary and permanent acreage of impacts for each soil type that would be disturbed by construction of the Pipeline.

TABLE 4.2.1.2-1 SOIL SERIES IMPACTED BY THE PIPELINE FACILITIES [a]				
Map Unit Name	Crossing Length (miles)	Temporary Workspace (acres) [b]	Permanent Easement (acres) [c]	Total (acres)
Creole mucky clay (CR)	8.0	84.2	47.3	131.5
Hackberry loamy fine sand (Hb)	1.3	15.8	7.7	23.5
Hackberry-Mermentau complex, gently undulating (Hm)	5.1	55.3	26.7	82.0
Mermentau Clay (ME)	8.9	78.9	53.6	132.5
Peveto fine sand, 1 to 3 percent slopes (Pe)	0.0	<0.1	0.0	<0.1
Udifluvents, 1 to 20 percent slopes (UD)	0.0	0.2	0.7	0.9
Water	0.1	0.0	0.5	0.5
Total	**23.4**	**234.4** [d]	**136.5** [d]	**370.9** [d]

[a] Includes Pipeline, meter station, mainline valve, access roads, ATWS, and contractor yard. Pipeline workspaces within the Venture Global property are included in the Terminal land use tables to avoid duplication.
[b] Temporary workspace acreage is exclusive of permanent easement acreage.
[c] Acreages for permanent easement include HDD areas not affected at the surface.
[d] 0.1-acre rounding discrepancy.

Publicly available information was reviewed to identify and evaluate the soils that would be most susceptible to impacts from construction of the Pipeline. In addition to the soil limitations discussed in section 4.2.1.1, soil limitations relevant to construction of the Pipeline are discussed below.

Compaction Potential

Approximately 78 percent (291.8 acres) of soils that TransCameron Pipeline would cross are classified as compaction-prone. TransCameron Pipeline would minimize rutting and compaction of soils by constructing in dry conditions to the extent practicable. In wetter conditions, the use of timber mats and low-ground pressure equipment would help to minimize impacts on compaction-prone soils. Additionally, special construction methods described in section 2 (e.g., the “push” and HDD methods) would minimize impacts on compaction-prone soils.

Erosion Potential

Soils within the pipeline route that are highly erodible by water are classified as Udifluvents, 1 to 20 percent slopes; soils that are highly erodible by wind are classified as Peveto fine sand. Approximately 0.9 acre of soils that would be impacted by Pipeline construction are classified as highly erodible (0.9 acres Udifluvents and <0.1 acre Peveto fine sand). During construction, TransCameron Pipeline would adhere to its Project-Specific Plan and Procedures and the SWPPP to minimize erosion within the construction workspace. A very small amount of the soils impacted by the Pipeline are highly wind erodible (<0.1 acre).

Prime Farmland

Approximately 6 percent (23.5 acres) of soils that would be crossed by the Pipeline are classified as prime farmland. To prevent mixing of soils during construction, TransCameron Pipeline would segregate the topsoil from subsoil and replace it in the proper order during backfilling and final grading. Following construction, agricultural areas would be restored to preconstruction conditions in accordance with TransCameron Pipeline’s Project-specific Plan and Procedures. With implementation of the Project-specific Plan, impacts on prime farmland soils would not be significant.

4.2.2 Contaminated Soils

TransCameron Pipeline conducted an analysis to identify potential contaminated soils or hazardous waste. TransCameron Pipeline conducted several Phase I Environmental Site Assessments that did not reveal any evidence of spills, leaks, or releases such as distressed vegetation, stained or discolored soil, oil sheens, or unusual odors. Additionally, database searches did not reveal any known releases of petroleum products, hazardous materials, or hazardous waste along the Pipeline or adjacent properties.

During construction, some potential exists for spills of hazardous materials, such as hydraulic fluid and diesel fuel for vehicles and equipment. Venture Global has developed and would adhere to its SPCC Plan and Project-specific Plan for construction activities. Use of these plans would minimize the potential for spills and provide measures to clean up any inadvertent spills. Therefore, we conclude that the Pipeline would not impact contaminated soils and TransCameron Pipeline's implementation of its SPCC Plan and Project-specific Plan would minimize potential impacts related to any inadvertent spills.

4.3 WATER RESOURCES

Water resources include groundwater and surface waters that could be affected by construction and operation of the Project. During scoping, the EPA and LDEQ expressed concern with potential impacts on water resources, including water supply, water quality, and 303(d) impaired waters.

4.3.1 Groundwater

The proposed Project site is on the Chicot aquifer, which makes up the upper aquifer of the broader Coastal Lowlands aquifer system. The Coastal Lowlands aquifer system comprises unconsolidated to poorly consolidated discontinuous wedges of sand, silt, and clay that increase in thickness toward the Gulf of Mexico and vary in depth. It is divided into five permeability zones; the proposed Terminal and Pipeline would be in Permeable Zone A, which extends along the coast of Louisiana. In this region, the total system exceeds a thickness of 10,000 feet, with an 800 to 1,000-foot-thick permeable zone comprising Holocene to upper Pleistocene deposits of interbedded sand and clay (Renken, 1998). Of the five permeability zones, Permeable Zone A has the largest withdrawals of groundwater, primarily for public water supply, agricultural, and industrial purposes. Although this zone has historically yielded large amounts of water, large groundwater withdrawals have resulted in water level declines, with the greatest decline in southwest Louisiana (SWLA) (Renken, 1998).

4.3.1.1 Sole Source Aquifers

Sole source aquifers are 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, 2016a). The Chicot aquifer in Louisiana has been designated as a sole source aquifer by the EPA. The dominant use of the water drawn from the aquifer is rice irrigation, with public drinking water supply being the second most extensive use of water drawn from the aquifer (USGS, 2014d). In 2010, groundwater withdrawals from the Chicot aquifer system in Cameron Parish totaled about 7.74 million gal/d.

Although within the Chicot aquifer system, the Project facilities are in a coastal area that does not provide recharge to any major Louisiana freshwater aquifers (LGS, 1988).

4.3.1.2 Groundwater Quality

The LDEQ Aquifer Sampling and Assessment Program monitors approximately 200 water wells throughout the state, including 24 wells in the Chicot aquifer. These wells are at least 17 miles from the Terminal site. Under the Federal Safe Drinking Water Act, the EPA has established the Maximum Contaminant Level (MCL) for pollutants that may pose a health risk in public drinking water. A Primary MCL is the highest level of a contaminant that the EPA allows in public drinking water. Secondary MCLs are defined as non-enforceable guidelines for taste, odor, or appearance (LDEQ, 2009).

Over the 12-year period of the Aquifer Sampling and Assessment monitoring program, the following six analytes have shown increasing concentrations in the wells in the Chicot aquifer: pH, alkalinity, chloride, hardness, barium, and iron. During the same time period, the following three analytes decreased: temperature, total phosphorous, and total nitrogen. Although some exceedances of federal secondary drinking water standards were detected, overall the data show that the groundwater produced from the aquifer is hard, but is of good quality (LDEQ, 2009). Approximately 200 geotechnical borings and several aquifer testing wells were drilled and tested by Venture Global Calcasieu Pass at and near the Terminal site in 2015 and 2016. Boring results indicated no evidence of existing groundwater contamination. Additionally, several Phase I Environmental Site Assessments were performed in 2015, including extensive database searches, with results indicating no evidence of groundwater contamination at the Terminal site. Therefore, we conclude the Terminal would not impact or be impacted by groundwater contamination.

4.3.1.3 Water Supply Wells

Although all fresh groundwater withdrawals in Cameron Parish come from the Chicot aquifer system, the aquifer produces only salt water along the coast and in isolated bodies north of the coast (USGS, 2014). Salinity is frequently expressed as the Total Dissolved Solid (TDS) concentration of water, which is a measure of the total ionic concentration of dissolved minerals in water. Groundwater TDS concentrations near the Terminal and Pipeline range from 600–700 milligrams per liter which is slightly above drinking water standards (LDEQ, 2009). In the vicinity of the Pipeline, fresh groundwater is present, with an approximate base ranging from 300 to 600 feet below National Geodetic Vertical Datum of 1929 (USGS, 2014). The EPA does not include TDS in the list of pollutants where primary MCLs have been established, but a TDS of 500 milligrams per liter has been established as a secondary MCL.

According to publicly available LDNR data, no active public or private drinking water supply wells are registered within 150 feet of the proposed Project (LDNR, 2012); the data does identify three active monitoring wells and four abandoned and plugged rig supply wells within 150 feet of the Project's proposed construction workspaces, as shown in table 4.3.1.3-1. The three active monitoring wells are located approximately 80 feet north of the Pipeline's construction workspace, near MP 4.8. While the owner of the wells is publicly available, the focus of the monitoring is not identified on LDNR's Strategic Online Natural Resource Information System database. One of the four plugged and abandoned rig supply wells is within the Terminal site; the other three plugged and abandoned rig supply wells are within 150 feet of the Pipeline's construction workspace. Based on review of the USGS topographic maps and field survey data, there are no springs within 150 feet of the proposed Pipeline.

The LDEQ operates a Wellhead Protection Program designed under the federal Safe Drinking Water Act Amendments of 1986 to protect the quality of public drinking water supplies obtained from community water wells (LDEQ, 2011). The LDEQ also operates a Source Water Assessment Program as required by the federal Safe Drinking Water Act Amendments of 1996 to determine the potential susceptibility of public water supply systems to contamination. A source water protection area defines the zone through which contaminants, if present, are likely to migrate and reach either a well or surface water intake supplying drinking water to the public. A wellhead protection area defines the same zone but for groundwater wells only, and are therefore, subsumed by source water protection areas. These drinking water protection areas vary from a 1,000-foot to 1-mile buffer from the water supply, depending on the characteristics of the supply source (e.g., screen depth of a well, construction date, or aquifer). Based on LDEQ information (LDEQ, 2015a), a total of 11 source water protection areas associated with groundwater supply wells were identified within the proposed project workspace; their associated protection areas, which vary from 0.5 mile to 1-mile buffers, are between 520 and 5,200 feet from the proposed Project workspace and have a depth of 251 to 320 feet within the Chicot aquifer. All 11 source water protection areas are associated with the proposed pipeline route.

TABLE 4.3.1.3-1

LDEQ IDENTIFIED GROUNDWATER WELLS WITHIN 150 FEET OF THE CONSTRUCTION WORK AREA

Project Facility	Water Source	Status; Use	Well Depth (feet)	Approx. MP	Distance and Direction from Construction Workspace (feet)
Terminal Site	Chicot aquifer, Shallow Sand	Plugged and abandoned; rig supply	260	N/A	0; within
Pipeline	Chicot aquifer, Shallow Sand	Plugged and abandoned; rig supply	340	N/A	120; North
	Chicot aquifer, Shallow Sand	Plugged and abandoned; rig supply	240	N/A	33; West
	Chicot aquifer, Upper Sand Unit	Plugged and abandoned; monitor	385	N/A	145; South
	Alluvial Aquifers, Undifferentiated	Active/Monitoring	19	4.8	80; North
	Alluvial Aquifers, Undifferentiated	Active/Monitoring	32	4.8	80; North
	No information available	Active/Monitoring	150	4.8	80; North

Source: LDNR, 2012.
N/A = not applicable

4.3.1.4 Groundwater Impacts and Mitigation

Terminal Facilities

Impacts on groundwater could occur during construction and operation activities at the Terminal site. The activities with the greatest potential to affect groundwater include excavation, deep piling activities, potential spills of hazardous materials, and groundwater withdrawals.

Excavations for construction have the potential to intercept groundwater, thereby affecting groundwater quality and/or quantity. Although these excavations would generally be shallow, groundwater throughout much of the Terminal site is expected to be at or near the ground surface. Therefore, dewatering may be required during excavation and would occur in accordance with the Project-specific Plan and Procedures.

Hammer and vibratory-driven pilings would be used during the construction of berthing docks, liquefaction units, storage tanks, and power plant. A potential impact associated with driven pilings is the cross contamination of lower permeable aquifer zones through downward vertical seepage from one layer to another. The anticipated maximum depth of pilings is at an elevation of approximately 110 feet below ground surface. At this depth, the pilings would stay within the upper (shallow) permeable zone of the Chicot aquifer. Subsurface materials above the aquifer consist of clay, silty clay and sandy clay, reducing permeability and limiting both vertical and horizontal water flow. Due to the proposed depth of pile foundations (approximately 110 feet below the ground surface) and the characteristics of the material above the Chicot aquifer, the potential for cross-contamination of groundwater is low.

The greatest potential for an impact on groundwater would be an accidental release of hazardous substances, such as fuels, lubricants, and coolants, while constructing and operating the Terminal facilities. Venture Global Calcasieu Pass would construct and operate the Terminal in accordance with its SWPPP and SPCC Plan. The SPCC Plan includes planning and preventative measures for spill avoidance; general BMPs, including refueling procedures, required spill response equipment to be kept on-site, and proper management of typical fuels, lubricants, and hazardous materials management; general spill response procedures; reportable spill response procedures; cleanup requirements; and waste storage and disposal requirements. We have reviewed these plans and find them to be acceptable.

Venture Global Calcasieu Pass has stated that the Terminal would require approximately 600,000 gal/d of fresh water for project operations (approximately 400 gallons per minute [gpm]). Venture Global Calcasieu Pass is continuing to consider options for water supply, including a municipal water supply connection, surface water, and groundwater. Venture Global Calcasieu Pass evaluated the Cameron Parish water supply system and determined that the water supply system could provide approximately 250 gpm (approximately 360,000 gal/d) to the Project without significant pressure loss based on current user loads. The evaluation also indicated that the system may require upgrades to infrastructure to meet or exceed this level of service. The municipal water is pumped from the upper Chicot aquifer through five municipal supply wells. The closest municipal supply well to the Terminal site boundary is about 1.3 miles north-northeast of the proposed Terminal and is outside of the 1-mile fixed radius wellhead protection area.

Venture Global Calcasieu Pass also evaluated the Chicot aquifer and the Calcasieu River to assess their potential as water supply sources for the Project. The evaluation included publicly available data and limited aquifer testing in October 2016. This testing confirmed that the upper Chicot aquifer can provide a sufficient volume of water for construction and operation purposes but would require on-site treatment for salinity. However, average salinity in the Calcasieu River is about 12 times greater than the salinity of groundwater at the Terminal site, which would place a much greater demand on the water treatment system if water was used from the Calcasieu River. Based on the initial suitability study, Venture Global Calcasieu Pass would likely permit, design, and install water supply wells for construction and operation to help meet the project's water demands. In addition, given the distance of the nearest municipal water supply well from the Terminal site (1.3 miles) and the high permeability and large storage volume in the upper Chicot aquifer, it is unlikely that an on-site supply well(s) would interfere with the municipal supply well. Venture Global Calcasieu Pass would conduct additional aquifer testing during the final design process.

The final source(s) of supply has not been determined for the Project, but would likely include water from the Cameron Parish water supply system in combination with groundwater. As mentioned above, the Cameron Parish water supply system may require upgrades to infrastructure to meet the partial needs of the project (250 gpm). Similarly, a water well on the Terminal site or nearby capable of providing up to 400 gpm on a continuous long-term basis, could have impacts such as exacerbating saltwater intrusion in the coastal aquifer. Therefore, **we recommend that:**

- **<u>Prior to the end of the draft EIS comment period</u>, Venture Global Calcasieu Pass should file with the Secretary of the Commission (Secretary) the results of the planned aquifer test well, including the aquifer pumping test results and analysis of potential long-term impacts, and identify the source(s) for the Terminal's long-term freshwater supply. In addition, Venture Global Calcasieu Pass should file with the Secretary documentation of consultation with the LDEQ regarding adequate groundwater supply for both construction and long-term operations.**

Venture Global Calcasieu Pass would use surface water for LNG tank hydrostatic testing and dust control. Additional information on the Terminal facility's water needs is provided in section 4.3.2.2.

As identified in 4.3.1.3-1, no active public or private drinking water supply wells have been identified within 150 feet of the Terminal site's construction work area. However, Venture Global Calcasieu Pass has indicated that if any public or private wells are present at the Terminal site and are damaged during construction, Venture Global Calcasieu Pass would ensure that a temporary source of water is provided until the damaged water wells is restored to its former capacity and quality, that a replacement source is provided, or that the landowner is fairly compensated for the damages.

Overall, we conclude that significant impacts on the groundwater resources underlying the Terminal facilities would not occur due to: lack of active public or private drinking water supply wells within 150 feet of the Terminal site's construction work area; construction of the proposed pilings within the permeable zone of the Chicot aquifer at a sufficiently shallow depth to avoid crossing aquifer confining layers; and surficial mitigation measures that would Venture Global Calcasieu Pass would implement in the event of a hazardous material spill. Further, the site is underlain by multiple strata of dense clay content, which provide a restrictive layer to slow or prevent the downward migration of surface and near waters or contaminants, thereby providing a natural protective barrier to groundwater quality.

Pipeline Facilities

Impacts on groundwater could occur during construction and operation activities associated with the pipeline facilities. The activities with the greatest potential to affect groundwater include excavation, potential spills of hazardous materials, and water withdrawals.

Groundwater wells near the proposed Pipeline could be temporarily impacted if trenching and backfilling during construction affects local water table elevations. In low-lying areas where groundwater is near the surface, trench dewatering may be required; however, no significant impact on groundwater flow would be expected from dewatering activities. As previously described, three active monitoring wells have been identified within 150 feet of the Project's construction workspaces. The greatest potential for impacts on groundwater would be an accidental release of a hazardous substance, such as fuels, lubricants, and coolants while constructing and operating the Pipeline. TransCameron Pipeline would implement the measures contained in its Project-specific Procedures, as well as its SWPPP and SPCC Plan, which provide measures to minimize the potential impacts associated with spills of hazardous materials. We have reviewed these plans and find them to be acceptable.

Water would be required during construction for hydrostatic testing and HDD drilling operations. TransCameron Pipeline would obtain the hydrostatic test water from surface water sources. Water for HDDs would be obtained during dewatering of the pipeline trench adjacent to the HDD, where push installation would be used. No new groundwater wells would be required for these water uses.

Overall, substantial impacts on the groundwater resources underlying the pipeline facilities are not anticipated due to: the absence of active public and private drinking water supply wells within 150 feet of the Pipeline construction work areas; surficial mitigation measures that would be implemented by TransCameron Pipeline in the event of a hazardous material spill; and post-construction contour restoration and revegetation to ensure the restoration of overland flow and recharge patterns. Further, the project is underlain by multiple strata of dense clay content, which provide a restrictive layer to slow or prevent the downward migration of surface and near waters or contaminants, thereby providing a natural protective barrier to groundwater quality. Finally, LDEQ (2015b) confirmed that the Project-Specific Plan and Procedures would meet and exceed its standards for construction and operation within source water protection areas. With the implementation of the measures described above, we conclude that impacts on groundwater and wells would not be significant and would be minimal and temporary in nature.

4.3.2 Surface Water

4.3.2.1 Existing Surface Water Resources

Terminal Facilities

The Terminal would be on an approximately 828.6-acre property on the east side of the Calcasieu River Ship Channel. The Calcasieu River Ship Channel was formed by channelization of the Calcasieu River for 36 miles from Lake Charles to the Gulf of Mexico and an additional 32 miles out to the deep draft anchorage areas in the Gulf. The channel was created to provide deepwater access for maritime commerce, and has become one of the nation's most active "energy corridors" (Port of Lake Charles, 2016). The channel is maintained by the USACE at a depth of 40 feet and a width of 400 feet; in the vicinity of the Terminal, this requires dredging one to two times per fiscal year (USACE, 2015).

The original Calcasieu River Ship Channel was constructed for navigation by the USACE in the 1920s. The channel has been modified and expanded several times in the last century with the most recent modification (widening and deepening) completed in 1968. This channel provides ready access for large ships to the Port of Lake Charles; however, it has significantly changed the hydrology of the lower Calcasieu River by allowing ingress of high salinity water; this intrusion of salt water is further amplified by the heavy ship traffic in the Calcasieu River Ship Channel. Industrialization has also affected the Calcasieu River with the Port of Lake Charles being a major center of the petrochemical industry; historic pollution is a concern in the system and seafood/finfish in the estuary are monitored for health hazards. Finally, the accidental spill and emergency releases of oil and other chemicals into the water are a concern in the region (LDWF, 2012), although the EPA reports no contaminated sediments for this segment of the Calcasieu River. NOAA (2015a) reports that the Calcasieu River Ship Channel had water temperatures ranging from 45 to 92 °F in 2015, depending on the season. Due to tidal influx of ocean water from the Gulf of Mexico, salinity concentrations vary from 10 to 25 parts per thousand (NOAA, 2015b).

In addition to the Calcasieu River Ship Channel, surface water resources associated with the proposed Terminal facilities would include six unnamed waterbodies (three open water borrow pits and three ditches) within the 413.2-acre Terminal site workspace, one intermittent waterbody (Gravity Drainage District #3 canal) associated with the Northeast Access Road to the Terminal site, and three unnamed waterbodies (ditches) associated with the Berm TWS at the Terminal site. Additionally, two unnamed waterbodies (borrow pits) and two sections of the Calcasieu River Ship Channel would be within the area of Marine Facilities. These surface water resources are part of the Lower Calcasieu Subbasin (HUC 08080206), a 1,080-square-mile subbasin. None of the waterbodies that would be affected by the Terminal facilities, including the Calcasieu River Ship Channel, are listed as Wild and Scenic Rivers. There are also no state-designated Natural and Scenic Rivers affected by the Terminal facilities. Based on the LDEQ *2014 Louisiana Water Quality Inventory Integrated Report*, designated uses for the Calcasieu River, from below Moss Lake to the Gulf of Mexico, including the Calcasieu River Ship Channel and Monkey Island Loop, are primary contact recreation, secondary contact recreation, fish and wildlife propagation, and oyster propagation. This segment of the Calcasieu River is not listed as impaired for these designated uses (LDEQ, 2014). The Calcasieu River is classified in this location as a saltwater fishery (LDWF, 2014a) and has been designated as a Traditional Navigable Waterway under section 10 of the RHA (USACE, 2013b). A full list of waterbodies at the Terminal site, including waterbody type, waterbody regime and area is provided in appendix F.

Pipeline Facilities

Construction of the Pipeline would cross a total of 123 waterbodies, including 50 centerline crossings by the pipeline and 73 crossings within the construction workspace but beyond the centerline. A full list of the waterbodies that would be crossed by the pipeline centerline, including location by MP, waterbody type, waterbody type, waterbody regime, crossing length at centerline, area, and proposed crossing method, is provided in appendix F.

The Pipeline's 50 proposed waterbody crossings include 21 perennial channels, 5 intermittent channels, and 24 open waterbodies (e.g., pond or borrow areas/permanently flooded). Named waterbodies that would be crossed by the Pipeline include Creole Canal, Little Chenier Canal, and King's Bayou. These waterbodies include 6 minor crossings (less than 10 feet wide), 30 intermediate crossings (10 to 100 feet wide), and 14 major crossings (greater than 100 feet wide). The Pipeline is within the watersheds of the Intracoastal Waterway-Frontal Calcasieu Lake (HUC 0808020605) and the Mermentau River-Frontal Gulf of Mexico (HUC 0808020211); these segments of the Intracoastal Waterway and the Mermentau River are on the list of impaired waters under section 303(d) of the CWA. Causes for water quality impairment include fecal coliform, turbidity, temperature, chloride, sulfates, and TDS.

4.3.2.2 Surface Water Impacts and Mitigation

Terminal Facilities

As described below, construction and operation of the Terminal facilities would permanently impact eleven of the thirteen waterbodies within the proposed Terminal property boundary, and would both temporarily and permanently impact the adjacent Calcasieu River Ship Channel. These impacts may result from dredging activities, ship and boat traffic, site construction, stormwater runoff, water use, hydrostatic testing, and accidental spills or other releases of hazardous substances.

Venture Global Calcasieu Pass would minimize impacts on the waterbodies through the positioning and constriction of the perimeter berm, minimizing the area enclosed by the berm, and minimizing the offshore dredge area. The perimeter berm layout is designed to avoid permanent impacts on waterbodies and wetlands that lie outside the berm to the north and south of the Terminal site.

Table 4.3.2.2-1 provides a summary of waterbody impacts resulting from the Project. Of the 9.6 acres of waterbodies within the Terminal property boundary, 2.6 acres would be permanently impacted, an additional 0.1 acre would be temporarily impacted, as described below:

- Terminal site (0.1 acre of borrow pit and 1.2 acres of ditch);
- berm TWS (less than 0.1 acre of borrow pit and 0.1 acre of ditch); and
- marine facilities (0.1 acre of borrow pit and 1.1 acres at the Calcasieu River Ship Channel). The 1.1 acres of the Calcasieu River Ship Channel accounts for the portion of the Ship Channel within the Terminal property boundary.

TABLE 4.3.2.2-1 SUMMARY OF WATERBODY IMPACTS (ACRES) AT THE TERMINAL SITE										
Terminal Facilities	Ponded/ Borrow Area		Ditch		Canal		Calcasieu River Ship Channel		Total	
	Temp.[a]	Perm.[b]	Temp.[a]	Perm.[b]	Temp.[a]	Perm.[b]	Temp.[a]	Perm.[b]	Temp.[a]	Perm.[b]
PROPERTY BOUNDARY										
Terminal Site	0.00	0.1	0.0	1.2	0.0	0.0	0.0	0.0	**0.0**	**1.3**
Northeast Access Road	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	**0.0**	**0.1**
Southwest Service Road	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	**0.0**	**0.0**
Martin Access Road	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**
DeHyCo Access Road	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**
Eastern TWS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**
Floodwall TWS	<0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	**0.1**	**0.0**
Southwest TWS	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	**<0.1**	**0.0**
Northeastern TWS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**
Northwestern TWS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**
Pipeline within Venture Global Property	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**
Marine Facilities	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1.1	**0.0**	**1.2**
Disturbed Subtotal	**<0.1**	**0.2**	**0.1**	**1.2**	**0.0**	**0.1**	**0.0**	**1.1**	**0.1**	**2.6**
DISTURBED TOTAL	**<0.1**	**0.2**	**0.1**	**1.2**	**0.0**	**0.1**	**0.0**	**1.1**	**0.1**	**2.6**

[a] Temp = Temporary impact outside of the permanent operational footprint.
[b] Perm = Permanent impact inside the operational footprint.
TWS = temporary workspace

Dredging

Excavation and dredging would be required to create a recessed berthing area for the proposed LNG berthing docks. To create this recess, 29.3 acres of exposed land would be excavated landward of the existing shoreline, and 64.8 acres of submerged land would be dredged seaward of the existing shoreline. Excavation of the 29.3 acres of exposed land would extend over an area measuring 2,950 feet (north/south) by 275 feet (east/west) and would total about 2.8 million yd^3 of material. This would include 15.4 acres of land to be converted to open water in the proposed LNG berthing area and 13.9 acres to be used for operations purposes (i.e., utility dock and LNG loading docks). In order to achieve the required water depth of -44.3 feet NAVD88, approximately 2,000,000 yd^3 would be dredged from a 64.8-acre area further offshore in the channel. In total, an estimated 5.0 million y^3 of material over 94.1 acres would be excavated or dredged for the Project.

Venture Global Calcasieu Pass would use mechanical dredging/excavation to remove nearshore/shallower soils and sediments, with concurrent hydraulic cutter-suction pipeline dredging to remove offshore/deeper sediments. Venture Global Calcasieu Pass anticipates that the nearshore mechanical dredging/excavation would be conducted by clamshell dredge, dragline, barge-mounted hydraulic excavator, land-based hydraulic excavator, or any practicable combination thereof. Venture Global Calcasieu Pass anticipates that the offshore dredging would include a floating fleet consisting of dredge plants, booster pumps, and support vessels; the primary floating hydraulic dredge plants would be a 27- to 30-inch hydraulic cutter-section pipeline dredge, with a second hydraulic cutter-section pipeline dredge of equivalent size or smaller anticipated to supplement the primary dredge as deemed necessary by Venture Global Calcasieu Pass' contractor. These dredging and excavating activities would require approximately 270 days to complete. To achieve this construction schedule, Venture Global Calcasieu Pass anticipates the use of multiple concurrently operating hydraulic and mechanical dredges.

Impacts on water quality resulting from dredging include temporary increases in suspended sediment and turbidity levels. The USACE and Lake Charles Harbor and Terminal District partner to conduct maintenance dredging of the Calcasieu River; in the vicinity of the proposed Terminal site, this maintenance dredging occurs one to two times per Fiscal Year (USACE, 2015). This routine dredging, combined with existing vessel traffic associated with operation of existing facilities, causes sustained high and variable turbidity levels within the Calcasieu River Ship Channel. Hydraulic cutter-suction pipeline dredging may cause localized increases in suspended sediment near the site of dredging; however, the nature of suction dredging incorporates the suspended sediments into the surrounding waters then the mixture is pumped to the placement location. Venture Global Calcasieu Pass estimates 15 to 20 percent solids in the slurry. Mechanical dredging may also cause localized increases in suspended sediments; however, Venture Global Calcasieu Pass anticipates that the sediments would remain largely as clumps within the clamshell bucket. Sediments that are suspended in the water column during dredging operations are expected to settle out within hours or days. The amount of time depends on factors such as the grain size of the sediments, with finer sediments taking longer to be redeposited, especially if there are other outside influences causing continued water movement (e.g., currents, ship traffic).

Venture Global Calcasieu Pass evaluated the sediments to be dredged in accordance with the EPA/USACE *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual*, issued February 1998. The testing manual outlines the sequential analysis and evaluations pertinent to characterizing sediments to be dredged for physical, chemical, and biological procedures. Venture Global Calcasieu Pass conducted a Tier I Evaluation, which includes a comprehensive analysis of existing readily available physical, chemical, and biological monitoring data. Based on this analysis, which was included in Venture Global's Joint Permit Application (JPA) to USACE and LDEQ, Venture Global Calcasieu Pass identified no evidence of potential sediment pollution due to reported release, that the sediments are from locations far removed from sources of contaminants, that the sediments are from depths deposited in preindustrial times, and that the sediments are composed of sands and consolidated clays. As such, Venture Global Calcasieu Pass' Tier I Evaluation found that no further testing was required.

Of the estimated 5.0 million yd^3 of sediment and soils proposed to be removed during initial dredging operations plus the 237,934 yd^3 of overdredge allowance, Venture Global Calcasieu Pass proposes to reuse 716,000 yd^3 at the CPNWR to create/restore 136.4 acres of marshland, constituting a beneficial use of dredge material. Venture Global Calcasieu Pass proposes to place the remainder of the dredge material in a nearshore area about 2 miles southwest of the Terminal in accordance with the EPA/USACE *Evaluation of Dredged Material Proposed for Ocean Disposal – Testing Manual* (EPA 503/8-91/001). Dredged material on the Terminal site would be reused as general backfill to bring the Terminal facilities to uniform elevations and for construction of a berm surrounding the site. The placement of dredge material in this nearshore area southwest of the Terminal would provide some benefit in the protection of the recently restored West Beach, and would constitute a BUDM. Venture Global Calcasieu Pass would transport the dredge material via two slurry pipelines, which are further described in sections 4.4.2 and 4.13. The CMP/BUDM would be conducted in accordance with the JPA permit conditions and the LDEQ's Water Quality Certification requirements. Potential water quality concerns with the installation and operation of the slurry pipeline would be addressed through the terms and conditions of the USACE section 404/10 permit. On January 27, 2017, Venture Global submitted a revised CMP/BUDM.

Venture Global Calcasieu Pass would conduct maintenance dredging only in areas that are dredged during the initial construction of the Terminal. Based on current accretion rates reported for nearby dredging projects and reasonable assumptions to maintain suitable LNG carrier underkeel clearance, Venture Global Calcasieu Pass' models predict that maintenance dredging would be required every 2 years over an area of approximately 50 acres and remove approximately 151,000 yd^3 of material. Storm-induced accretions of about 8 inches per storm have been reported as a result of receding tropical storm surges and may require that an additional 100,600 yd^3 be removed in a one-time event to restore pre-storm conditions. Venture Global Calcasieu Pass would conduct maintenance dredging by similar methods as initial dredging, and maintenance dredged material is expected to be reused in a manner consistent with the initial dredged materials, as described above. Venture Global Calcasieu Pass would seek a long-term placement agreement with the BUDM sites for placement of the maintenance material. Venture Global Calcasieu Pass would also consider disposal on the Terminal site and/or a regional Confined Disposal Facility depending upon the Confined Disposal Facility storage capacity at the time of maintenance dredging.

Venture Global Calcasieu Pass is required to obtain several permits that would address dredging and dredged material management, including permits under section 404 of the CWA and sections 10 and 14 of the RHA of 1899 from the USACE; a permit for water discharges from the Terminal from the EPA and/or LDEQ under section 401 of the CWA; a Coastal Use Permit from LDNR under LAC 43:I.Ch.7; and an NPDES and Louisiana Pollutant Discharge Elimination System (LPDES) permit under section 402 of the CWA issued by LDEQ to regulate return water flowing from the dredged material placement area. In August 2015, two JPAs were submitted to the USACE and the LDNR; one was submitted by Venture Global Calcasieu Pass for the Terminal facilities and one was submitted by TransCameron Pipeline for the Pipeline. 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 November 2016, a JPA was submitted to the USACE that combined the applications for the Terminal facilities and the Pipeline. The November 2016 application was recently updated and submitted to the USACE on September 8, 2017 to reflect an updated CMP/BUDM. Venture Global anticipates receipt of these permits in 2018. The proposed dredging at the Terminal site would increase suspended sediment and turbidity levels at the Terminal site; however, these impacts would be temporary; therefore, we conclude that potential impacts from dredging would not be significant.

Construction of Marine Facilities

The Project would require marine structures to enable the export of LNG on ocean-going LNG carriers. The LNG carriers would require suitable moorings and loading platforms to facilitate the transfer of LNG, and the material deliveries during construction and support vessels during operations would require suitable dockage. Furthermore, the Terminal site would require a river water intake for the facility's fire water system, an outfall for the facility's stormwater system, and a stabilized waterfront shoreline.

The LNG berthing facilities would be mounted on piles and include one loading platform, eight breasting dolphins, eleven mooring dolphins, and interconnecting walkways. The proposed utility dock would be concrete-decked and supported on piles. A water intake and two fire water pumps would be located at the utility dock to support the facility's fire protection system. Stormwater discharge from the Terminal facility's stormwater management system would be discharged through several co-located pipe outfalls near the southern limits of the shoreline, which would be supported with rip-rap armoring.

These marine structures would be constructed over a period of approximately 18 months. Venture Global Calcasieu Pass would construct several of the marine structures concurrently and would begin with shoreline stabilization in locations where no piles would be driven, following the dredging of the shoreline slope. Structure-supporting piles would be driven initially at the utility dock, followed by the loading platforms and trestles, and then the dolphins and walkway supports. Venture Global Calcasieu Pass would then place concrete decks in a similar sequential order. Installation of the stormwater outfall piping would be concurrent with the appropriate elevation of the Terminal site's berm construction.

The placement of the rip-rap for shoreline stabilization would be performed by one or more of the following: rock-dump barge, deck barge, barge-mounted hydraulic excavator, and land-based hydraulic excavator.

The activities associated with the construction of the marine terminal facilities would result in temporary and minor increases in turbidity and sediment levels in the immediate vicinity of construction activities. The operational impacts of maintenance dredging would also be temporary and localized to the Project area. Therefore, we conclude that no permanent or long-term water quality impacts would result due to the absence of contaminated sediments and soils from this area.

<u>Ship and Boat Traffic</u>

Ship and boat traffic associated with construction and operation of the Terminal could impact surface water resources as a result of ship movements, including propeller use, wave action, and ballast water exchanges.

Throughout construction of the Project, barges and support vessels would deliver large equipment and materials to the Terminal facility site via the Construction Support Facility docks. Venture Global Calcasieu Pass anticipates that the marine construction fleet would include dredge barges, heavy lift cranes, derrick crane barges, deck barges, tugs, and support vessels. The support vessels anticipated include booster pump barges, tender boats, work barges, material barges, fuel barges, personnel shuttles, and survey vessels. Venture Global Calcasieu Pass anticipates up to 4,028 barge trips over the entirety of the construction phase. During operation of the Project, approximately 12 to 13 LNG carriers would call on the Terminal per month. Ship traffic associated with construction and operation of the Terminal may increase shoreline erosion and resuspension of bottom sediments, resulting in temporary increases in turbidity levels within the turning basin and berthing area and along vessel transit routes. The Calcasieu River Ship Channel was specifically created to provide deepwater access for maritime commerce. It is managed by the Port of Lake Charles, a deepwater seaport, and is maintained by regular dredging (Port of Lake Charles, 2016). As such, use of the channel by barges and support vessels to deliver materials during construction of the Terminal facilities would be consistent with the use of this active shipping channel, and associated impacts on water quality would be minor.

The LNG carriers would discharge ballast water into the Calcasieu River Ship Channel during LNG loading. As required by USCG regulations (33 CFR 151.2025), vessels equipped with ballast tanks must 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. Under these requirements, vessels must implement strategies to prevent the spread of exotic aquatic nuisance species in U.S. waters. These strategies include retaining ballast water on board, minimizing uptake or discharge at certain times or locations, and exchanging ballast water from coastal sources with mid-ocean seawater. Vessels that have operated outside of the U.S. EEZ must retain their ballast water on board or undergo a mid-ocean (greater than 200 nm from shore and at a water depth greater than 6,562 feet) ballast water exchange in accordance with applicable regulations. LNG carriers would discharge all ballast water under federal oversight and in accordance with federal regulations.

LNG carriers would discharge ballast water as they are loading cargo. Venture Global Calcasieu Pass has indicated the ballast water discharged into the LNG berthing area would be composed mainly of Gulf of Mexico ocean water. Potential impacts on water quality due to ballast water discharge would be a temporary increase in salinity level, a temporary decrease in dissolved oxygen levels, and potential change in pH level in the immediate vicinity of the LNG berthing area. Because the proposed Terminal site and turning basin/berthing area are within the lower Calcasieu River Ship Channel (about 0.2 mile from the Gulf of Mexico), these differences are expected to be minor and may not be measurable under normal tidal cycles. Ballast water would be discharged near the bottom of the marine berth where relatively dense saltwater from the Gulf of Mexico characteristically underlies freshwater from inland sources. Furthermore, the amount of ballast water discharged during each LNG carrier visit to the LNG Terminal would represent a negligible influence on the overall system. Ballast water is stored in the ship's hull below the waterline; as a result, discharged water temperatures are not expected to deviate significantly from ambient water temperatures.

Impacts on water resources resulting from ballast water would be temporary and minor, only affecting a relatively small area. Further, to ensure compliance with U.S. laws and regulations governing ballast water discharges, Venture Global Calcasieu Pass would ensure that any visiting vessels possess documentation to demonstrate compliance with ballast water regulations and BMPs prior to allowing any ballast water to be discharged into the marine berthing area. Therefore, we conclude that significant impacts on surface waters would not occur as a result of ballast water discharge.

Site Construction

Construction and operation of the Terminal would permanently impact 2.6 acres of waterbodies identified on the site including the Calcasieu River Ship Channel, two manmade ditches, and three borrow pits. In addition, the expansion of an existing access road to the site (the Northeast Access Road) would temporarily impact less than 0.1 acre of Drainage District #3 Canal to replace an existing culvert. Impacts on waterbodies associated with the Terminal are provided in appendix F.

Venture Global Calcasieu Pass would be required to obtain permits for the loss of these waters of the U.S. under sections 401 and 404 of the CWA and provide compensatory mitigation, developed in consultation with the USACE and LDEQ. Given that Venture Global Calcasieu Pass would obtain the required permits and develop the required mitigation, we conclude that these 2.6 acres of permanent impact on waterbodies at the Terminal site would not be significant.

Stormwater Runoff

During construction, impacts on downgradient surface water resources would be minimized through the implementation of Venture Global Calcasieu Pass' SWPPP, which has been prepared to comply with the EPA's National Stormwater Program General Permit requirements.

During operations, Venture Global Calcasieu Pass would control stormwater runoff through the site's stormwater management system. In areas where oils (hydrocarbons) may be present, the design includes the retention of the first 10-minute flush at seven underground holding tanks in order to retain potential oily water runoff; the remaining stormwater would be discharged directly into the Calcasieu River Ship Channel in accordance with stormwater quality design standards. In areas where surface water runoff would not come into contact with oils, the design would include piped collection to seven open topped concrete basins with collected waters pumped to one or more stormwater discharge locations into the Calcasieu River Ship Channel.

In addition, stormwater removal from within the LNG storage tank dikes must conform to 49 CFR 193.2173, requiring water to be pumped out at 25 percent of the maximum predictable collection rate from a storm of 10-year frequency and 1-hour duration.

Water Use

Venture Global Calcasieu Pass might use existing municipal water supply sources and/or on-site groundwater wells to provide a portion of the industrial and potable fresh water for the Project's construction and operation. In addition, sea water from the Calcasieu River Ship Channel would be used for LNG tank hydrostatic tests and earthworks. The volumes of water required to construct the Terminal are provided in table 4.3.2.2-2.

TABLE 4.3.2.2-2

WATER REQUIREMENTS TO CONSTRUCT THE TERMINAL

Activity	Quantity (gallons)	Source
Personnel raw water consumption	45,404,000	Municipal/on-site wells
Personnel potable water consumption	11,351,000	Municipal
Raw water for concrete	7,037,620	Municipal/ on-site wells
Raw water for fireproofing	1,362,120	Municipal/ on-site wells
Raw water for truck washing & miscellaneous	2,724,240	Municipal/ on-site wells
Contingencies	4,767,420	Municipal/ on-site wells
Raw water tank hydrostatic testing	76,755,000	Sea Water
Raw water for backfilling earthworks/roads	26,107,300	Sea Water
Total	**175,508,700**	

Operation of the Terminal would require approximately 600,000 gal/d of water. As stated above (see section 4.3.1.4), Venture Global Calcasieu Pass is continuing to consider options for water supply, including a municipal water supply connection, surface water, and groundwater. The Cameron Parish water supply system was evaluated for Project use. The evaluation indicated that the water supply system could supply approximately 250 gpm (approximately 360,000 gal/d) to the Project without significant pressure loss based on current user loads. The evaluation also indicated that the system may require upgrades to infrastructure to meet or exceed this level of service.

Hydrostatic Testing

Prior to placing the LNG storage tanks into service, Venture Global Calcasieu Pass would hydrostatically test them to ensure structural integrity. The total volume of water required for hydrostatic testing of this equipment would be nearly 77 million gallons from the Calcasieu River Ship Channel, as quantified in table 4.3.2.2-2 above. Hydrostatic testing would involve filling each of the inner tanks with approximately 38 million gallons of water. Following completion of the hydrostatic testing of the tanks, the test water would be discharged either on-site or directly into the Calcasieu River Ship Channel. The discharges would be conducted in accordance with Venture Global's Project-specific Procedures. No chemicals would be added to the hydrostatic test water before or after testing. Based on the measures in the Project-specific Procedures, Venture Global Calcasieu Pass would minimize impacts associated with hydrostatic testing of the LNG storage tanks. Additionally, Venture Global Calcasieu Pass would conduct the withdrawal, testing, and discharge of hydrostatic test waters in accordance with LDEQ General Permit LAG670000 for discharges of hydrostatic test water discharges.

Spills and Hazardous Materials

Construction and operation of the Terminal facilities, as well as ship and boat traffic to and from the facility, have the potential to adversely impact water quality in the event of an accidental release of a hazardous substance such as fuel, lubricants, coolants, or other material. Venture Global Calcasieu Pass would implement the measures outlined in its SPCC Plan in the event of a spill, as well as measures outlined in the Project-specific Procedures. Venture Global Calcasieu Pass would minimize the risk of a spill by implementing general preventative BMPs, including personnel training, equipment inspection, and refueling procedures.

Conclusion

Construction and operation of the Terminal would temporarily impair water quality within the vicinity of the site as a result of dredging, maintenance dredging, and stormwater runoff. As described previously, impacts on water quality from dredging activities would be short-term and localized to within a few hundred feet of the activity. Through implementation of Venture Global Calcasieu Pass' BMPs, Project-specific Plan and Procedures, and SPCC Plan, potential construction and operation impacts resulting from stormwater runoff or the discharge of hydrostatic test water would be adequately minimized or avoided and would not be significant. Additionally, permanent waterbody impacts associated with Terminal site construction would be conditioned and mitigated through permitting with the USACE and LDNR.

Pipeline Facilities

Waterbody Crossings

As depicted in appendix F, a total of 50 designated waterbodies would be crossed by the proposed pipeline centerline; TransCameron Pipeline would use either the HDD or open-cut method.

TransCameron Pipeline proposes to conduct eight HDD operations along the Pipeline. As some of the HDDs would encompass more than one waterbody, a total of 14 waterbodies would be crossed using the HDD method, including King's Bayou and Creole Canal. The total length of HDD crossing would be 4.2 miles, or approximately 18 percent of the pipeline route. Crossing these waterbodies via HDD would significantly reduce potential impacts on these waterbodies as the pipe would be installed underneath the waterbody, avoiding impacts on the waterbody bed and banks. Use of the HDD method could result in an inadvertent release of drilling mud into waterbodies. Drilling mud primarily consists of water and bentonite clay. If an inadvertent release were to occur, it could temporarily impact water quality; however, TransCameron Pipeline would implement numerous measures as identified in its *HDD Contingency Plan* to minimize this impact. We have reviewed this plan and find it to be acceptable.

TransCameron Pipeline did not conduct geotechnical investigations for the proposed HDDs. We believe geotechnical studies are necessary to further analyze the feasibility of each HDD. **We recommend that:**

- **<u>Prior to construction of the Pipeline</u>, TransCameron Pipeline should file with the Secretary the results of site-specific geotechnical investigations conducted for each proposed HDD. Describe the subsurface lithology along the drill path, standard penetration test results, and soil mechanic properties. Depict this data on each HDD profile. Utilizing this data also file an HDD feasibility study conducted by a qualified contractor. Discuss the potential for hydrofracture and an inadvertent release of drilling fluids using the USACE methodology for the installation of pipelines using HDD.**

A total of 36 waterbodies would be crossed by the open-cut method. This method would be implemented primarily for waterbodies located within wetland areas. Removal of the trench spoil would require the full 110-foot-wide construction right-of-way. Waterbodies crossed via the push method could experience impacts on the water quality as a result of increased turbidity or sedimentation during pipeline construction and operation. However, these impacts would be short-term and minor because in-stream construction activities would occur within 24 (minor waterbodies) to 48 hours (intermediate waterbodies). TransCameron Pipeline would cross 10 major waterbodies using the open-cut method. TransCameron Pipeline filed site-specific construction plans for each major waterbody crossing, identifying all areas to be disturbed by construction including extra work areas, spoil storage areas, sediment control structures, etc., as well as mitigation for navigational issues. We have reviewed these plans and find them acceptable.

Of the 29.7 acres of waterbodies within the Pipeline construction footprint and outside of the Terminal site, 28.6 acres would be temporarily affected, and 1.1 acres would be avoided by HDD. To minimize impacts on waterbodies, TransCameron Pipeline would implement measures described in its Project-specific Procedures. These measures include:

- restoring stream banks and natural contours to preconstruction conditions to the maximum extent practicable;
- stabilizing banks and installing temporary erosion sediment barriers within 24 hours of completing the crossing; and
- vegetating disturbed riparian areas with native species of conservation grasses, legumes and woody species similar in density to adjacent undisturbed lands.

Additionally, lubricant, hydraulic fluid, and fuel spills from refueling construction equipment, fuel storage, or equipment failure in or near a waterbody could flow or migrate to the waterbody and impact water quality and other aquatic resources. TransCameron Pipeline would implement measures outlined in its SPCC Plan and Project-specific Procedures to minimize the potential impacts of spills and hazardous materials in waterbodies.

TABLE 4.3.2.2-3

SUMMARY OF WATERBODIES CROSSED BY THE PIPELINE

	Waterbody Impacts (Acres)													
	Estuarine Openwater		Estuarine Channel		Canal		Pond/Borrow Area		Ditch		Stream/River		Total	
Project Facility	Temp [a]	Perm [b]	Temp [a]	Perm [b]	Temp [a]	Perm [b]	Temp [a]	Perm [b]	Temp [a]	Perm [b]	Temp [a]	Perm [b]	Temp [a]	Perm [b]
Pipeline Facilities	11.8	8.8	0.1	0.1	0.2	0.3	1.6	1.3	0.1	0.4	<0.1	0.1	**13.9[c]**	**11.1**
Above ground 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	**0.0**	**0.0**
ATWS	4.6	0.0	<0.1	0.0	<0.1	0.0	0.1	0.0	<0.1	0.0	0.0	0.0	**4.7**	**0.0**
Contractor Yard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	**<0.1**	**0.0**
Access Roads	0.0	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	<0.1	<0.1	0.0	0.0	**<0.1**	**<0.1**
TOTAL	**16.4**	**8.8**	**0.1**	**0.1**	**0.3**	**0.3**	**1.6[c]**	**1.3**	**0.2[c]**	**0.4**	**<0.1**	**0.1**	**18.6[c]**	**11.1**

[a] Temp = Temporary impact outside of the permanent operational footprint.
[b] Perm = Permanent impact inside the operational footprint.
[c] 0.1 acre rounding discrepancy.
Notes: ATWS = additional temporary workspace; horizontal directional drill (HDD) areas (no impacts on waterbodies) are included in the permanent easement waterbody acreages. 4.3 acres of waterbodies are avoided by HDD, including 0.4 acre of canal, 0.7 acre of pond/borrow area, 0.3 acre of ditch, and 2.9 acres of stream/river.

Water Use

Pipeline construction would require the use of water for HDDs, hydrostatic pre-testing, and hydrostatic testing. For HDDs, approximately 51.7 million gallons of water would be withdrawn from the pipeline trench adjacent to the HDD. Water for hydrostatic pre-testing and testing would be obtained from surface water sources. The volumes of water required to construct the Pipeline are provided in table 4.3.2.2-3.

Hydrostatic Testing

Prior to being placed into service, TransCameron Pipeline would hydrostatically test the Pipeline to ensure structural integrity. TransCameron Pipeline would need 1,347,387 gallons of water for hydrostatic pre-testing and 7,049,043 gallons of water for hydrostatic testing of the complete Pipeline. Environmental impacts from the discharge of hydrostatic test water would be minimized by implementation of the measures outlined in Venture Global's Project-specific Plan and Procedures. These measures include:

- locating hydrostatic test manifolds outside of wetlands and riparian areas to the extent practicable;
- complying with all appropriate permit requirements; and
- not discharging into state-designated special waters, waterbodies that provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless the relevant federal, state, and local permitting agencies grant permission.

Conclusion

Waterbodies crossed by the Pipeline via the open-cut methods would experience short-term decreases in water quality resulting from increased turbidity, sedimentation, and overall bed and bank disturbance. However, we have determined that implementation of TransCameron Pipeline's SPCC Plan, HDD Contingency Plan, and Project-specific Procedures would adequately minimize impacts on surface water resources to less than significant levels.

4.3.2.3 Alternative Measures to FERC Procedures

Venture Global Calcasieu Pass has developed and is proposing the use of Project-specific Procedures by modifying our Procedures as necessary for this Project. The Project-specific Procedures can be viewed on eLibrary under Docket No. CP15-550.[15] 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 well as adequately protective of the environment. Venture Global's proposed deviations are discussed below. A discussion of TransCameron Pipeline's proposed 110-foot right-of-way width is provided in section 2.4.2.

Time Window for Construction

Section V.B.1 of our Procedures require that instream work within coolwater and warmwater 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. Venture Global has requested approval from LDFW for instream construction in warmwater fisheries from May 1 to September 30 for those waterbodies that would be crossed by the open-cut method, and year-round for the construction of the Terminal facilities. However, documentation of LDFW approval for these instream construction windows is pending. Therefore, **we recommend that:**

- **<u>Prior to construction</u>, Venture Global should file with the Secretary written concurrence from LDWF for the proposed instream construction windows.**

Extra Work Areas

Section V.B.2.A of our Procedures requires that extra work areas be at least 50 feet from water's edge except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. Table 4.3.2.3-1 identifies by MP ATWS that would be in or within 50 feet of waterbodies. For each ATWS, the table provides a justification for such a location.

Extensive wetlands and open waters comprise a significant portion of the Pipeline's environmental terrain. In many cases, linear waterbodies (e.g., ditches and canals) are flanked directly by wetlands and have no upland bank profile, making it infeasible to locate ATWS areas at least 50 feet from wetland and waterbody boundaries. However, to minimize wetland and waterbody impacts, the Project would incorporate the practices described below:

- co-locate of the proposed Pipeline parallel and adjacent to existing pipeline corridors for approximately 86 percent of the route;

[15] The Project-specific Procedures can be viewed on eLibrary under Accession No. 20150904-5415.

- reduce impacts on wetlands and waterbodies through use of construction methods that include:
    - predominant use of open-cut and HDD construction techniques for waterbodies and push method for wetlands, as opposed to upland construction methods;
    - installation of timber mats in ATWS at high traffic work stations, such as push sites and HDD sites;
    - use of low-ground pressure, amphibious equipment in push ditch workspaces and associated ATWS; and
    - use of a minimum 50-foot setback from the waterbody between MP 15.3 and MP 17.7.

Spoil Pile Placement and Control

Section V.B.4.b of our Procedures requires the use of sediment barriers to prevent the flow of spoil or silt-laden water into any waterbody. TransCameron Pipeline states that the poor compaction of the native soil in marshland and open water for pipeline construction is not conducive to the installation of sediment barriers. TransCameron Pipeline further states that the native soil would not offer enough lateral support to withstand the pressure of unconsolidated spoil against the barrier and it anticipates that spoil would not remain in designated workspaces. We agree that the use of sediment barriers in marshland and open water would not provide additional protection of soils; however, TransCameron Pipeline should use sediment barriers in soils conducive to the installation of sediment barriers. The performance based measures in the Procedures would still apply and Venture Global's EIs would be responsible for ensuring that sediment barriers are installed where necessary and practicable along the edge of the right-of-way to prevent silt-laden water from flowing off the construction right-of-way.

TABLE 4.3.2.3-1

ADDITIONAL TEMPORARY WORKSPACES IN OR WITHIN 50 FEET OF WATERBODIES ALONG THE PIPELINE

Pipeline Approx. Milepost	Waterbody ID	Waterbody Type	Waterbody Regime	Workspace Type	Waterbody Impact Acreage [a]	ATWS Dimensions (feet)	ATWS Acreage [b]	Distance to (feet)	Justification
2.9	OW042	Borrow Area	Permanently Flooded	Foreign Pipeline Crossing / Push Site	0.05	100 x 700	1.61	0	Foreign pipeline crossing in wetlands expanse – no upland exists at this location
7.8	WB033	Canal	Perennial	HDD Pipe String	0.03	2100 x 100[a]	4.28	0	Workspace is in wetlands expanse – no upland exists at this location
15.2	WB014	Ditch	Perennial	Open Water Crossing	0.01	255 x 100	0.58	0	Waterbody crossing in wetlands expanse – no upland exists at this location
15.2	OW029	Estuarine Open water	Permanently Flooded	Open Water Crossing	0.46	3,900 x 15	1.34	0	Provides additional workspace width for spoil storage/handling in open water/wetland expanse – no upland exists at this location (other than road crossings)
15.5	OW029	Estuarine Open water	Permanently Flooded	Open Water Crossing	0.03			0	
15.5	OW027	Estuarine Open water	Permanently Flooded	Open Water Crossing	0.40			0	
15.7	OW026	Estuarine Open water	Permanently Flooded	Open Water Crossing	0.02			0	
15.8	OW025	Estuarine Open water	Permanently Flooded	Open Water Crossing	0.01			0	
16.2	OW024	Estuarine Open water	Permanently Flooded	Open Water Crossing	0.04	4,350 x 15	1.48	0	Provides additional workspace width for spoil storage/handling in open water/wetland expanse – no upland exists at this location (other than road crossings)
16.4	OW023	Estuarine Open water	Permanently Flooded	Open Water Crossing	0.01			0	
16.4	WB011	Estuarine Channel	Perennial	Open Water Crossing	0.02			0	
16.4	OW022	Estuarine Open water	Permanently Flooded	Open Water Crossing	0.31			0	
16.6	OW021	Estuarine Open water	Permanently Flooded	Open Water Crossing	0.81			0	
17.1	OW021	Estuarine Open water	Permanently Flooded	Foreign Pipeline Crossing	1.25	700 x 100	1.61	0	Foreign pipeline crossing in wetlands expanse – no upland exists at this location
17.2	OW021	Estuarine Open water	Permanently Flooded	Open Water Crossing	0.24			0	
17.3	OW021	Estuarine Open water	Permanently Flooded	Foreign Pipeline Crossing	0.02	100 x 10	0.02	0	Foreign pipeline crossing in wetlands expanse – no upland exists at this location

TABLE 4.3.2.3-1

ADDITIONAL TEMPORARY WORKSPACES IN OR WITHIN 50 FEET OF WATERBODIES ALONG THE PIPELINE

Pipeline Approx. Milepost	Waterbody ID	Waterbody Type	Waterbody Regime	Workspace Type	Waterbody Impact Acreage [a]	ATWS Dimensions (feet)	ATWS Acreage [b]	Distance to (feet)	Justification
17.4	OW020	Borrow Area	Permanently Flooded	Open Water Crossing	0.01			0	
17.4	OW019	Estuarine Open water	Permanently Flooded	Open Water Crossing	0.16	3,000 x 15	0.95	0	Provides additional workspace width spoil storage/handling in open water/wetland expanse – no upland exists at this location
17.5	OW018	Estuarine Open water	Permanently Flooded	Open Water Crossing	0.19			0	
17.7	OW017	Estuarine Open water	Permanently Flooded	Foreign Pipeline Crossing	0.09	700 x 100	1.61	0	Foreign pipeline crossing is in open water/ wetland expanse – no upland exists at this location (other than road crossing)
17.8	OW016	Estuarine Open water	Permanently Flooded	Foreign Pipeline Crossing	0.22			0	
17.8	OW016	Estuarine Open water	Permanently Flooded	Foreign Pipeline Crossing	0.27	160 x 100	0.37	0	Foreign pipeline crossing is in open water/ wetland expanse – no upland exists at this location (other than road crossing)
17.8	OW016	Estuarine Open water	Permanently Flooded	Foreign Pipeline Crossing	0.07			0	

[a] Waterbody impact acreage is a subset total of the additional temporary workspace (ATWS) acreage.
[b] ATWS acreage includes both upland and wetland land use types.
HDD = horizontal directional drill

4.4 WETLANDS

Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation (USACE, 1987). Wetlands can be a source of substantial biodiversity and serve a variety of functions that include providing wildlife habitat, recreational opportunities, flood control, and naturally improving water quality. During scoping, the EPA, LDFW, FWS, and public expressed concern with Project wetland impacts and the avoidance, minimization, and mitigation measures to address these impacts.

At the federal level, wetlands are protected 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 proposed Project is in the New Orleans District of the USACE, and Venture Global submitted an application under section 404 to the New Orleans District on August 28, 2015; Venture Global submitted a revised application on July 8, 2016; Venture Global submitted another revised application on September 8, 2017.

Wetland impacts authorized under section 404 of the CWA also require state water quality certification under section 401 of the CWA and a state-issued Coastal Use Permit for impacts on coastal wetlands, if applicable. For the proposed Project, state water quality certification would be issued by the LDEQ. The State of Louisiana defines coastal wetlands as wetlands less than 5 feet amsl that occur within the designated coastal zone (Louisiana Revised Statute 49:214.2). Coastal wetlands are under the jurisdiction of the LDNR OCM and the USACE. According to the revised June 7, 2012 Coastal Zone Inland Boundary, all Project components are within the state designated coastal zone.

4.4.1 Affected Wetlands

Venture Global conducted wetland delineations in accordance with the USACE's Wetlands Delineation Manual (USACE, 1987) and the USACE's Atlantic and Gulf Coast Plain Regional Supplement, Version 2.0 (USACE, 2010a). In accordance with the USACE's methodology, an area is a wetland if positive indicators for the three mandatory wetland criteria are identified in a given area, with special exceptions. These criteria include the presence of hydrophytic vegetation, wetland hydrology and hydric soils. The LDNR OCM does not adopt the same three-parameter approach for defining jurisdictional wetlands; LDNR OCM permitting guidelines indicate that wetlands do not need to meet hydric soil criteria to be regulated under the coastal use permit program.

Wetland types identified during Venture Global's field surveys within the Project area were assigned based on the same classification system used by the NWI, Classification of Wetlands and Deepwater Habitats of the United States (FGDC, 2013), adapted from Cowardin et al. (1979). This hierarchical system broadly classifies wetlands as marine, estuarine, palustrine, riverine, or lacustrine, and then further characterizes them by vegetation type and hydrology.

The wetland types associated with the proposed Project facilities include estuarine intertidal emergent (E2EM), estuarine emergent-mosaic (EEM), estuarine intertidal scrub shrub (E2SS), estuarine intertidal forested (E2FO), estuarine mudflat, palustrine emergent (PEM), palustrine scrub shrub (PSS), and palustrine forested (PFO) wetlands. Estuarine communities occur in tidal areas in which salinity due to ocean-derived salts is equal to or greater than 0.5 percent; E2EM communities are dominated by erect, rooted, herbaceous hydrophytes, while E2SS communities are dominated by woody vegetation less than 16 feet in height. Estuarine mudflats are within these wetlands and have hydric soils and hydrology, but lack any vegetative growth. Palustrine communities occur in tidal and non-tidal areas in which salinity due to ocean-derived salts is below 0.5 percent; PEM wetlands are dominated by persistent emergent vascular plants, while PSS wetlands are dominated by woody vegetation less than 16 feet in height. PFO wetlands are dominated by woody species greater than 16 feet in height. In the Project area, estuarine communities dominate in areas subject to tidal influence, and palustrine communities occur in areas protected from the influx of saline oceanic water.

Further descriptions of the wetland communities identified in the Project area are discussed for the Terminal and Pipeline facilities below. Lists of wetlands affected by the Project, including wetland identification number, wetland types, and nature and acreage of impact, are provided in appendix G for the Terminal site and Pipeline, respectively.

4.4.1.1 Terminal Facilities

A total of 462.3 acres of wetlands were identified within the property boundary and at the adjoining construction support facilities; 461.4 acres are within the Venture Global Property and 0.9 acre is within the Liberty Support Facility as shown in table 4.4.2-1 (appendix G). Seven wetland community types were identified: PEM, PSS, E2EM, EEM, E2SS, PFO, and mudflats. Construction and operation of the Project would impact 186.4 acres of wetlands, while 275.0 acres would be avoided and not disturbed.

Vegetation varies by community type. The PEM wetland communities are dominated by herbaceous plants, including alligator weed, annual marsh elder, common reed, Gulf cord grass, hop sedge, soft rush, salt meadow cord grass, swamp smartweed, and wand panic grass. PSS wetland communities have a similar herbaceous understory, but are dominated by shrub/sapling species including Carolina desert thorn, honey-locust, Jesuit’s bark, and groundsel tree. E2EM wetland communities are dominated by Bermuda grass, bushy seaside tansy, coastal salt grass, common reed, Gulf coast spike rush, Gulf cord grass, narrowleaf cattail, salt meadow cord grass, saltwater cord grass, and shore grass. EEM wetland communities contain species such as saltmarsh cordgrass, saltmeadow cordgrass, needlerush, and narrow-leaved cattail. Common PFO species include French tamarisk and Chinese tallow. The E2SS communities are dominated by Carolina desert thorn, French tamarisk, groundsel tree, Jesuit’s bark, and saltwater false willow. Estuarine mudflats lack any vegetative cover.

4.4.1.2 Pipeline Facilities

Venture Global conducted field surveys within a nominal 250-foot-wide study corridor, except where additional coverage was required to include all workspaces, including the construction right-of-way, ATWS, contractor yards and access roads. A total of 324.3 acres of wetlands were identified during survey of the Pipeline survey corridor and associated facilities (appendix G).

Temporary impacts would amount to 322.5 acres (202.5 acres in temporary construction workspace and 120 acres on the pipeline’s permanent operational easement) as shown in table 4.4.2-2. TransCameron Pipeline would avoid 15.3 acres of wetlands by installing certain sections of pipeline by HDD (4.2 acres of E2EM, 0.9 acre of E2SS, 0.4 acre of E2FO, 8.6 acres of PEM, and 1.2 acres of PSS).

Permanent wetland impacts would amount to 1.4 acres for the Pipeline. These 1.4 acres are on proposed aboveground facility sites (meter stations and MLVs) and permanent access roads. Permanent impacts would involve approximately less than 0.1 acre of E2EM, 1.2 acres of E2SS, and 0.2 acre of PEM.

In total, five wetland communities were observed along the Pipeline route: E2EM, E2SS, E2FO, PEM, and PSS. Of the 323.9 acres of wetlands within the survey corridor for the Pipeline, 219.4 acres are E2EM, 54.4 acres are PEM, 35.2 acres are E2SS, 14.5 acres are PSS, and 0.4 acres are EFO. Wetland vegetation generally consists of bushy seaside tansy, salt meadow cord grass, salt marsh cord grass, gulf cord grass, coastal salt grass, and giant bulrush in the herbaceous stratum. Where present, the shrub stratum is dominated by groundsel tree, Jesuit's bark, poison bean, and coffeeweed.

4.4.2 Wetland Impacts and Mitigation

Construction and operation of the Terminal facilities would affect 186.4 acres of wetlands. In addition to avoidance and minimization of wetland impacts, Venture Global identified mitigation measures that it would implement. Wetland impacts associated with the Terminal and Pipeline facilities are summarized in tables 4.4.2-1 and 4.4.2-2, respectively, below. A full list of wetlands affected by the Project, including wetland identification number, wetland types, and nature and acreage of impact is provided in appendix G. In LDFW's scoping comments, it recommended reducing the temporary pipeline construction ROW to 75 feet and permanent right-of-way to 30 feet, and install culverts in access roads in wetlands every 250 feet. The FERC requires a 50-foot permanent right-of-way for pipeline operations. 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. TransCameron Pipeline has requested and provided justification for a 110-foot-wide pipeline construction right-of-way. The FERC has reviewed the Project-specific Procedures and agrees with TransCameron Pipeline'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 requires Venture Global Calcasieu Pass and TransCameron Pipeline to restore pre-construction 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 Environmental Inspector. Culverts would be used as necessary across access roads to meet these FERC requirements, and any additional requirements the USACE permit might contain. It might not be necessary or appropriate to place culverts every 250 feet, but adherence to the FERC Procedures would ensure minimal impact on hydrologic conditions.

TABLE 4.4.2-1

SUMMARY OF WETLAND IMPACTS FOR TERMINAL FACILITIES (ACRES)

	E2EM		EEM		E2SS		PEM		PSS		PFO/EFO		Mudflat/ Sandflat		Wetland Total	
PROPERTY BOUNDARY																
	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp [a]	Perm [b]
Terminal Site	0.0	14.2	0.0	14.0	0.0	0.7	0.0	61.2	0.0	28.9	0.0	0.0	0.0	0.3	**0.0**	**119.3**
Northeast Access Road	0.0	0.5	0.0	0.0	0.0	0.0	0.0	2.6	0.0	<0.1	0.0	0.0	0.0	0.0	**0.0**	**3.1**
Southwest Service Road	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.5**
Martin Access Road	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.8**
DeHyCo Access Road	<0.1	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**<0.1**	**0.0**
Eastern TWS	0.0	0.0	0.0	0.0	0.0	0.0	19.3	0.0	2.9	0.0	2.5	0.0	0.0	0.0	**24.7**	**0.0**
Floodwall TWS	5.8	0.0	3.6	0.0	0.1	0.0	5.9	0.0	1.8	0.0	0.0	0.0	0.1	0.0	**17.2**	**0.0**
Southwest TWS	0.8	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	**0.8**	**0.0**
Northeastern TWS	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.3**	**0.0**
Northwestern TWS	<0.1	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	**<0.1**	**0.0**
Pipeline within Property Boundary	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	1.1	0.0	<0.1	0.0	0.0	0.0	**2.6**	**0.0**
Marine Facilities	0.0	9.7	0.0	0.0	0.0	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	**0.0**	**17.1**
Subtotal	**6.6**	**25.3**	**3.6**	**14.1**	**0.1**	**7.5**	**27.0**	**64.1**	**5.8**	**28.9**	**2.5**	**0.0**	**0.1**	**0.9**	**45.6**	**140.8**
Wetland Avoided (Not Disturbed)[c]		*154.7*		*22.4*		*12.6*		*80.6*		*3.6*		*1.1*		*<0.1*		*275.0*
Property Total		**186.6**		**40.1**		**20.2**		**171.6**		**38.3**		**3.6**		**1.0**		**461.4**

TABLE 4.4.2-1

SUMMARY OF WETLAND IMPACTS FOR TERMINAL FACILITIES (ACRES)

	E2EM		EEM		E2SS		PEM		PSS		PFO/EFO		Mudflat/ Sandflat		Wetland Total	
CONSTRUCTION SUPPORT FACILITIES																
	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm
Liberty Support Facility	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.9**	**0.0**
Martin Support Facility	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**
DeHyCo Support Facility	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**
Mudd Support Facility	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**
Baker Hughes Support Facility	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**
Support Facility Total	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0
TERMINAL TOTAL		**186.6**		**40.1**		**20.2**		**172.5**		**38.3**		**3.6**		**1.0**		**462.3**

[a] Temporary workspace; impacts are temporary.

[b] Impacts are permanent.

[c] These wetlands are within the land that would be owned by Venture Global Calcasieu Pass, but not impacted.

TABLE 4.4.2-2

SUMMARY OF WETLAND IMPACTS FOR PIPELINE (ACRES)

	E2EM		E2SS		PEM		PSS		PFO/EFO		Mudflat/ Sandflat		Wetland Total	
	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp [a]	Perm [b]
Pipeline Facilities	85.5	76.0	14.5	14.1	17.2	22.8	6.7	6.7	0.0	0.4[c]	0.0	0.0	**123.9**	**120.0**
Aboveground Facilities	0.0	0.0	0.0	1.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**1.3**
ATWS	49.3	0.0	4.8	0.0	13.5	0.0	1.1	0.0	0.0	0.0	0.0	0.0	**68.7**	**0.0**
Contractor Yard	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**6.1**	**0.0**
Access Roads	2.5	<0.1	0.5	0.0	0.7	0.1	0.1	0.0	0.0	0.0	0.0	0.0	**3.8**	**0.1**
TOTAL	**143.4**	**76.0**	**19.8**	**15.4**	**31.4**	**23.0**	**7.8**	**6.7**	**0.0**	**0.4**	**0.0**	**0.0**	**202.5**	**121.4**

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a Temporary workspace; impacts are temporary.

b Permanent easement; impacts are temporary except for 1.3 acres of wetlands aboveground facilities and 0.1 acre of wetlands at permanent access road (as shown on the table).

c HDD areas (no impacts on wetlands) are included in the permanent easement wetland acreages. TransCameron Pipeline avoids 15.3 acres of wetland impact at HDD locations, including 4.2 acres of estuarine emergent, 0.4 acre of estuarine forested, 0.9 acre of estuarine scrub-shrub, 8.6 acres of palustrine emergent, and 1.2 acres of palustrine scrub shrub.

4.4.2.1 Terminal Facilities

Construction of the Terminal facilities would result in the permanent loss of 140.8 acres of wetlands, as shown in table 4.4.2-1. Of this total, 123.7 acres would be permanently filled and converted to upland industrial land and the 17.1 acres of wetlands associated with the marine facilities would be excavated and converted to open water as part of the proposed berthing area and turning basin. Impacts on 3.1 acres of wetlands along the Northeast Access Road would be required for widening of the existing roadway. Impacts on 0.5 acre of wetlands associated with the Southwest Service Road and 0.8 acre of wetlands associated with the Martin Access Road would be required for access to and around the facility. Temporary impacts of 45.6 acres within the Property site would be required for TWS and any pipelines within the property boundary. Impacts on one wetland are also required for the proposed Construction Support Facilities; however, the 0.9-acre impact would be temporary.

The majority of the wetlands that would be affected by construction of the Terminal facilities are PEM, PSS, and E2EM wetlands, with lesser amounts of EEM, E2SS, PFO, and estuarine mudflats impacted. To minimize impacts on wetlands, the Terminal facilities were designed to result in less wetland impact. To mitigate unavoidable impacts on wetlands, Venture Global would comply with its CMP/BUDM developed through permitting and consultation with the USACE and LDNR, which includes a combination of mitigation banking and marsh creation/restoration. The CMP/BUDM identifies a mitigation ration of 1.72:1 for mitigation of wetlands. The most recent version of this plan, filed with the FERC in August 2017. The banking is proposed at the South Fork Coastal Mitigation Bank, operated by Delta Land Services; the marsh creation/restoration is proposed at the East Cove Unit of the CPNWR, managed by the FWS. In addition to providing compensatory mitigation, Venture Global proposes to place a majority of the dredged material in a nearshore area about 2 miles southwest of the Terminal to provide a beneficial use in the form of protection to the recently restored West Beach. Finally, Venture Global also proposes to make a volume-based contribution to the Coastal Resources Trust Fund.

Placement of dredge material would be either through use of a hopper barge or a slurry pipe. The slurry pipe would be routed from the dredge area to the marsh restoration area(s) using a combination of floating, submerged, and land surface pipe sections. The slurry pipe would run north within the Calcasieu River Ship Channel for approximately 5.1 miles to Calcasieu Lake, crossing the navigation channel just north of Monkey Island and then recrossing the navigation channel south of St. John's Island to minimize disruption to activities at existing docks. The slurry pipe would then enter the East Fork Channel and run east along the south shoreline of Calcasieu Lake for about 2.4 miles, before turning southeast into the CPNWR for about 0.6 mile. The temporary placement of slurry pipe over existing substrate and on the river bed within the navigation channel (precluding interference with deep draft vessels) would not cause any change in the overall health or diversity of biotic communities. Pipe laid directly on the river bed within the navigation channel would be at a depth that would not interfere with deep draft vessels.

The disposal of spoil material in the nearshore area off the West Beach would require an approximately 3-mile-long slurry pipe running southwest across the Calcasieu River Ship Channel then south over the west jetty rocks at the mouth of the channel. The slurry pipe within the navigation channel would be laid on the river bed, thereby precluding interference with deep draft vessels. Substrate within the channel and nearshore area has historically been disturbed through periodic maintenance dredging and turbidity from vessels, wave action, and/or weather events. The deposition of dredge material in the nearshore area would temporarily affect sessile organisms but would not likely affect the overall community given the relatively small area to be covered. The resultant change in bathymetry and substrate characteristics would represent an increase in habitat diversity in the area of deposition, and would provide wave protection to Holly Beach.

Based on our review of the proposed CMP/BUDM, we believe that the implementation of the final plans, as approved by the USACE and LDNR, would sufficiently reduce these unavoidable impacts on waters of the United States to less than significant levels. The Project's CMP/BUDM has not been finalized and approved by USACE and LDNR. However, we are including a recommendation in section 5.2 that requires Venture Global to obtain all federal authorizations prior to construction.

4.4.2.2 Pipeline Facilities

Construction

A total of 323.9 acres of wetlands would be affected by construction of the Pipeline, including aboveground facilities (meter stations and MLVs), ATWS areas, contractor yards, and access roads. Wetlands affected by construction include emergent, scrub shrub, and forested communities.

The majority of the Pipeline would be constructed using the push method through wetlands, which would require a 110-foot-wide construction right-of-way in wetlands for spoil placement. Excavation of the pipeline trench, stockpiling of the trench spoil, and backfilling of the trench would disturb soils and 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. If soils are not properly segregated during construction, the resulting mixed soil layers could alter biological components of the wetland and affect the reestablishment of native wetland vegetation. The temporary stockpiling of soil and movement of heavy machinery across wetlands could also lead to inadvertent compaction and furrowing of soils, which could alter natural hydrologic patterns, inhibit seed germination, and increase seedling mortality. Equipment could also introduce non-native and invasive species to the disturbed soil. Altered surface drainage patterns, stormwater runoff, runoff from the trench, and accidental spills could also negatively affect wetland regeneration.

During scoping a commenter expressed concern about marsh salinity impacts along the pipeline. Water discharged into wetlands from hydrostatic testing and dewatering of trenches could affect wetlands by introducing saline water into freshwater wetlands, which could affect vegetation that may not tolerate higher salinity waters. However, the majority of wetlands along the Pipeline are estuarine wetlands (e.g., salt marsh) with saline waters, and any water withdrawals for hydrostatic testing would likely be from saline surface waters. In addition, as stated in section 4.3.2.2, impacts from the discharge of hydrostatic test water would be minimized by implementation of the measures outlined in Venture Global's Project-specific Plan and Procedures. Further, TransCameron Pipeline would obtain an NPDES permit specific to hydrostatic testing to ensure all discharges comply with established water quality standards. Groundwater that may be dewatered from a trench and reach wetlands would also likely be saline given the high TDS concentrations in the Project area. Overall, any water discharged around a wetland from hydrostatic testing or trench dewatering would be relatively minor and short-term.

The effects of construction would be greatest during and immediately following construction. Following construction, disturbed areas would be restored to preconstruction contours and the permanent right-of-way maintained, in accordance with TransCameron Pipeline's Project-specific Procedures. Generally, once pipelines are in place, wetland vegetation communities would transition back to a community with a function similar to that of the wetland prior to construction. In emergent wetlands, the impact of construction would be relatively minor and short-term, because the herbaceous vegetation would regenerate quickly (generally within 1 to 2 years). Scrub shrub wetland impacts would also be minor and short-term, but these wetlands could take 2 to 4 years to reach functionality similar to preconstruction conditions depending on the age and complexity of the wetland system. In forested wetlands, the impact of construction would be long-term due to the long regeneration period of these vegetative types (30 years or more); however, only one forested wetland (an EFO) was identified within the Project area, and impacts on this forested wetland would be avoided by the use of HDD.

TransCameron Pipeline would minimize construction-related wetland impacts by collocating 20.1 miles (86 percent) of the 23.5-mile Pipeline with other utility and transportation corridors. In addition, impacts on several wetlands totaling 18.5 acres, including the only forested wetland in the Project area, would be mitigated by the use of the HDD method. Use of HDD would avoid any surface disturbance to these wetlands, and no clearing is proposed between the HDD entry and exit points. An inadvertent release of drilling mud into a wetland would affect water quality. If an inadvertent release occurs, TransCameron Pipeline would implement the corrective action and cleanup measures outlined in its HDD Contingency Plan to minimize potential impacts on wetland resources (see appendix D). In addition, TransCameron Pipeline would restore wetlands in accordance with its Project-specific Procedures. Wetland restoration would include measures for re-establishing vegetation, controlling the invasion and spread of invasive species and noxious weeds, and monitoring the success of the revegetation and weed control efforts. With implementation of these plans, we conclude that construction impacts on wetlands would be minimized. Section 2.6.4.7 describes the specialized construction techniques that TransCameron Pipeline would implement for construction through wetlands.

Operational Impacts and Mitigation

Approximately 121.4 acres of wetlands would be within the permanent easement area of the Pipeline. This includes wetlands within the 50-foot-wide permanent pipeline right-of-way, aboveground facility sites, and permanent access roads.

Within the 50-foot-wide permanent easement associated with the Pipeline, TransCameron Pipeline would maintain a 10-foot wide corridor centered over the pipeline in an herbaceous state during operation to facilitate pipeline inspections and maintenance. As a result, a 10-foot-wide corridor through scrub-shrub wetlands would be permanently converted to emergent wetland. While the conversion would not constitute a wetland loss (including wetland function), it would represent a permanent change in wetland type. In accordance with the Project-specific Procedures, TransCameron Pipeline may selectively remove trees within a 30-foot-wide corridor centered over the pipeline with roots that could compromise the integrity of the pipeline coating. Because TransCameron Pipeline would avoid the only forested wetland by using an HDD, this selective tree removal during maintenance would not result in any wetland cover type conversion. The remaining permanent easement would be allowed to revegetate naturally.

Approximately 1.4 acres of wetland would be permanently filled for MLVs, meter stations, and permanent access roads. This wetland loss would be mitigated through the Project's Compensatory Mitigation Plan (found within the CMP/BUDM, appendix E). Through implementation of the measures in the Project-specific Procedures and development of a final CMP/BUDM, we conclude that permanent impacts on wetlands would be reduced to less than significant levels.

4.4.3 Alternative Measures to FERC Procedures

Venture Global proposes to use Project-specific Procedures by modifying our Procedures as necessary for this Project. Venture Global proposes alternatives to our Procedures. We have reviewed these modifications and the site-specific justification and have found the majority of them to be justified, particularly given the hydrology of the region, as well as adequately protective of the environment.

4.4.3.1 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. Since the majority of the Project area consists of wetlands, Venture Global has proposed that where upland refueling sites are less than 100 feet from wetlands, the Project will maintain a 10-foot setback. All refueling and equipment storage procedures, irrespective of proximity to wetlands will be undertaken in accordance with Venture Global Calcasieu Pass' and TransCameron Pipeline's SPCC Plan to reduce the potential for spills during construction and to mitigate the environmental impacts if a spill should occur.

Section IV.A.1.e of our Procedures requires all hazardous materials (e.g., fuels, oils) to be stored at least 100 feet of a wetland boundary. Since the majority of the Project area consists of wetlands, it would be logistically impractical and potentially more environmentally damaging to track construction equipment long distances to refueling areas than refueling at the work area. Therefore, Venture Global has proposed floating a fuel barge with each piece of amphibious equipment to refuel as work progresses. The fuel barge will have secondary containment devices, spill kits, and absorbent pads. Equipment operators would be full trained in refueling procedures and the SPCC Plan.

4.4.3.2 Right-of-Way Width

Section VI.A.3 of our Procedures requires the pipeline right-of-way be limited to 75 feet or less in wetland areas. TransCameron Pipeline has proposed a 110-foot-wide pipeline construction right-of-way due to poorly cohesive soils. TransCameron Pipeline states that the increased right-of-way width would accommodate the associated larger trench width and spoil pile, and in wetland areas, to safely and effectively implement the push construction technique. Based on the soil characteristics in the Project area, we conclude this modification has been adequately justified. Further discussion of TransCameron's proposed 110-foot right-of-way width is provided in section 2.4.2.

4.4.3.3 Aboveground Facilities

Section VI.A.6 of our Procedures requires that aboveground facilities be located outside wetlands, except where the location of such facilities outside of wetlands would prohibit compliance with DOT regulations. Venture Global has proposed an alternative measure to this requirement to allow the construction of an MLV and a meter station within wetlands. The MLV and meter station must connect to the existing ANR/Bridgeline meter station because that is the proposed receipt point of feed gas from ANR and Bridgeline. The existing ANR/Bridgeline meter station is completely surrounded by wetlands, and therefore, we agree that construction of these facilities within wetlands is justified.

4.4.3.4 Extra Work Areas

Section VI.B.1.a of our Procedures requires that extra work areas be at least 50 feet from wetland boundaries except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. TransCameron Pipeline has proposed to place certain ATWS areas in or within 50 feet of wetlands, as identified in table 4.4.3.4-1 below.

Extensive wetlands and open waters comprise a significant portion of the Pipeline's environmental terrain. In many cases, linear waterbodies (e.g., ditches and canals) are flanked directly by wetlands and have no upland bank profile, making it infeasible to locate ATWS areas at least 50 feet from wetland and waterbody boundaries. However, to minimize wetland and waterbody impacts, the Project would incorporate the practices described below:

- co-location of the proposed Pipeline parallel and adjacent to existing pipeline corridors for approximately 86 percent of the route.
- reduction of impacts on wetlands and waterbodies through use of construction methods that include:
    - predominant use of open-cut and HDD construction techniques for waterbodies and push method for wetlands, as opposed to upland construction methods;
    - installation of timber mats in ATWS at high traffic work stations, such as push sites and HDD sites; and
    - use of low-ground pressure, amphibious equipment in push workspaces and associated ATWS.

TABLE 4.4.3.4-1

PROPOSED LOCATIONS OF ADDITIONAL TEMPORARY WORKSPACE WITHIN WETLANDS

Approximate Milepost	Wetland ID [a]	ATWS Size (acres)	Distance (feet) and Direction from Wetland	ATWS Purpose	Justification
Pipeline					
0.0	WL131ds	0.71	0; within	Meter station	Meter station site is proposed at existing ANR facility – upland has been used to extent practicable for ATWS.
0.1	WL131de and WL042e	0.22	0; within	Meter station	Meter station site is proposed at existing ANR facility – upland has been used to extent practicable for ATWS.
0.1	WL063de and WL042e	0.93	0; within	HDD exit	Wetland expanse characterizes area. No upland alternative exists.
0.1	WL063de and WL063ds	5.1	0; within	HDD pipe string area	Wetland expanse characterizes area. No upland alternative exists.
0.5	WL041e	1.2	0; within	HDD entry site	Wetland expanse characterizes area. No upland alternative exists.
1.0	WL104de and WL040e	2.1	0; within	HDD exit	Wetland expanse characterizes area. No upland alternative exists.
1.0	WL040e	1.4	0; within	Push site	Wetland expanse characterizes area. No upland alternative exists.
1.1	WL104de	4.1	0; within	HDD pipe string area	Wetland expanse characterizes area. No upland alternative exists.
1.4	WL104ds and WL104de	2.0	0; within	HDD pipe string area	Wetland expanse characterizes area. No upland alternative exists.
1.7	WL040e	2.0	0; within	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
2.8	WL040e	1.5	0; within	Foreign line crossing/ Push Site	Wetland expanse characterizes area. No upland alternative exists.
3.6	WL040e	0.7	0; within	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
4.2	WL040e and WL509ds	0.3	0; within	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
4.2	WL039e	2.6	0; within	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
4.2	WL510de	0.1	0; within	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
4.4	WL130de	0.4	0; within	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
4.9	WL039e	2.2	0; within	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
5.0	WL129de	0.5	0; within	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
6.7	WL055de	1.6	0; within	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
6.8	WL038e	0.4	0, within	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
7.0	WL038e	0.1	0; within	Waterbody crossing	Wetland expanse characterizes area. No upland alternative exists.
7.1	WL038e	0.1	0; within	Waterbody crossing	Wetland expanse characterizes area. No upland alternative exists.
7.4	WL038e	2.3	0; within	HDD pipe string area	Wetland expanse characterizes area. No upland alternative exists.
7.4	WL038e	0.4	0; within	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
7.6	WL038e	1.8	0; within	HDD pipe string area	Wetland expanse characterizes area. No upland alternative exists.
7.8	WL038e	0.2	0; within	HDD pipe string area	Wetland expanse characterizes area. No upland alternative exists.
7.8	WL038e	1.0	0; within	HDD exit	Wetland expanse characterizes area. No upland alternative exists.
7.9	WL038s	0.3	0; within	HDD exit	Wetland expanse characterizes area. No upland alternative exists.
8.3	WL037e	0.6	0; within	HDD entry site	Wetland expanse characterizes area. No upland alternative exists.

TABLE 4.4.3.4-1

PROPOSED LOCATIONS OF ADDITIONAL TEMPORARY WORKSPACE WITHIN WETLANDS

Approximate Milepost	Wetland ID [a]	ATWS Size (acres)	Distance (feet) and Direction from Wetland	ATWS Purpose	Justification
8.3	WL037e, WL053de, WL101ds, and WL101de	8.6	0; within	HDD pipe string area	Wetland expanse characterizes area. No upland alternative exists.
8.5	WL037e	0.6	0; within	HDD exit	Wetland expanse characterizes area. No upland alternative exists.
9.4	WL036e	0.6	0; within	HDD entry site	Wetland expanse characterizes area. No upland alternative exists.
10.0	WL035e	1.4	0; within	HDD exit	Wetland expanse characterizes area. No upland alternative exists.
13.0	WL034e	0.1	0; within	Waterbody crossing	Wetland expanse characterizes area. No upland alternative exists.
13.5	WL034e	0.1	0; within	Waterbody crossing	Wetland expanse characterizes area. No upland alternative exists.
13.5	WL033e	0.1	0; within	Waterbody crossing	Wetland expanse characterizes area. No upland alternative exists.
14.1	WL033e and WL033s	1.7	0; within	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
14.2	WL033de	0.4	0; within	Foreign line crossing	Wetland expanse characterizes area. No upland alternative exists.
15.2	WL032e	0.6	0; within	Waterbody crossing	Wetland expanse characterizes area. No upland alternative exists.
15.2	WL032e	<0.1	0; within	Open water crossing	Provides additional workspace width for spoil storage/handling in open water/wetland expanse – no upland exists at this location.
15.5	WL032s and WL031s	<0.1	0; within	Open water crossing	Provides additional workspace width for spoil storage/handling in open water/wetland expanse – no upland exists at this location.
15.7	WL031e	0.1	0; within	Open water crossing	Provides additional workspace width for spoil storage/handling in open water/wetland expanse – no upland exists at this location.
15.8	WL030e	0.3	0; within	Open water crossing	Provides additional workspace width for spoil storage/handling in open water/wetland expanse – no upland exists at this location.
16.2	WL030e	0.1	0; within	Open water crossing	Provides additional workspace width for spoil storage/handling in open water/wetland expanse – no upland exists at this location.
16.3	WL030e	0.2	0; within	Open water crossing	Provides additional workspace width for spoil storage/handling in open water/wetland expanse – no upland exists at this location.
16.4	WL029e	0.1	0; within	Open water crossing	Provides additional workspace width for spoil storage/handling in open water/wetland expanse – no upland exists at this location.
17.1	WL029e	0.4	0; within	Foreign line crossing	Wetland/waterbody expanse characterizes area – no upland alternative exists.
17.2	WL029e	0.1	0; within	Open water crossing	Provides additional workspace width for spoil storage/handling in open water/wetland expanse – no upland exists at this location.
17.4	WL029e and WL029s	0.1	0; within	Open water crossing	Provides additional workspace width for spoil storage/handling in open water/wetland expanse – no upland exists at this location.
17.6	WL029e	0.1	0; within	Open water crossing	Provides additional workspace width for spoil storage/handling in open water/wetland expanse – no upland exists at this location.
17.7	WL029e	0.6	0; within	Foreign line crossing	Wetland expanse characterizes area – no upland alternative exists.

TABLE 4.4.3.4-1

PROPOSED LOCATIONS OF ADDITIONAL TEMPORARY WORKSPACE WITHIN WETLANDS

Approximate Milepost	Wetland ID [a]	ATWS Size (acres)	Distance (feet) and Direction from Wetland	ATWS Purpose	Justification
17.8	WL029e, WL517de, and WL028e	0.6	0; within	Foreign line crossing	Wetland/waterbody expanse characterizes area – no upland alternative between construction workspace and existing foreign pipeline right-of-way.
18.0	WL028e and WL027e	0.4	0, within	Foreign line crossing	Wetland expanse characterizes area – no upland alternative exists.
18.8	WL026e and WL026s	1.4	0; within	HDD exit	Temporary construction workspace.
19.2	WL025e	0.6	0; within	HDD entry site	Temporary construction workspace.
19.8	WL121d	7.2	0; within	Foreign line crossing	Wetland expanse characterizes area – no upland alternative exists.
20.0	WL025e and WL059d	3.5	0; within	Foreign line crossing	Wetland expanse characterizes area – no upland alternative exists.
20.3	WL024e	0.2	0; within	Waterbody crossing	Wetland expanse characterizes area – no upland alternative exists.
20.4	WL024e	0.3	0; within	Waterbody crossing	Wetland expanse characterizes area – no upland alternative exists.
20.5	WL024e and WL024s	0.2	0; within	Waterbody crossing	Wetland expanse characterizes area – no upland alternative exists.
21.2	WL024e, WL024s, and WL514de	1.0	0; within	HDD exit	Wetland expanse characterizes area – no upland alternative exists.
21.6	WL023s and WL023ds	0.6	0; within	HDD entry	Wetland expanse characterizes area – no upland alternative exists.
22.0	WL023e	0.1	0; within	Waterbody crossing	Wetland expanse characterizes area – no upland alternative exists.
22.1	WL023e and WL023s	0.1	0; within	Waterbody crossing	Wetland expanse characterizes area – no upland alternative exists.
22.7	WL021s	0.1	0; within	HDD pipe string area	Wetland expanse characterizes area. No upland alternative exists.
22.7	WL021s	0.1	0; within [b]	Tie-in Location	Within Eastern TWS at Terminal Site – located and configured to minimize wetlands impacts.

[a] Wetland IDs with “de,” “ds,” or “dm” were previously desktop digitized then later field verified/surveyed; those ending with “d” are desktop digitized.

[b] Acreage impacts included in Terminal acreage impacts for summary calculations.

ANR = ANR Pipeline Company; ATWS = additional temporary workspace; HDD = horizontal directional drill; TWS = temporary workspace

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

4.4.3.5 Access Roads

Section VI.B.1.d of our Procedures requires 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 wetland. TransCameron Pipeline has requested a modification to this requirement to allow construction of access roads to several HDD entry and exit work sites where there are no existing roads; at these sites, a new temporary access road would be constructed across the wetland where impacts would be less than building a new access road along the construction right-of-way. We have reviewed these proposed temporary access roads and note that the only proposed improvements are the use of timber matting for stabilization and to minimize wetland impact. Therefore, we conclude this modification has been adequately justified.

4.4.3.6 Temporary Sediment Control

Section VI.B.3 of our Procedures requires the use of temporary sediment barriers to prevent the flow of spoil or silt-laden water into any wetland. Venture Global has requested a modification from these Procedures in locations where the push method would be used. In general, we agree that the use of temporary sediment barriers across the right-of-way would not be practicable, impeding the proposed push/pull of the pipeline. In addition, we note that due to the flat topography, flow of upland spoil into the wetland is not likely. However, we believe that sediment barriers should be installed along the edge of the right-of-way to minimize sediment transport off right-of-way (likely caused during spoil placement or construction vehicle movement causing "pumping" of water and wetland soils). Therefore, while we conclude that sections VI.B.3.a and VI.B.3.b of this requested modification are warranted, but the requested modification to section VI.B.3.c is not justified. The performance based measures in the Procedures would still apply and Venture Global's EIs would be responsible for ensuring that sediment barriers are installed where necessary and practicable along the edge of the right-of-way to prevent silt-laden water from flowing off the construction right-of-way. Because we do not agree with the requested modification to section VI.B.3.c, **we recommend that:**

- **<u>Prior to construction</u>, Venture Global should revise its Project-specific Procedures without the requested modification to section VI.B.3.c and file it with the Secretary for review and written approval by the Director of the Office of Energy Projects (OEP).**

4.5 VEGETATION

The Project is within the Texas-Louisiana Marshes Level IV Ecoregion, within the larger Western Gulf Coastal Plain. The Texas-Louisiana Marshes Level IV Ecoregion is described as flat plains covered by standing water, including tidal marshes with bayous, lakes, canals, and cheniers. The primary land use and land cover types include marshland, wildlife and waterfowl habitat, and oil and gas production (Daigle et al., 2006). The primary habitat type surrounding the Project area is coastal marsh.

Venture Global identified vegetation in the Project area during its late 2014 and early 2015 environmental field surveys. Descriptions of natural communities in the Project area were based on data from the LNHP's Natural Communities of Louisiana (LDWF, 2009).

4.5.1 Existing Vegetation Resources

4.5.1.1 Terminal Facilities

Much of the proposed Terminal site is within areas where the primary vegetation type is salt marsh and brackish marsh. Portions of the Terminal site would also be located in non-marsh/other areas, which consist of residential and agricultural (e.g., hay, pasture) properties as well as transportation corridors (e.g., high local roadways).

4.5.1.2 Pipeline

Much of the Pipeline would be located within areas where the primary vegetation type is freshwater marsh, intermediate marsh, brackish marsh, non-marsh/other, and open water. Portions of the Pipeline would also cross open water areas, and non-marsh/other areas, which consist of residential and agricultural (e.g., hay, pasture, cultivated crop) properties as well as transportation corridors (e.g., highways).

4.5.1.3 Construction and Operation Impacts and Mitigation

This section summarizes the Project's construction and operation impacts on vegetation. Construction of the Project would affect a total of approximately 835.5 acres of land. Of this land area, 740.3 acres is vegetated as further discussed in section 4.8 and listed in land use tables 4.8.1.1-1 and 4.8.2.1-2. Following construction, about 447.9 acres of vegetation would be allowed to return to preconstruction vegetation conditions and 292.4 acres of vegetation would be permanently altered. Overall, the Project would have the greatest construction impact on brackish marsh (379.1 acres) within the Terminal site and coastal wetlands (282.2 acres) along the pipeline route.

4.5.1.4 Terminal Site

Construction and operation of the Terminal facilities would temporarily and permanently impact existing vegetation at the site. The Terminal site, Terminal Support Facilities, access roads, and marine facility area would permanently impact approximately 304.8 acres of marsh, 0.2 acre of water, and 9.0 acres of non-marsh/other land. About 91.8 acres of marsh lie within the TWS for the Terminal site along with 7.5 acres of non-marsh/other land. The majority of the TWS at the Construction Support Facilities, 44.2 acres, is non-marsh/other land. Approximately 6.9 acres of marsh and 0.3 acre of water are also within the TWS at the Construction Support Facilities. There is no submerged aquatic vegetation in the Project area that would be impacted by the Terminal facilities.

Many of the vegetation community types represented at the Terminal site are considered of low quality due to the successional nature of the communities, presence of fill, and historic use of the site for grazing and industrial purposes. Permanent conversion of habitat from non-industrial to industrial would convert existing non-industrial habitat types to an industrial status. The resulting change would have a minor impact on species in the area because these areas have undergone previous disturbance.

4.5.1.5 Pipeline Facilities

Construction of the Pipeline would affect about 370.9 acres of land as indicated in table 4.5.1.5-1. Of this land area, approximately 143.7 acres have been mapped as marsh and 227.2 acres have been mapped as non-marsh/other based on Louisiana Coastal Marsh Vegetative Type datasets (LDWF, 2001). The non-marsh/other dataset contains vegetated areas, which can be separated into various land use areas as shown in table 4.5.1.5-1 and as further discussed in section 4.8. Based on these land uses, construction would affect about 346.3 acres of vegetation, of which 1.2 acres would be permanent. The 1.2 acres of permanent impacts on vegetation from the Pipeline is associated with aboveground facility sites and permanent access roads.

Of the remaining 345.1 acres, 329.8 acres would be temporarily affected and 15.3 acres would be avoided by HDD as discussed in section 4.4. To further avoid and minimize impacts on vegetation associated with the Pipeline, TransCameron Pipeline would implement measures described in the Project-specific Plan and Procedures, which specifically address reseeding, revegetation, and monitoring of vegetation. Temporarily affected areas within the pipeline right-of-way would be seeded in accordance with local NRCS requirements and thereafter, vegetation would be allowed to revert to preconstruction conditions following construction. Revegetation would be considered successful once the right-of-way surface condition is properly restored similar to adjacent undisturbed land. Implementation of the Project-specific Plan and Procedures would also ensure that ground disturbance and restoration activities minimize the spread of invasive species.

Construction of the Pipeline may result in fragmentation of surrounding habitats (Lester et al., 2005); however, wetland fragmentation is not expected as the Pipeline facilities have been sited adjacent to roads, utilities, and other previously disturbed areas, to the extent practicable and there are no forested impacts, which would also minimize fragmentation. In emergent wetlands, vegetation within the construction workspace would be flattened during the course of construction but would not be purposely cleared, other than through trench excavation. Prior to trench excavation in upland areas, vegetation would be cut and removed from the construction workspace. Generally, tree stumps would be cut flush with the ground surface and left in place, except where their removal is necessary to create a safe and level work surface. Cleared vegetation would be chipped or hauled offsite to a commercial disposal facility. Chipped material would be spread across the work area during revegetation. Clearing and grading operations would incorporate procedures to minimize vegetation removal from slopes, wetlands, and channel banks; prevent undue soil profile disturbance; restore preconstruction ground contours; and prevent topsoil erosion.

TransCameron Pipeline has identified one contractor yard for the Pipeline. The 9.8-acre yard would be used for material and equipment storage and laydown, as well as contractor and inspection offices. The proposed site consists of herbaceous upland and emergent wetland used as pasture that would be temporarily affected. Access roads would temporarily affect 8.6 acres of herbaceous upland and emergent wetland, and 1.1 acres of developed land (primarily existing roadway), and permanently affect 0.2 acre of emergent wetland.

Based on the amounts and types of vegetation impacted along the pipeline route, the temporary nature of the impacts, and TransCameron Pipeline's proposed impact minimization measures, we have determined that constructing and operating the Pipeline would not significantly affect vegetation.

TABLE 4.5.1.5-1

VEGETATION AFFECTED BY CONSTRUCTION AND OPERATION OF THE PIPELINE (ACRES) [A]

Facility	Hay Pasture, Cultivated Crops		Herbaceous		Barren		Developed		Open Water		Wetland		Shrub/Scrub		Total	
	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp [b]	Perm [c]
Pipeline																
Pipeline Facilities	13.9	13.3	3.7	5.2	0.0	<0.1	2.5	3.8	7.8	4.0	111.6	108.0	0.9	0.7	140.4	135.0[d]
Aboveground Facilities (Meter Stations and MLVs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.3
ATWS	2.5	0.0	8.7	0.0	0.0	0.0	1.1	0.0	3.0	0.0	59.2	0.0	0.1	0.0	74.5[d]	0.0
Contractor Yards	0.0	0.0	8.7	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.8	0.0
Access Roads	1.2	0.0	5.1	0.0	0.1	0.0	1.1	<0.1	0.0	0.0	2.2	0.2	0.0	0.0	9.7[d]	0.2
Project Total	**17.6**	**13.3**	**26.2**	**5.2**	**0.1**	**<0.1**	**5.8**	**4.2**	**10.8**	**4.0**	**173.0**	**109.2**	**1.0**	**0.7**	**234.4**	**136.5**

[a] Pipeline workspaces within the Terminal site boundary are removed and included in the Terminal site land use table to not duplicate acreages at Project areas.

[b] Temporary workspace acreage is exclusive of permanent easement acreage.

[c] Acreages at Permanent Easement include horizontal directional drill areas not affected at the surface as well as temporarily affected lands at the permanent easement and will remain a part of the existing land use at the TransCameron Pipeline easement areas.

[d] A 0.1-acre rounding discrepancy.

ATWS = additional temporary workspace; MLV = mainline valve

4.5.2 Exotic or Invasive Plant Communities and Noxious Weeds

Exotic plant communities, invasive species, and noxious weeds can out-compete and displace native plant species, thereby negatively altering the appearance, composition, and habitat value of affected areas. In their scoping comments, the EPA expressed concern with the Project's potential introduction and spread of invasive plants. In accordance with the Plant Protection Act of 2000 (7 USC 7701), 13 plants have been federally designated as noxious weeds that could occur in Louisiana, and the State of Louisiana has designated one plant, Chinese tallow, as a "noxious plant harmful to growth and development of other plants and pasture and may be destroyed wherever found in this state." The Chinese tallow poses one of the greatest threats to vegetation communities in the area by rapidly replacing native plants and trees and radically altering marsh, forest, and coastal prairie ecosystems.

Venture Global would construct the Project in compliance with its Project-specific Plan and Procedures. 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. However, Venture Global has not proposed specific measures to be implemented in accordance with this section; therefore, **we recommend that:**

- **<u>Prior to construction,</u> Venture Global should coordinate with the NRCS and LDWF to develop Project-specific noxious weed control procedures. Venture Global should file its Project-specific noxious weed control procedures with the Secretary, including documentation of its consultation with the NRCS and LDWF, for review and written approval by the Director of OEP.**

4.5.3 Vegetative Communities of Special Concern

Vegetative 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. The Project would largely impact coastal marsh. Vegetative communities of special concern in the Project area include coastal live oak-hackberry forest and three state designated rare plant species.

4.5.3.1 Coastal Live Oak-Hackberry Forest

During scoping the LDWF expressed concern with Coastal Live-Oak Hackberry Forest natural communities in the Project area; according to the LDWF (2016a), the Project is within and adjacent to a Coastal Live Oak-Hackberry Forest natural community (also known as a chenier forest). These communities formed on abandoned beach ridges (cheniers) primarily in SWLA and were stranded via deltaic sedimentation by the constantly shifting Mississippi River. These chenier forest communities are considered imperiled in Louisiana with an S1 state rank[16]. Cheniers are important storm barriers, limiting saltwater intrusion, and act as a migratory staging/stopover site for Neo-tropical migratory birds.

The LDNR (LDNR, 2009) chenier dataset indicated locations where cheniers may be present. Cheniers were indicated both within the Terminal site and along the Pipeline. It was observed during environmental field surveys that much of the Coastal Live Oak-Hackberry Forest areas no longer exist, as they have been heavily cleared to support cattle grazing. In addition to heavy cattle use in the area, it was

[16] State Element Rank S1 = critically imperiled in Louisiana because of extreme rarity (5 or fewer known extant populations) or because of some factor(s) making it especially vulnerable to extirpation (http://www.wlf.louisiana.gov/wildlife/explanation-endangered-species-rankings).

observed that the habitat has been affected by storms and hurricanes, based on the presence of downed trees with intact root systems. A small area of hackberry, with no associated live oak, identified as persisting (approximately 2–3 acres) would be permanently impacted by Terminal site construction. Because this natural community has been reduced to a remnant of what is recorded by the Louisiana Natural Heritage Program (LNHP), and current land use practices prevent natural regeneration of mature oak-hackberry forest cover, Venture Global Calcasieu Pass proposes no specific mitigation. However, because the majority of the parcel of land east of the Terminal site would be leased by Venture Global, this large parcel of land would no longer be grazed and would not be developed. It is likely that portions of the habitat may naturally regenerate to Coastal Live Oak-Hackberry Forest in this area over time.

Chenier locations identified along the pipeline route are listed in table 4.5.3.1-1. Environmental field surveys also revealed a small habitat consisting of a few scattered oaks (no hackberry) that would be removed for construction of the Pipeline between MPs 22.5 and 23.0. Because this natural community has been reduced to a remnant and current land use practices prevent natural regeneration of mature oak-hackberry forest cover (as this area is also grazed and hay pasture), no specific mitigation is proposed by TransCameron Pipeline.

TABLE 4.5.3.1-1

SUMMARY OF IMPACTS ON CHENIERS FOR PIPELINE

Milepost From – To	Habitat Type	Area of Impact (acres)	Type of Impact	Pipeline Length at Centerline (feet)	Pipeline Width at Centerline (feet)
6.3 – 6.4	Grazing and hay land [a]	1.3	Temporary	486	110
7.9 – 8.0	Grazing and hay land [a]	0.6	Temporary	142	110
14.1 – 14.1	Grazing and hay land [a]	0.3	Temporary	151	110
14.2 – 14.2	Grazing and hay land [a]	0.1	Temporary	99	110
21.2 – 21.2	Grazing and hay land [a]	0.4	Temporary	98	110
21.2 – 21.3	Grazing and hay land [a]	0.6	Temporary	179	110
21.3 – 21.4	Grazing and hay land [a]	0.5[b]	Temporary	460	110
22.3 – 22.3	Grazing and hay land [a]	0.3	Temporary	136	110
	Total:	**3.9**			

Source: LDNR, 2009.
[a] The cheniers are primarily agricultural land used for cattle grazing or hay field; no chenier oak-hackberry habitat is present along the Project pipeline right-of-way.
[b] Impacts avoided by horizontal directional drill installation of the pipeline segment.

4.5.3.2 Rare Plant Species

A review of LNHP data identified multiple reported occurrences of the following three state-designated rare plant species in the Project vicinity. During scoping, the LDWF also expressed concern with saltflat grass and woolly honeysweet in the Project area.

- punctate cupgrass (*Eriochloa punctate*) – imperiled due to its rarity;
- saltflat grass (*Monanthochloe littoralis*) – critically imperiled due to its rarity; and
- Mexican hat (*Ratibida peduncularis*) – imperiled/rare in Louisiana.

One occurrence of punctate cupgrass is identified by the LNHP as occurring within the Terminal site. The LNHP occurrence information does not identify the date of the last observation, but this species was not observed during the Venture Global Calcasieu Pass' environmental field surveys conducted in late

2014 and early 2015. One occurrence of saltflat grass is identified by the LNHP south of the Terminal site. During Venture Global Calcasieu Pass' environmental field surveys, observations of saltflat grass were recorded at five locations within the Terminal site. Two occurrences are within portions of the Terminal site that would not be impacted by construction; three locations would be unavoidable and would be impacted by construction. The LDWF has indicated that it would provide comments on rare plant impacts during the USACE and LDNR public notice periods for the Project.

A consultation letter dated February 2015 from the LNHP identified four additional state-designated rare plant species potentially located within the project vicinity.

- narrow-leaved Puccoon (*Lithospermum incisum*) – critically imperiled due to its rarity;
- sea oats (*Uniola paniculata*) – critically imperiled due to its rarity;
- wedge-leaf Prairie-clover (*Dalea emarginata*) – imperiled due to its rarity; and
- woolly Honeysweet (*Tidestromia lanuginose*) – critically imperiled due to its rarity.

Venture Global would conduct surveys to determine the presence or absence of these additional plant species prior to Project construction. Because these surveys have not yet been completed, **we recommend that:**

- **<u>Prior to the end of the draft EIS comment period,</u> Venture Global should file with the Secretary its plan to conduct outstanding surveys for state-designated rare plant species, correspondence with the LNHP, and any mitigation measures Venture Global would implement.**

4.6 WILDLIFE AND AQUATIC RESOURCES

4.6.1 Wildlife Resources

Wildlife species inhabiting the Project area are characteristic of the habitats provided by the plant communities that occur in the Project region. Detailed information on vegetation types present within the Project area is included in section 4.5. Habitat types were identified based on aerial photography and field surveys. Aquatic resources are discussed in section 4.6.2. Threatened, endangered, and other special status wildlife species are discussed in section 4.7.

4.6.1.1 Existing Wildlife Habitat

Wildlife habitats associated with the Terminal site and Pipeline facilities are dominated by vegetated wetlands, interspersed with areas of open water, herbaceous upland, scrub/shrub upland, and agricultural/pasture land.

Louisiana coastal wetlands dominate the landscape in this region, and include estuarine emergent, estuarine mudflats, estuarine scrub/shrub, PEM, and PSS wetland communities. These wetlands support a diverse ecosystem that provides nutrients, cover, shelter, and water for a variety of terrestrial and aquatic wildlife species, including waterfowl, wading birds, nesting birds, raptors, mammals, reptiles, and amphibians. Approximately 735 species of birds, finfish, amphibians, shellfish, reptiles, and mammals utilize this habitat (Bartlett, 2015).

Open water habitats associated with the Terminal site include the Calcasieu River Ship Channel, perennial ditches, an intermittent ditch, and ponds. Open water habitats associated with the Pipeline facilities include both freshwater and estuarine streams, manmade ditches and canals, manmade stock ponds and borrow areas, estuarine open water areas, and both freshwater and estuarine ponds. Typical wildlife associated with open water habitat includes wading birds, waterfowl, beavers, otters, nutria, snakes, and other wildlife species dependent on aquatic environments. Aquatic species are discussed further in section 4.6.2.

Herbaceous upland and scrub/shrub upland that would be affected by the Project consists primarily of grasses, forbs, and shrubs. These vegetation communities provide foraging habitat for aerial predators, such as red-tailed hawk, eastern kingbird, loggerhead shrike, American kestrel, eastern screech-owl, short-eared owl, common nighthawk, and turkey vulture. Other bird species may include northern bobwhite, eastern bluebird, killdeer, upland sandpiper, horned lark, vesper sparrow, savannah sparrow, grasshopper sparrow, bobolink, and eastern meadowlark. Mammals typically associated with these habitats include white-tailed deer, striped skunk, shrews, voles, cotton rat, armadillo, raccoon, and mice. Typical reptiles and amphibians associated with these habitats include chorus frog, box turtle, rat snake, and garter snake (Benyus, 1989; Martin et al., 1951).

Agricultural/pasture lands that would be affected by the Project include those used for the cultivation of crops, such as rice fields, or lands used for pasture and hay. Agricultural lands do not provide high quality habitat for cover or nesting but do provide foraging opportunities for several species. Not only are cultivated crops widely used by wildlife, but the attendant growth of "weeds" is also an important source of food for ground-feeding birds and rodents (Martin et al., 1951). Irrigation ditches, ponds, and flooded fields provide habitats for shorebirds, wading birds, and waterfowl. Many species capable of inhabiting open lands would also utilize agricultural lands.

4.6.1.2 Impacts and Mitigation

Terminal Facilities – Construction Impacts

Construction of the Terminal site, Northeast Access Road, Southeast Access Road, Martin Access Road, and the Marine Facilities on Venture Global's property would permanently impact 314 acres of land. Permanent impacts on wildlife habitats include 189.1 acres of wetland, 0.4 acre of open water, 4.3 acres of agricultural/pasture land, 61.8 acres of herbaceous land, and 33.1 acres of shrub/scrub. This wildlife habitat would be permanently converted to industrial land for the new LNG facility, in which most of the vegetated and open water habitats would be replaced with surfacing materials such as concrete or gravel. The remaining Terminal site land that would be permanently impacted includes developed land (22.4 acres) and barren land (2.9 acres), which are not anticipated to provide significant wildlife habitat value. Construction activities for TWS, access roads, and the portion of the pipeline within Venture Global's property would temporarily impact 93.9 acres of wildlife habitat, including 71.9 acres of agriculture/pasture land, 1.9 acres of herbaceous land, 14.6 acres of wetland, and 5.5 acres of shrub/scrub; these temporarily disturbed areas would be restored in accordance with the Project-specific Plan and Procedures. Impacts on aquatic wildlife as a result of the marine dredging and excavation are discussed in section 4.6.2.1.

Venture Global Calcasieu Pass' proposed Construction Support Facilities would temporarily impact a total of 51.4 acres of land. The majority of these impacts (79 percent) are on developed lands. Wildlife habitats temporarily impacted include 4 acres of agricultural/pasture land, 1.8 acres of open water, 1.5 acres of wetland, and 3.4 acres of shrub/scrub. Venture Global Calcasieu Pass would restore these areas in accordance with the Project-specific Plan and Procedures after construction. There would be no permanent impacts on land from the proposed Construction Support Facilities.

During scoping a member of the public expressed concern of potential Project noise impacts on wildlife. Construction noise, use of construction equipment, and other human activity could impact wildlife. While these impacts would be short-term and temporary, they could cause displacement, stress, and direct mortality of some individuals.

Potentially suitable cover, nesting, and foraging habitat for some wildlife species would be reduced due to clearing and removal of vegetation. Individuals of smaller, less mobile wildlife such as reptiles and amphibians could be inadvertently killed by construction equipment. More mobile species, such as birds and mammals, may relocate to similar habitats nearby when construction activities commence. The permanent reduction in available habitat within the area 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. The greatest impact on wildlife habitat would result from the permanent loss of about 189.5 acres of wetland and open water habitat on the Terminal site. Subject to final review and approval by the USACE, Venture Global would provide compensatory mitigation for permanent impacts on these waters of the U.S. that would be permanently converted to upland. Based on a field survey conducted on December 11, 2014, it was determined that the wildlife habitat functions of these wetland and open water habitats have been degraded from past disturbance, including cattle grazing and the placement of fill.

Noise generated during construction could cause short-term impacts on wildlife that may be present in the area. Pile driving and dredging would take last approximately 270 days. Wildlife species exhibit different hearing ranges, and all wildlife do not respond the same way to similar sound source levels. Wildlife response to sound depends on a number of factors including, but not limited to, ambient noise levels; construction noise levels, frequency, distance, and duration; and weather and atmospheric conditions. Construction noise may not affect some wildlife species, but others may be sensitive to noise, forcing individuals to move out of the construction area and expend more energy finding replacement habitat. This disruption of normal behavioral patterns could lead to reduced feeding, increased risk of predation, delayed reproduction, and increased juvenile mortality. Increased lighting and vehicular traffic associated with Project construction could result in animal displacement, including the avoidance or abandonment of an area. The level of displacement is dependent on the sensitivity of the species, the surrounding topography, and the surrounding vegetation types. Most of these impacts would last only the duration of construction; however, there would be some displacement associated with permanent habitat loss.

An accidental spill or release of hazardous materials (e.g., fuels) during construction could potentially come into contact with wildlife, leading to injury or acute toxic effects. However, the potential impacts from accidental hazardous materials spills and releases would be avoided or minimized through the implementation of measures in the SPCC Plan.

Terminal Facilities – Operations Impacts

Operation of the LNG facility would result in increased noise, lighting, and human activity that could disturb wildlife in the area. The potential disturbance to wildlife would be similar as those described for construction. However, due to the heavy ship traffic and other industrial uses along the Calcasieu River Ship Channel, most wildlife in the area are acclimated to the noise and artificial lighting associated with these activities. Therefore, it is anticipated that operational impacts on wildlife would be minimal. See section 4.6.1.3 for further discussion of lighting at the facility and potential impacts on migratory birds.

To minimize project-related impacts on wildlife, Venture Global Calcasieu Pass would implement its Project-specific Plan and Procedures, as well as an SPCC Plan for materials regulated by the EPA. In addition, the USACE New Orleans District would require compensatory mitigation for wetland impacts that cannot be avoided (see section 4.4.4). Therefore, we conclude construction and operation of the proposed LNG facility would not have significant long-term impacts on wildlife species due to the degraded wildlife habitat value provided by the site and the proposed mitigation for wetland impacts.

Pipeline – Construction Impacts

Construction of the Pipeline and associated appurtenances (e.g., contractor yards, ATWS, access roads, and aboveground facilities) would require approximately 371 acres of land (see table 4.8.2.1-2). No forested lands would be affected by the Pipeline facilities, and some wetlands and surface waters would be avoided with HDD (see sections 4.3 and 4.4).

The Pipeline, ATWS, access roads, and contractor yards would temporarily impact 228.6 acres of wildlife habitat, including 17.6 acres of agricultural/pasture land, 26.2 acres of herbaceous land, 10.8 acres of open water, 173 acres of wetland, and 1.0 acre of shrub/scrub. Approximately 92 percent of this temporary impact is from the Pipeline and ATWS. TransCameron Pipeline would restore these areas in accordance with its Project-specific Plan and Procedures. Approximately 5.9 acres of lands temporarily affected by pipeline construction include barren land and developed land, which are not anticipated to provide significant wildlife habitat value.

The Pipeline and associated aboveground facilities and access roads would permanently impact 132.4 acres of wildlife habitat, including 13.3 acres of agricultural/pasture land, 5.2 acres of herbaceous land, 4 acres of open water, 109.2 acres of wetland, and 0.7 acre of shrub/scrub. Approximately 99 percent (131.2 acres) of this permanent habitat impact is due to the permanent pipeline right-of-way, most of which would continue to be vegetated and periodically maintained after construction. Approximately 1 percent (1.2 acres) of the permanent habitat impact would be the conversion of vegetation to hardscape from placement of fill materials for the aboveground facilities and access roads; this includes 1.0 acre of wetland for aboveground facilities and 0.2 acre of wetland for access roads. Approximately 4.2 acres of lands permanently affected by pipeline construction include barren land and developed land, which are not anticipated to provide significant wildlife habitat value.

Following construction, temporarily disturbed areas would be restored and the permanent right-of-way maintained in accordance with the Project-specific Plan and Procedures; further, impacts on wetlands would require mitigation developed in consultation with the USACE as part of the section 404 permit process. The duration of impacts on wildlife habitat would depend on the rate at which vegetation regenerates immediately following pipeline construction. Herbaceous land and emergent wetland habitats would generally revegetate within 1 to 4 years after construction is completed. Open water habitat would revert to preconstruction conditions shortly after the completion of in-water work (see section 4.6.2.2 for further discussion of impacts on aquatic resources). Because the 131.2 acres of permanent right-of-way within wildlife habitat consists of agricultural/pasture land, herbaceous land, open water, emergent wetlands, and shrub/scrub land, these lands would be allowed to revert to preconstruction conditions, and maintenance of this permanent right-of-way would not significantly alter the vegetative cover type of these habitats. As a result, no long-term impacts on habitat and wildlife that use those habitats are anticipated along the Pipeline.

Impacts on wildlife during pipeline facilities construction would generally be similar to the impacts described for the Terminal facility. Construction noise, use of construction equipment, and other human activity could impact wildlife. While these impacts would be short-term, they could cause displacement, stress, and direct mortality of some individuals. However, we conclude these impacts on wildlife would not be significant as there is an abundance of similar habitat adjacent to the Pipeline.

Pipeline Facilities – Operations Impacts

Operations-related impacts on wildlife would primarily include periodic noise associated with maintenance vehicles and human activity. These potential impacts on wildlife would be similar to what is described for construction (but at a much smaller scale) and could cause displacement, stress, and direct mortality of some individuals. However, these operational impacts would occur only periodically and on a much more localized basis. Therefore, we conclude that impacts on wildlife from operation of the Pipeline would not be significant.

4.6.1.3 Unique and Sensitive Wildlife Resources

Unique or sensitive wildlife resources, such as migratory birds, colonial waterbird nesting areas, and managed wildlife areas, may be present in the vicinity of the proposed Project and are discussed below. State and federally listed endangered, threatened, and other special status species are discussed in section 4.7.

Migratory Birds

Migratory bird species nest in the United States and Canada during the summer months 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 Migratory Bird Treaty Act (MBTA) and bald and golden eagles are additionally protected under the Bald and Golden Eagle Protection Act. The MBTA prohibits the take or killing of individual migratory birds, their eggs and chicks, and active nests. The MBTA provides that it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg of any such bird. Executive Order 13186 (January 2001) directs federal agencies to consider the effects of agency actions on migratory birds and determine 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 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. During scoping the FWS and the public expressed concern with potential Project impacts on migratory birds.

On March 30, 2011, the FWS and the Commission entered into an MOU 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, Bald and Golden Eagle Protection Act, ESA, Federal Power Act, NGA, or any other statute and does not authorize the take of 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 areas in the north to winter along the Gulf Coast and remain throughout the non-breeding season. The proposed Project is within the Mississippi Flyway and along the eastern edge of the Central Flyway. The Central and Mississippi Flyways both terminate at the Gulf Coast, making it one of the most important waterfowl areas in North America. Of the 650 species of birds known to occur in the United States, nearly 400 species occur along the Gulf Coast (Esslinger and Wilson, 2003). The Gulf Coast provides wintering and migration habitat for significant numbers of continental duck and goose populations. The coastal marshes of Louisiana, Alabama, and Mississippi regularly hold half of the wintering duck population of the Mississippi Flyway (Esslinger and Wilson, 2003).

In order to accurately identify bird species with the greatest conservation priority, the FWS Migratory Bird Office issued a report describing the Birds of Conservation Concern (FWS, 2008). The report identifies priority bird species at the national, regional, and Bird Conservation Region levels. The Project is within Bird Conservation Region 37 – Gulf Coastal Prairie. The Gulf Coastal Prairie is composed of the flat grasslands and marshes that hug the coast of the Gulf of Mexico from northern Tamaulipas across the mouth of the Rio Grande through southeastern Texas and SWLA to the mouth of the Mississippi River. This Bird Conservation Region features one of the greatest concentrations of colonial waterbirds in the world and provides critical in-transient habitat for migrating shorebirds (FWS, 2008). Table 4.6.1.3-1 identifies the forty Birds of Conservation Concern species that have been documented or are cited as probable to occur in the vicinity of the proposed Project.

Although nesting bald eagles are not known to occur in the Project area, Venture Global has committed to following the National Bald Eagle Management Guidelines. Bald eagles nest in Louisiana from October through mid-May. As the Project area does not have nesting habitat (e.g., lacks trees or any structures in which bald eagle would typically nest), impacts on bald eagles are not anticipated.

TABLE 4.6.1.3-1

BIRDS OF CONSERVATION CONCERN WITHIN BIRD CONSERVATION REGION 37

Bald eagle *(Haliaeetus leucocephalus)*	Red-headed woodpecker *(Melanerpes erythrocephalus)*	Snowy plover *(Charadrius alexandrines)*
Brown-headed nuthatch *(Sitta pusilla)*	Swainson’s warbler *(Limnothlypis swainsonii)*	Whimbrel *(Numenius phaeopus)*
Dickcissel *(Spiza Americana)*	Swallow-tailed kite *(Elanoides forficatus)*	Wilson’s plover *(Charadrius wilsonia)*
Fox sparrow *(Passerella illiaca)*	Rusty blackbird *(Euphagus carolinus)*	American bittern *(Botaurus lentiginosus)*
Henslow’s sparrow *(Ammodramus henslowii)*	American oystercatcher *(Haematopus palliates)*	Black rail *(Laterallus jamaicensis)*
LeConte’s sparrow *(Ammodramus leconteii)*	Worm-eating warbler *(Helmitheros vermivorum)*	Black skimmer *(Rynchops niger)*
Loggerhead shrike *(Lanius ludovicianus)*	Magnificent frigatebird *(Fregata magnificens)*	Gull-billed tern *(Gelochelidon nilotica)*
Mississippi kite *(Ictinia mississippiensis)*	Hudsonian godwit *(Limosa haemastica)*	Least bittern *(Ixobrychus exilis)*
Nelson’s sparrow *(Ammodramus nelson)*	Marbled godwit *(Limosa fedoa)*	Least tern *(Sterna antillarum)*
Painted bunting *(Passerina ciris)*	Lesser yellowlegs *(Tringa flavipes)*	Sandwich tern *(Thalasseus sandvicensis)*
Peregrine falcon *(Falco peregrinus)*	Long-billed curlew *(Numenius americanus)*	Yellow rail *(Coturnicops noveboracensis)*
Prothonotary warbler *(Protonotaria citrea)*	Red knot *(Calidris canutus rufa)*	Short-eared owl *(Asio flammeus)*
Seaside sparrow *(Ammodramus maritimus)*	Reddish egret *(Egretta rufescens)*	Short-billed dowitcher *(Limnodromus griseus)*
Sedge wren *(Cistothorus platensis)*		

Source: FWS, 2015a.

Important Bird Areas

The Important Bird Area (IBA) program is a nationwide Audubon program that identifies habitats that are essential in sustaining bird populations.[17] IBA sites include migratory staging areas, winter roost sites, and prime breeding areas for songbirds, wading birds, and other species. The Project is proposed entirely within the Chenier Plain IBA, one of Louisiana's largest IBAs at over 2.3 million acres. The extensive open water and marshes in this IBA are home to over 360 species of birds, including ducks, egrets, geese, raptors, wading birds, and shorebirds. It also serves as a stopover area for many of the transient birds that overwinter in Central and South America (National Audubon Society, 2013).

Large portions of this IBA are treeless, consisting of nearly 50 percent open water and 50 percent emergent herbaceous wetlands, including salt, brackish, intermediate, and freshwater marsh. The marshland makes this IBA a prime place for ducks, other waterfowl, wading birds, and shorebirds because of the emerged and submerged vegetation that the marsh produces. Northern harriers and red-tailed hawks are also abundant in the marshes through the winter. Agricultural croplands may provide feeding habitat for waterfowl (National Audubon Society, 2013).

A small but disproportionately important feature of this IBA is the Louisiana Chenier Plain. Cheniers are beach ridges vegetated by coastal oak woodlands, which provide important stopover habitat for neotropical migratory birds. These are the first lands that migratory birds see after a journey of more than 500 miles across the Gulf of Mexico (National Audubon Society, 2013). Cheniers attract thousands of trans-Gulf migrant birds during their peak migratory months of April to May and August through October (USACE, 2010b).

Remnant forests present on cheniers – coastal live oak-hackberry forest – are ranked by the LNHP as imperiled or critically imperiled because they are vulnerable to extirpation. Cheniers have been greatly impacted because these features are slightly above the level of the surrounding wetland and are the only inhabitable land for people in these areas. As a result, many of the cheniers have been cleared of vegetation for home sites, linear transportation projects, and commercial properties or have been drastically altered by livestock grazing (LDNR, 2009). LNHP data (2015) shows mapped coastal live oak-hackberry forest natural community along the Pipeline between approximately MPs 22.5 and 23.0, and in an area within the Terminal site. This habitat has been previously disturbed by the development and maintenance of pipelines, roads, and utilities, which threatened this type of natural community through habitat fragmentation. Based on environmental surveys conducted at the Terminal site and along the pipeline route in 2014 and 2015, the coastal live oak-hackberry forest area recorded by LNHP no longer exists or has been severely degraded, having been previously cleared to support cattle grazing. In addition to the cattle use, observations during surveys suggest that the habitat has been affected by storms and hurricanes, based on the presence of downed trees with intact root systems.

Impacts and Mitigation

The vegetative communities in the Project area provide potential habitat for migratory bird species, including songbirds, waterbirds, and raptors. Construction of the Terminal facility and Pipeline facilities would permanently and temporarily impact wildlife habitat areas as previously described. Much of the habitat associated with the Terminal site is previously disturbed by cattle grazing and past fill activities that reduce nesting habitat value. However, the undisturbed areas associated with the Terminal site contain

[17] The IBA program carries no regulatory authority. Identification of a site as an IBA imposes no legal restrictions or management requirements on any property, public or private. The intent is to recognize areas that are essential for bird populations.

higher quality nesting habitat that would be more attractive to breeding bird species. Much of the habitat along the Pipeline consists of wetlands, which provide habitat for waterfowl and other migratory birds.

During scoping and in several letters and email correspondence regarding the Project, the FWS and LDNR expressed a general concern with impacts on cheniers because of their importance to migratory birds. The FWS also commented that the Terminal site and proposed Pipeline route appear to contain back dune scrub/shrub areas and coastal chenier ridges, which are considered to be the most important habitat for many neotropical migrant songbirds during fall and spring seasons. Because of the high importance attributed to chenier habitat for migratory birds, and because this habitat is considered to be in high decline, the FWS has requested that impacts on migratory birds be thoroughly assessed and mitigated (FWS, 2014). To address potential impacts on these sensitive resources, TransCameron Pipeline identified the location of chenier ridges that would be crossed by the proposed Project using desk-top evaluation and field studies. Potential chenier ridge habitat was identified at MP 21.3, 22.3, 22.6, and from 22.9 to 23.0 of the Pipeline route. Further, LDNR chenier GIS data that map locations where cheniers may be present were used to estimate potential impacts on cheniers along the Pipeline. Based on this data, construction would temporarily impact approximately 3.6 acres of chenier habitat along the Pipeline (table 4.6.1.3-2); no proposed aboveground facilities are located on mapped cheniers. However, these cheniers are significantly degraded and consist of grazing/hay lands, lacking the coastal oak woodlands or shrub habitats which are considered to be the most important habitat for many migratory birds.

TABLE 4.6.1.3-2

SUMMARY OF IMPACTS ON LOUISIANA DEPARTMENT OF NATURAL RESOURCES-MAPPED CHENIERS FOR PIPELINE FACILITIES

Milepost From-To	Habitat Type [a]	Area of Impact (acres)	Type of Impact	Pipeline Length at Centerline (feet)	Pipeline Width at Centerline (feet)
6.3-6.4	Grazing and hay land	1.3	Temporary	486	110
7.9-8.0	Grazing and hay land	0.6	Temporary	142	110
14.1-14.1	Grazing and hay land	0.3	Temporary	151	110
14.2-14.2	Grazing and hay land	0.1	Temporary	99	110
21.2-21.2	Grazing and hay land	0.4	Temporary	98	110
21.2-21.3	Grazing and hay land	0.6	Temporary	179	110
21.3-22.3	Grazing and hay land	0.5[b]	Temporary	460	110
22.3-22.3	Grazing and hay land	0.3	Temporary	136	110
	TOTAL	**3.6**			

Source: LDNR, 2009.

a The cheniers are primarily agricultural lands used for cattle grazing or hay field; no chenier oak-hackberry habitat is present along the pipeline right-of-way.

b Impacts avoided by horizontal directional drill installation of the pipeline segment and area not included in impact total.

Other impacts on migratory birds and their habitats due to construction and operation of the Project would be similar to impacts described for wildlife resources (see section 4.6.1.2). Additionally, birds could be affected by flaring and lighting at the liquefaction terminal. Flaring would be required during initial startup of the facility and occasionally during operations. The FWS has not raised flaring as an issue of concern in the project area but there are incidents reported nationally where flares attract and can prove fatal to birds. We believe that the temporary flaring during construction and occasional flaring during operation would not represent a significant impact on migratory birds passing through the area. Artificial lighting can hide natural light sources. Fatalities to avian species due to artificial lighting are well documented. 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 proposed LNG facility would require adequate lighting for operations and safety. Venture Global Calcasieu Pass has developed a Facility Lighting Plan that includes mitigation measures for light pollution, including the use of diffusers, lenses, and shields to reduce glare and light pollution, and to focus light distribution on the LNG loading dock platforms, perimeter fence, and working areas inside the Terminal's perimeter berm.

As previously mentioned, migratory bird habitat occurs at the Terminal site and along the Pipeline and would be permanently and temporarily impacted. However, much of the permanent habitat impacts are associated with the Terminal site, which has been previously disturbed with reduced nesting habitat value. Most of the migratory bird habitat along the Pipeline (mostly herbaceous wetlands) would be temporarily impacted and restored after construction. In addition, any permanently impacted wetlands at the Terminal site or along the Pipeline would be mitigated through wetland creation/restoration at CPNWR's East Cove Unit. Therefore, we conclude that impacts on migratory birds would not be significant. To further mitigate impacts, at the Terminal site, and where practicable along the Pipeline route, Venture Global would conduct clearing outside the migratory bird nesting window of March 1 to September 15. Where clearing cannot occur outside of the nesting window, Venture Global proposes to conduct a survey for nests prior to construction; if active nests are detected, they would be avoided until young have fledged.

Colonial Waterbird Nesting Areas

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 the nesting season, and 2) they obtain all or most of their food from the water (FWS, 2002). Colonial waterbirds demonstrate nest fidelity, meaning that 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 will nest in developed areas (e.g., least terns), many waterbirds are wary of human activity (e.g., great blue heron and great egrets).

During scoping the LDFW and FWS expressed concern with potential Project impacts on colonial nesting birds. The LDWF indicated that bird nesting colonies occur within the Project area (LDWF, 2015a). Potential impacts on colonial waterbirds and their habitats due to construction and operation of the Project would be similar to impacts described for wildlife resources (see section 4.6.1.2). LDWF prohibits entry into or disturbance of active breeding colonies, as well as work within a certain radius of active nesting colonies. Because nesting colonies may move from year to year, LDWF requested field surveys by a qualified biologist no more than 2 weeks prior to the commencement of construction, should construction occur during the nesting season. LDWF further has established seasonal restrictions on activity within 300 meters for colonies containing wading birds to outside the nesting season for wading birds (September 1 to February 15), 400 meters for colonies containing gulls, turns, and/or black skimmers, and 700 meters for brown pelicans to outside the nesting season for those species (September 16 to April 1). The FWS also recommends a qualified biologist inspect the proposed work areas within jurisdictional wetlands during the nesting season for the presence of undocumented rookeries, and further would require that any activity within 1,000 feet of a colony containing wading birds, anhingas, and/or cormorants be restricted to the non-nesting period (FWS, 2014). The FWS has established non-nesting periods for various colonial waterbirds, starting on July 1, August 1, or September 1, and ending on February 15, March 1, March 15, or April 1, depending on the bird species (FWS, 2015b).

To ensure that active nesting colonies are not disturbed by construction activities, **we recommend that:**

- **<u>Prior to construction,</u> Venture Global should conduct nesting bird colony surveys within the appropriate buffer area. Before the initiation of surveys, Venture Global should consult with the LDWF and FWS for appropriate survey methods, timeframes, and locations. The survey reports, any LDWF or FWS comments on the surveys, and Venture Global's proposed mitigation measures should be filed with the Secretary. Venture Global must receive written approval from the Director of OEP before construction or implementation of any mitigation measures may proceed.**

With this recommendation and the implementation of the measures recommended by the FWS and LDWF, we conclude that impacts on colonial waterbirds would be minimized and not significant.

Species of Concern

Based on consultations with the LDWF, the following wildlife species of concern were identified as potentially occurring in the Project area: piping plover (*Charadrius melodus*), Wilson's plover (*Charadrius wilsonia*), snowy plover (*Charadrius alexandrinus*), and diamondback terrapin (*Malaclemys terrapin*). Piping plover is a federally and state-listed threatened species and is therefore discussed in section 4.7.

The Wilson's plover is considered critically imperiled for nonbreeding populations (S1N) and imperiled for breeding populations (S2B). It is found year round in Louisiana, breeding along the Gulf of Mexico coast and wintering mostly in northeastern Florida but also from central Florida west to Texas, then south through northern South America. Wilson's plover has a breeding season that begins in late March and extends into August. Its habitat includes coastal areas that are saline and thinly vegetated including salt flats, coastal lagoons, beaches, and sand dunes. Nests are chosen by males close to debris for wind obstruction, though not commonly in vegetated areas. Threats to this species include habitat loss and disturbance as a result of beachfront expansion; nesting area disturbance and trampling by humans, animals and vehicles; and coastal land loss (LDWF, 2015b).

The snowy plover is considered critically imperiled for breeding populations (S1B) and imperiled for nonbreeding populations (S2N). It is found year round in Louisiana, breeding along the Gulf of Mexico coast and is a relatively rare migrant and winter resident along the coast of Louisiana. Snowy plovers have a breeding season that begins in late March and extends into August. Nests are created in loose colonies on open beaches and are commonly depressions scraped into the sand and lined with material such as pebbles, vegetation, or shell fragments. Winter habitat is mostly on dry sandy or shell beaches, above the high tide mark, and along the coast or on barrier islands. Threats to this species include destruction of eggs and nests by humans, vehicles or horses; entanglement in discarded fishing line; habitat degradation or abandonment as a result of the expansion of beachfront development and recreation; and habitat loss due to coastal land loss and erosion (LDWF, 2015c; LDWF, 2015a).

LDWF data identifies snowy and Wilson's plovers as occurring just south of the Terminal site. The project would not impact sandy beaches, which are the habitat preferred by these species. Construction-related impacts would primarily be limited to temporary displacement due to noise in the vicinity of active construction on the southern portions of the Terminal facility, including pile driving which would last about 270 days. This impact would be similar to the noise impacts described previously for wildlife and migratory birds. These species are mobile, and would likely avoid areas of ongoing construction activity. Operation of the LNG facility would result in increased noise, lighting, and human activity that could disturb wildlife in the area. These impacts would be similar to the operations impacts described previously for wildlife and migratory birds. However, due to the heavy ship traffic and other industrial uses along the Calcasieu River Ship Channel, most wildlife in the area are acclimated to the noise and artificial lighting associated with these activities, and it is anticipated that any potential impacts that would occur during operation would be negligible.

The diamondback terrapin is considered a rare species (S3) (LDWF, 2016b). LDWF data has not identified any known occurrences of diamond back terrapin in the Project area, but potential habitat occurs in the Terminal and Pipeline Project area. The species is restricted to saline or brackish habitats, favoring seagrass beds, marshes and estuaries (especially those bordered by mangroves). In Louisiana, barrier island marshes and seagrass beds on the bayside of the islands are important areas for the species. They nest from April to May with nest cavities dug at the sandy edges of marshes and dunes. Threats to the species include poor water quality, human disturbance to nesting areas, loss of populations by crab traps, altered or lost habitat due to dredging and siltation, and coastal land loss (LDWF, Undated). Construction impacts would include permanent loss of brackish wetland habitats at the Terminal site; however, mitigation would be required to mitigate this impact under section 404 of the CWA. Construction-related noise impacts could also temporarily displace individuals that may be in the Project area due to active construction; this impact would be similar to the noise impacts described previously for wildlife and migratory birds. Operation of the LNG facility would result in increased noise, lighting, and human activity that could disturb wildlife in the area; these impacts would be similar to the operations impacts described previously for wildlife and migratory birds. However, due to the heavy ship traffic and other industrial uses along the Calcasieu River Ship Channel, most wildlife in the area are acclimated to the noise and artificial lighting associated with these activities, and it is anticipated that any potential impacts that would occur during operation would be negligible. Due to the potential for impacts on diamondback terrapin, **we recommend that:**

- **<u>Prior to the end of the draft EIS comment period</u>, Venture Global should file with the Secretary its plan to conduct surveys for state-designated rare wildlife species, including the diamondback terrapin, correspondence with the LDWF, and any mitigation measures Venture Global would implement.**

Managed Wildlife Areas

No managed wildlife areas would be directly affected by the proposed Pipeline or Terminal facilities. However, there are several managed wildlife areas in the vicinity of the Project, including the CPNWR where Venture Global has proposed wetland mitigation to compensate for the proposed Pipeline and Terminal wetland impacts. More information on this proposed wetland mitigation is provided below.

The 40-acre Peveto Woods Sanctuary, maintained by the Baton Rouge Audubon Society, is approximately 1.5 miles west of the proposed Terminal site. The site was the first chenier sanctuary for migratory birds established in Louisiana. The sanctuary provides critical migratory stopover habitat for birds, butterflies and other wildlife with special emphasis on neotropical migrants. It is used by as many as 2 million birds each year, as well as the migratory Monarch butterfly (Baton Rouge Audubon Society, 2010).

Three National Wildlife Refuges (NWRs) are in the vicinity of the Project in Cameron Parish: the Sabine NWR, the Cameron Prairie NWR, and the Lacassine NWR. The NWR system is a network of habitats managed by the FWS for the benefit of wildlife, outdoor recreational opportunities, and environmental protection.

The Sabine NWR is approximately 6 miles northwest of the proposed Terminal facilities. It was established in 1937 to provide habitat for migratory waterfowl and other birds. The refuge consists of a basin of wetlands between the Gulf of Mexico's chenier ridges and the coastal prairie. It is the largest coastal marsh refuge on the Gulf of Mexico, encompassing a total of 124,511 acres of fresh, intermediate, and brackish marshes. In addition to providing habitat for over 300 species of birds, it is one of the largest estuarine-dependent marine species nurseries in SWLA (FWS, 2012).

The Lacassine NWR is more than 10 miles northeast of the proposed Pipeline and 24 miles northeast of the Terminal site. It is a 35,000-acre refuge consisting primarily of freshwater marsh habitat. The refuge preserves a major wintering site for waterfowl in the United States, particularly providing key habitat within Lacassine Pool for wintering pintails (FWS, 2009a).

The Cameron Prairie NWR is approximately 0.6 mile north of the proposed Pipeline and 3 miles northeast of the Terminal site. It was established to preserve and protect wintering waterfowl and their habitat and was the first refuge established under the North American Waterfowl Management Plan. It contains 9,621 acres of fresh marsh, coastal prairie, and old rice fields. It is at the convergence of two major flyways, and provides important habitat for migratory birds (FWS, 2009b). Venture Global's proposed wetland mitigation plan includes wetland creation/restoration at Cameron Prairie NWR's East Cove Unit (Venture Global LNG, 2017). This mitigation will be primarily for project impacts on tidal wetlands, tidal mudflats, and waters (both tidal and non-tidal). Part of the mitigation plan includes utilizing sediments dredged from the Calcasieu River Ship Channel during Terminal construction as part of the creation/restoration effort. Venture Global Calcasieu Pass would transport approximately 716,000 yd^3 of dredged material to the Cameron Prairie NWR to create/restore 136.4 acres of marshland.

Impacts on wildlife using nearby managed wildlife areas in the region would be limited to disturbance from increased noise during construction activities. Due to the distance between the Project facilities and these refuges, noise is likely to have an impact only on wildlife using the Cameron Prairie NWR. These impacts would be temporary, and sufficient suitable habitat in the region is available for wildlife displaced by noise impacts. Proposed wetland mitigation at the Cameron Prairie NWR would result in short-term and temporary noise impacts on wildlife that may be present in the area during mitigation construction. In the short term, mitigation construction would impact wetland habitat during wetland restoration activities and upland habitat for wetland creation activities, but there would be a long-term beneficial impact on the habitat and wildlife that utilize wetland habitats.

4.6.2 Aquatic Resources

4.6.2.1 Terminal Facilities

Existing Aquatic Resources

Of the waterbodies impacted by LNG Terminal construction and operation, the Calcasieu River Ship Channel, adjacent nearshore habitats in the Gulf of Mexico and one perennial ditch within the onshore portion of the Terminal footprint are likely to provide year-round habitat for aquatic species. The remaining waterbodies (i.e., ponds/borrow pits, roadside ditch) are unlikely to provide suitable habitat for aquatic species because they are intermittent and only wetted during and after periods of rainfall.

The Calcasieu River Ship Channel is an intertidal estuary located at the mixing zone between freshwater inflow from the Calcasieu River and tributaries and the nearshore Gulf of Mexico. The portion of the Calcasieu River Ship Channel in the vicinity of the proposed berthing docks and turning basin is periodically dredged to maintain a depth of 40 feet. The bed substrates are composed mainly of unconsolidated sand and silt. Unconsolidated sediment provides foraging habitat for benthic organisms and demersal fish. Substrates within the Calcasieu River Ship Channel are expected to support an early successional benthic community due to the routine dredging conducted in the channel, as well as disturbances from regular vessel traffic. One perennial ditch, WB001, on the proposed facility site has the potential to provide habitat for fish. WB001 is a channelized ditch with portions dug within wetlands and portions dug within uplands. The ditch once provided direct access to the Gulf of Mexico for a former biological fishery research center near the northern perimeter of the Terminal site. It appears that it has not been excavated in some time and has been intermittently disturbed by cattle. The ditch has an ordinary high water mark height of approximately 2 feet and width of approximately 8 feet. The northern end of WB001 connects to a roadside ditch and receives runoff from road pavement, as well as the adjacent wetlands. The southern end of WB001 terminates in a wetland area and does not reach the beach or shore; however, water from the Gulf of Mexico could flood the ditch during significant high tide storm events.

In addition to the stream features that may provide habitat for aquatic species, the Terminal site contains salt marsh and brackish marsh community types. These wetlands may provide nursery and foraging habitats supportive of a variety of economically important marine fish species, including striped mullet, Atlantic croaker, Gulf menhaden, spotted seatrout, sand seatrout, southern flounder, striped bass, blue crab, shrimp, and oysters (LDWF, 2014b; LDWF, 2014c; NMFS, 2015a). Some of these species serve as prey for other fish species managed under the Magnuson-Stevens Act by the Gulf of Mexico Fishery Management Council (GMFMC) and highly migratory species managed by the NMFS. These wetlands also produce and export nutrients and organic material, important components of the aquatic food web, which contribute to the overall productivity of the Calcasieu Lake estuary and nearshore Gulf of Mexico (EPA, 1999). The NMFS in their scoping comments also emphasized the importance of these wetlands as important habitat for aquatic species and fisheries in the project area.

The nearshore zone of the Gulf of Mexico extends from the shoreline offshore to the 60-foot (18-meter) isobath (GMFMC, 2004). Adjacent to the Project area this zone extends offshore for at least 40 miles (65 kilometers) onto the Texas-Louisiana Shelf, an extensive segment of the continental shelf characterized by relatively shallow water depths and bottom sediments dominated by unconsolidated silt and mud deposited over calcareous banks and salt domes (GMFMC, 2004). This portion of the nearshore zone provides habitat for a variety of fish, marine mammals, marine reptiles, and other aquatic organisms. Several of these fish and shrimp species support economically important fisheries.

Fisheries

During scoping, NMFS requested the EIS include a fisheries resources section. Representative fish species found in the Project area are presented in table 4.6.2.1-1. All fishery habitats in the Project area support warmwater fisheries; no coldwater fisheries occur in the Project area.

The LDWF's Waterbody Management Plan for the Calcasieu River lists the following fish species as species of conservation concern (LDWF, 2014c):

- paddlefish (*Polyodon spathula*);
- western sand darter (*Ammocrypta clara*); and
- bigscale logperch (*Percina macrolepida*).

Both bigscale logperch and western sand darter are obligate freshwater species and are intolerant of brackish or estuarine habitat; therefore, these species do not occur in the Project vicinity and would not be affected by Project construction and operation. Although primarily a freshwater fish, paddlefish are salinity tolerant and are occasionally found in estuarine systems in Louisiana (Capello et al., 2005; Singer and Ballantyne, 2005). Paddlefish populations have declined over the last 100 years as a consequence of habitat alteration, harvest, and other factors and many remaining populations are vulnerable to extirpation (Auer, 2005). During standardized sampling events in the Calcasieu River from August 2002 to August

2014, LDWF collected a total of 17 paddlefish (LDWF, 2014c). The low numbers of paddlefish observed suggest that this local population is small and potentially vulnerable to additional habitat loss. Insufficient information is available about this population to determine the extent of estuarine habitat use so the potential impacts of the proposed Project are unclear.

Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), currently listed as threatened under the ESA, have been infrequently observed in estuarine and nearshore habitats in the Project vicinity. While the probability of this species being present is low, the likelihood of occurrence cannot be discounted. Gulf sturgeon is further discussed in section 4.7.

TABLE 4.6.2.1-1

REPRESENTATIVE FISH SPECIES POTENTIALLY OCCURRING IN THE VICINITY OF THE PROJECT AREA

Common Name	Scientific Name	Habitat
Shellfish		
Blue crab	*Callinectes sapidus*	Estuarine
Blue shrimp	*Litopenaeus setiferus*	Estuarine
Brown shrimp	*Farfantepenaeus aztecus*	Estuarine
Fish		
Alligator gar	*Atractosteus spatula*	Freshwater
Atlantic croaker	*Micropogonias undulates*	Estuarine
Atlanta sharpnose shark	*Rhizoprionodon terraenovae*	Marine
Atlantic spadefish	*Chaetodipterus faber*	Marine
Bay anchovy	*Anchoa mitchilli*	Estuarine
Blacktip shark	*Carcharhinus limbatus*	Marine
Blue catfish	*Ictalurus furcatus*	Freshwater
Channel catfish	*Ictalurus punctatus*	Freshwater
Grouper	*Mycteroperca* spp.	Marine
Gulf menhaden	*Brevoortia patronus*	Estuarine
Largemouth bass	*Micropterus salmoides*	Freshwater
Sand seatrout	*Cyonoscion arenarius*	Estuarine
Sheepshead	*Archosargus probatocephalus*	Marine
Southern flounder	*Paralichthys lethostigma*	Estuarine
Spanish mackerel	*Scomberomorus maculatus*	Marine
Spotted seatrout	*Cynoscion nebulosis*	Estuarine
Striped bass	*Morone saxatilis*	Estuarine
Striped mullet	*Mugil cephalus*	Estuarine
Sunfish	*Lepomis microlophus*	Freshwater
Red drum	*Sciaenops ocellatus*	Estuarine
Red snapper	*Lutjanus campechanus*	Marine
Vermillion snapper	*Rhomboplites aurorubens*	Marine

Sources: LDWF, 2014b; LDWF, 2014c; NMFS, 2015a.

The Magnuson-Stevens Act mandated the identification of EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 USC 1802(10)). In addition to their ecological significance, EFH areas are of high economic importance due to the dependence of recreational and commercial fisheries associated with them. EFH is further discussed in section 4.6.3, and recreational fishing is discussed in additional detail in sections 4.8.1.3 and 4.8.2.3.

Marine Mammals and Sea Turtles

As identified in table 4.6.2.1-2 below, the Gulf of Mexico is home to 29 species of marine mammals, which are protected by the federal government under the Marine Mammal Protection Act (MMPA). 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 U.S. Under the MMPA, a "take" is defined as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal" (16 USC 1362). State law extends additional protections to nine of these species. The majority of these marine mammal species are most commonly found in deep water habitats on the edge of the continental shelf and are unlikely to frequent the shallow coastal waters in the Project vicinity (table 4.6.2.1-2). There is potential for the bottlenose dolphin, Atlantic spotted dolphin, and West Indian manatee to occur in the Project vicinity. The West Indian manatee is also listed as a threatened species by the FWS and an endangered species by LDWF, and is addressed in section 4.7.

TABLE 4.6.2.1-2

MARINE MAMMALS OF THE GULF OF MEXICO

Common Name	Scientific Name	Likely to Occur in Project Vicinity?
Atlantic spinner dolphin	*Stenella clymene*	No
Atlantic spotted dolphin	*Stenella frontalis*	Yes
Blue whale [a, b]	*Balaenoptera musculus*	No
Bottlenose dolphin	*Tursiops truncatus*	Yes
Cuvier's beaked whale	*Ziphius cavirostris*	No
Densebeak whale	*Mesoplodon densirostris*	No
Dwarf sperm whale	*Kogia sima*	No
Eden's whale	*Balaenoptera edeni*	No
False killer whale [a]	*Pseudorca crassidens*	No
Finback whale [a, b]	*Balaenoptera physalus*	No
Fraser's dolphin	*Lagenodelphis hosei*	No
Gulf stream beaked whale	*Mesoplodon europaeus*	No
Humpback whale [a]	*Megaptera novaeangliae*	No
Killer whale [a]	*Orcinus orca*	No
Melon-headed whale	*Pepnocephala electra*	No
Minke whale	*Balaenoptera acutorostrata*	No
North Atlantic right whale [a]	*Eubalaena glacialis*	No
Pantropical spotted dolphin	*Stenella attenuate*	No
Pygmy killer whale	*Feresa attenuate*	No
Pygmy sperm whale	*Kogia breviceps*	No
Risso's dolphin	*Grampus griseus*	No
Rough-toothed dolphin	*Steno bredanensis*	No
Sei whale [a, b]	*Balaenoptera borealis*	No
Short-finned pilot whale	*Globicephala macrorhynchus*	No
Sowerby's beaked whale	*Mesoplodon bidens*	No
Sperm whale [a]	*Physeter microcephalus*	No
Spinner dolphin	*Stenella longirostris*	No
Striped dolphin	*Stenella coeruleoalba*	No
West Indian manatee [b, c]	*Trichechus manatus*	Yes

Source: Hammock and Schulz, 2015.
[a] Federally endangered species.
[b] State endangered species.
[c] Federally threatened species.

Five of the world's seven sea turtle species have been recorded in the Gulf of Mexico, including: green, hawksbill, Kemp's ridley, leatherback, and loggerhead. All five species are listed as threatened or endangered and are managed jointly by the FWS and NMFS. These species are also listed as threatened or endangered by LDWF. Threatened and endangered species are addressed in section 4.7.

Impacts and Mitigation

Potential impacts on aquatic resources during construction and operation of the facility include those associated with dredging and construction of the berthing docks (including pile installation) and turning basin, the permanent loss of acres of wetlands and waterbodies associated with the Terminal facilities, ballast water exchanges, inadvertent spills, ship traffic, and hydrostatic testing. During scoping a member of the public expressed concern with terminal liquefaction system's potential impact on aquatic resources, including fisheries, from potential discharge of warm water into the surface waters. However, operation of the liquefaction system is not anticipated to impact aquatic resources because it is a Closed System (i.e., minimal water withdrawal or discharge), and any waste water from the system would be treated prior to discharge (see Section 2.1.3). Therefore, operation of the Closed System would not affect fish species targeted by recreational or commercial fishing.

<u>Construction and Operation of Marine Facilities</u>

Construction of the LNG berthing area and turning basin at the Terminal site would require dredging/excavation of 94.1 acres, of which approximately 83.3 acres are tidal estuarine habitat. This includes approximately 17.4 acres of shoreline tidal wetlands, of which 14 acres would be permanently converted to deepwater estuarine habitat, while approximately 3.4 acres would be permanently filled through development of the marine berm. Dredging between the shoreline and the edge of the Calcasieu River Ship Channel would permanently alter the depth profile of 65.9 acres of shallow to deepwater habitat between the shoreline and the edge of the navigation channel; the increased water depth would continue to provide deepwater habitat after dredging is completed. Approximately 1 acre of this habitat would be permanently shaded by new overwater structures. Construction dredging would produce a turbidity plume that extends beyond the construction footprint, with the direction and size of the plume depending on tidal currents at the time of disturbance.

The impacts of Project construction on fish and other aquatic organisms would vary by species, depending on the ability of the affected species or life stage to avoid affected habitats and sensitivity to each type of impact. For example, some fish species are highly mobile and would avoid areas affected by dredging, underwater noise, and elevated turbidity and would only be temporarily displaced. In contrast, other small or sedentary fish species and/or larval life stages may not avoid exposure to certain impacts like underwater noise. Fish larvae and benthic organisms, such as mollusks and crustaceans, that are in the dredge footprint would likely be killed.

Dredging would also temporarily increase noise, turbidity, and suspended solids within the water column, which can adversely affect fish eggs and juvenile survival, benthic community diversity and health, foraging success, and suitability of spawning habitat. Additionally, sediments in the water column could be deposited on nearby substrates, burying aquatic macroinvertebrates (an important food source for many species of fish). Impacts on aquatic resources due to increased turbidity and suspended solid levels would vary by species; however, the aquatic resources within the Project area are likely accustomed to regular fluctuations in noise and turbidity levels from industrial activity and regular maintenance dredging within the Calcasieu River Ship Channel. Being a relatively enclosed area, turbidity would likely affect most of the ship channel. Further, Venture Global Calcasieu Pass would use a hydraulic dredge with a suction cutter head, which would minimize resuspension of sediments and the resulting increases in turbidity and suspended sediment levels. 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. This indicates that fish and benthic organisms within the impact area would likely recover quickly after construction and maintenance dredging related disturbance. On this basis, we conclude that impacts on aquatic resources from dredging would be localized, temporary, and minor.

Venture Global Calcasieu Pass proposes to use some of the dredge material as part of their wetland mitigation plan (Venture Global LNG, 2017), with the remainder of the dredged material proposed to be placed in a nearshore area about 2 miles southwest of the Terminal. Placement of the dredge material in this nearshore area would cause a short-term increase in turbidity, with effects to aquatic organisms similar to dredging-related turbidity impacts previously described. Benthic habitat and organisms would be covered from the placement of the dredge material. However, nearshore benthic habitat typically consists of fine sediments similar to the dredge material, and these fine sediments are routinely moved around by natural processes. The benthic ecosystem has evolved around those patterns of sediment movement and disturbance and would be expected to recover quickly after dredge material placement. The placement of this dredge material would also provide some benefit in the protection to the recently restored West Beach.

Project construction would also produce temporary impacts that extend beyond the permanent Project footprint. The piers, mooring dolphins and other in- and overwater structures associated with the Terminal would require the placement of steel piles ranging from 20 to 96 inches in diameter. The piles would be placed using a combination of vibratory and impact pile driving. Organisms within the pile driving footprint would be killed or permanently displaced. Pile driving would also produce underwater noise sufficient to injure and/or alter the behavior of fish and other aquatic organisms a considerable distance from the point of disturbance.

Studies have shown that the sound waves from pile driving may result in injury or trauma to fish, sea turtles, and other animals with gas-filled cavities, such as swim bladders, lungs, sinuses, and hearing structures (Popper, 2012). The intensity of the sound pressure levels produced during pile driving depends on a variety of factors such as type and size of the pile, the substrate into which the pile is being driven, the depth of water, and the type of pile-driving equipment being used. Pile-driving noise has also been found to result in temporary displacement of fish, though multiple exposures to sound may result in habituation (Mueller-Blenkle et al., 2010). Venture Global Calcasieu Pass proposes to install a combination of 96-, 48-, and 20-inch-diameter steel piles. The 20-inch-diameter piles would be installed using a vibratory pile driver; the larger piles would be installed using impact hammers. Venture Global Calcasieu Pass anticipates the following:

- approximately 4,800 pile strikes would be required to install each 96-inch pile (20) and 48-inch pile (153);
- the installation rate for the 96-inch or one 48-inch piles would be one per day;
- the total duration of pile driving on any given day would be approximately 2 hours (assuming one pile driven in eight 15-minute increments over the span of 4 hours);
- the impact hammer frequency would be approximately 40 strikes per minute, with an impulse duration of approximately 0.5 seconds per strike; and
- the duration for vibratory pile driving would be approximately 2 hours per pile, with the assumption that a minimum of one pile per day would be installed, and if conditions allowed, two piles could be installed in one day.

Typical underwater sound pressure levels produced by proposed pile type and installation method are summarized in table 4.6.2.1-3. Sound pressure is expressed using three different measurement units, peak decibels (dB_{PEAK}), root mean square decibels (dB_{RMS}), and the sound exposure level (dB SEL).

TABLE 4.6.2.1-3

TYPICAL UNDERWATER SOUND PRESSURE LEVELS PRODUCED BY PROPOSED PILE TYPES AND INSTALLATION METHODS

Pile Type/Installation Method	Average of Observed Sound Pressure Levels		
	Peak (dB_{PEAK})	dB_{RMS}	dB SEL
96-inch steel/impact hammer	220	205	195
48-inch steel/impact hammer	210	195	185
20-inch steel/vibratory hammer	174	160	160

Source: California Department of Transportation, 2009.

Sound pressure levels measured at a reference distance 10 meters from the source.

Units: dB_{RMS} = root mean square decibels re: 1 micropascal (1 μPa); dB_{PEAK} = peak decibels re: 1 μPa; dB SEL = single strike or vibratory duration sound exposure level re: 1 μPa^2/Sec

Fish exhibit behavioral effects from both vibratory and impact pile driving at a threshold sound level of 150 dB_{RMS}, while cetaceans and pinnipeds exhibit disturbance behaviors at 160 dB_{RMS}. Injury-level effects on fish and marine mammals can result from exposure to high-intensity sound from single pile strikes, expressed in dB_{PEAK} as well as cumulative exposure to extended vibratory pile driving or multiple impact pile strikes at lower intensity, expressed as the cumulative sound exposure level (SEL_{CUM}). SEL_{CUM} is a function of the single pile strike or set-duration vibratory dB SEL and the total number of pile strikes or the total duration of vibratory pile driving over the period of exposure. NMFS has defined a set of categorical injury thresholds for fish and marine mammals by species group and the type of injury. In the case of marine mammals, two categories of injury are defined, temporary and permanent threshold shifts. These refer to temporary loss of hearing ability, and permanent loss of or reduction in hearing ability, respectively. Disturbance and injury thresholds are summarized in table 4.6.2.1-4.

TABLE 4.6.2.1-4

UNDERWATER NOISE DISTURBANCE AND INJURY THRESHOLDS FOR FISH, MARINE MAMMALS, AND MARINE TURTLES LIKELY TO OCCUR IN THE PROJECT VICINITY

Functional Hearing Group	Pile Driving Noise Source	Disturbance [a,b]	Barotrauma Injury [c]	Hearing Injury – Temporary Threshold Shift [d]	Hearing Injury – Permanent Threshold Shift [d]
	Impact – single strike		206 dB_{PEAK}		
Fish <2 grams	Vibratory – cumulative	150 dB_{RMS}	183 dB SEL	N/A	N/A
	Impact – cumulative				
	Impact – single strike		206 dB_{PEAK}		
Fish >2 grams	Vibratory – cumulative	150 dB_{RMS}	187 dB SEL	N/A	N/A
	Impact – cumulative				
	Impact – single strike			213 dB_{PEAK}	219 dB_{PEAK}
Low-frequency cetaceans	Vibratory – cumulative	160 dB_{RMS}	N/A	179 dB SEL	199 dB SEL
	Impact – cumulative			168 dB SEL	183 dB SEL
	Impact – single strike			224 dB_{PEAK}	230 dB_{PEAK}
Mid-frequency cetaceans	Vibratory – cumulative	160 dB_{RMS}	N/A	178 dB SEL	198 dB SEL
	Impact – cumulative			170 dB SEL	185 dB SEL
	Impact – single strike		207 dB_{PEAK}		
Marine turtles	Vibratory – cumulative	166 dB_{RMS}	210 dB SEL	N/A	N/A
	Impact – cumulative				

[a] Sources: Hastings, 2002; Southall et al., 2007.

[b] Source: Memorandum on the Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities (available: http://www.wsdot.wa.gov/Environment/Biology/BA#Noise).

[c] Source: Popper et al., 2014.

[d] Source: NMFS, 2016.

Units: dB_{RMS} = root mean square decibels re: 1 micropascal (1 µPa); dB_{PEAK} = peak decibels re: 1 µPa; dB SEL = single strike or vibratory duration sound exposure level re: 1 μPa^2/Sec

NMFS has provided guidance for calculation of the distance from the source required to attenuate sound pressure below these behavioral and injury level thresholds. Generally speaking, cumulative sound exposure is more relevant than peak sound exposure for the purpose of assessing impacts from pile driving projects. For example, the marine mammal species likely to occur in the nearshore zone of the Gulf of Mexico would have to be within 100 feet of construction to be injured by a single impact hammer strike or 1-second burst of vibratory pile driving associated with the Project, which is unlikely. However, construction of the Project would require thousands of individual pile strikes and/or several hours of continuous vibratory pile driving per day over several days of in-water construction. Calculation of SEL_{CUM} requires estimates of the duration of vibratory hammer operation or number of impact hammer strikes needed to install each type of pile, the number of each type of pile installed per day and the duration of the typical in-water work day. Based on Venture Global Calcasieu Pass' preliminary analysis, Project construction would result in underwater sound pressure levels exceeding the behavioral and injury-level effects thresholds for fish, marine mammals, and marine turtles extending potentially for several miles from the source.

The distances required to attenuate sound pressure levels below the respective behavioral and injury-level effects thresholds are summarized by species group in table 4.6.2.1-5. These threshold distances represent the likely maximum extent of potentially harmful underwater noise impacts for each species group from each type of pile driving. As shown, the proposed Project is likely to result in short-term impacts on fish, marine mammals and marine turtles occurring in the Project vicinity during the in-water construction period. Noise propagation would be constrained by the surrounding shoreline of the Calcasieu River Ship Channel where it opens into the Gulf of Mexico, meaning that the zone of noise effects would be restricted to the ship channel and a cone-shaped impact area a maximum of approximately 16 miles in width at the maximum threshold distance of 111 miles for temporary threshold shift impacts on low-frequency cetaceans. These distances are worst case scenarios and do not account for the underwater noise attenuation plan that would be developed and implemented in consultation with NMFS, FWS, and LDWF (see condition further below). This calculation is based on a simplistic noise propagation model that is likely to overestimate the full extent of noise impacts. In addition, the injury-level effect threshold distance calculations shown in table 4.6.2.1-5 assume that an individual subject would remain within this maximum SEL_{CUM} exposure area over an entire in-water work day, and therefore represent an improbable worst-case scenario for potential injury-level effects. The actual safe distance will vary depending on the sensitivity and the typical movement speed of each individual species and life stage in the affected habitat type and would probably be significantly less than the maximum threshold difference.

Venture Global Calcasieu Pass has indicated that it is considering noise attenuation measures to substantially reduce underwater sound pressure levels produced by pile driving. Examples of additional mitigation measures that could be developed include:

- use of bubble curtains around the pile;
- installation of temporary cofferdams;
- modification of pile impact frequency;
- implementation of soft starts that gradually increase the intensity of pile driving activities to allow aquatic life to leave the area;

- use of ramp-up procedures at the beginning of each pile installation or when a 15-minute or more delay has occurred; and

- placement of cushion blocks consisting of wood, nylon, or micarta between the pile and hammer.

Reducing the source noise level would in turn substantially reduce the extent of potential behavioral and injury level effects on aquatic species. In combination with appropriate monitoring and construction controls, these steps can effectively avoid and minimize potential adverse effects on fish and marine mammal species. The threshold distances presented in this analysis assume no noise attenuation would be used. The implementation of suitable noise attenuation measures are likely to significantly reduce the extent of potentially harmful underwater noise impacts.

Because Venture Global Calcasieu Pass has not committed to the specific mitigation measures that would be implemented to reduce the effects of pile driving noise, **we recommend that:**

- **<u>Prior to the end of the draft EIS comment period</u>, Venture Global Calcasieu Pass should file with the Secretary a plan to mitigate the effects of noise from pile driving activities in consultation with the NMFS, the FWS, and the LDWF.**

TABLE 4.6.2.1-5

THRESHOLD DISTANCES FOR UNDERWATER NOISE DISTURBANCE AND INJURY LEVEL EFFECTS ON FISH, MARINE MAMMALS, AND MARINE TURTLES LIKELY TO OCCUR IN THE PROJECT VICINITY

Functional Hearing Group	Pile Driving Noise Source	Disturbance [a,b]	Barotrauma Injury [c]	Hearing Injury – Temporary Threshold Shift [d]	Hearing Injury – Permanent Threshold Shift [d]
	Impact – single strike		0.05 mile		
Fish <2 grams	Vibratory – cumulative	28.8 miles	0.03 mile	N/A	N/A
	Impact – cumulative		6.2 miles		
	Impact – single strike		0.05 mile		
Fish >2 grams	Vibratory – cumulative	28.8 miles	0.03 mile	N/A	N/A
	Impact – cumulative		6.2 miles		
	Impact – single strike			0.02 mile	0.01 mile
Low-frequency cetaceans	Vibratory – cumulative	6.2 miles	N/A	0 miles (<100 feet)	0 miles (<100 feet)
	Impact – cumulative			111 miles	11.1 miles
	Impact – single strike			0 miles (<30 feet)	0 miles (<30 feet)
Mid-frequency cetaceans	Vibratory – cumulative	6.2 miles	N/A	0 miles (<100 feet)	0 miles (<100 feet)
	Impact – cumulative			4.0 miles	0.40 mile
	Impact – single strike		0.05 mile		
Marine turtles	Vibratory – cumulative	2.5 miles	0 miles (<100 feet)	N/A	N/A
	Impact – cumulative		0.18 mile		

[a] Based on Hastings, 2002; Southall et al., 2007.

[b] Based on Memorandum on the Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities (available: http://www.wsdot.wa.gov/Environment/Biology/BA#Noise).

[c] Based on Popper et al., 2014.

[d] Based on NMFS, 2016.

All values calculated using the Practical Spreading Loss Model, $L_{receiver} = L_{source} - 15 \log (R_{receiver}/R_{source})$

Over-water activities associated with installation of the berthing docks may cause avoidance of the area by mobile species due to noise and movement, but this impact would be minor and temporary. The berthing dock pilings would create aquatic habitat in the form of additional hard substrate areas, allowing for the growth of attached organisms. Over-water dock structures may also provide a source of refuge for some aquatic species.

Overall, we conclude that impacts on aquatic wildlife from construction of the berthing docks and turning basin would result in short-term impacts on aquatic organisms. In addition, we conclude that operation of the LNG Terminal and maintenance dredging (every 2 years) would result in minimal long-term impacts on aquatic organisms.

Site Construction

Construction and operation of the Terminal would permanently impact 2.6 acres of waterbodies identified on the site including the Calcasieu River Ship Channel, three manmade ditches, and five borrow pits. In addition, the expansion of an existing access road to the site (the Northeast Access Road) would temporarily impact 0.04 acre of Drainage District #3 Canal to replace an existing culvert. As described above, only one of the waterbodies (a perennial ditch) provides year-round habitat for aquatic resources; the remaining waterbodies provide limited habitat value due to restricted flow regimes. Because these features offer limited resources for aquatic resources, Project-related impacts would not be significant.

The loss of 187.3 acres of coastal marsh associated with the Terminal facilities (including the LNG facility, the Northeast Access Road, and the Construction Support Centers) may also result in a decrease in food and nutrient production for aquatic wildlife in the watershed. Venture Global would provide compensatory mitigation for this wetland loss in consultation with the USACE through the section 401 and 404 permitting processes. With compensatory wetland mitigation, we conclude that impacts on aquatic wildlife from construction of the LNG facilities would not be significant.

Ballast Water

The potential effects of ballast water on water quality are described in section 4.3.2.2. Resident species within the Calcasieu River Ship Channel are euryhaline (able to live in waters with a wide range of salinity) and are well adapted to natural spatiotemporal variation in salinity and oxygen levels. This adaptability and the ability to move over a short distance to more suitable conditions minimizes adverse impacts on aquatic resources associated with ballast water discharges.

U.S. 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 151.2025). Under these requirements, vessels must implement one of the following ballast management methods to prevent the spread of aquatic nuisance species in U.S. waters: 1) install a ballast water management system, 2) use only water from a U.S. public water system, 3) perform complete ballast exchange in an area 200 nm from any shore prior to discharging ballast water, unless the vessel is required to employ an approved ballast water management system per 151.2035(b), 4) do not discharge ballast, or 5) discharge ballast to a facility onshore or to another vessel for treatment. LNG vessels operating at the Terminal would discharge all ballast water in accordance with federal regulations. Since LNG vessels associated with the Project would load LNG for export, no ballast water withdrawal is proposed to occur at the Terminal.

With the implementation of the mandatory practices required by the USCG, we conclude that the impacts on aquatic resources from ballast water discharges associated with the Project would not be significant.

Inadvertent Spills

Aquatic resources could be adversely affected by an accidental spill or leak of hazardous materials into or near a waterbody. To minimize impacts on aquatic resources, Venture Global Calcasieu Pass would implement its SPCC Plan (see section 4.2.3). Implementation of the SPCC Plan would minimize the potential for releases to occur. Should a spill or leak occur, implementation of the response measures in the SPCC Plan would reduce response time and ensure appropriate cleanup, thereby minimizing impacts on aquatic resources. In addition, LNG carriers are required to develop and implement a Shipboard Oil Pollution Emergency Plan (SOPEP) which includes measures to be taken when an oil pollution incident has occurred or a ship is at risk of one.

Ship Traffic

Construction of the LNG Terminal would require 4,028 barge trips over the 35-month construction period. During operation of the Project, approximately 12 to 13 LNG carriers would call on the Terminal per month. Increases in ship traffic have the potential to increase shoreline erosion and suspended sediment concentrations due to increased wave activity. Because the barges and LNG carriers are typically slow moving vessels and would transit an existing, industrial channel created and maintained for the purposes of ship traffic, Project-related increases in shoreline erosion or suspended sediment concentrations within the Calcasieu River Ship Channel would not be significant.

Construction and operation of the Terminal, particularly the ship traffic, could impact marine mammals and reptiles, resulting in an increase in stress, injury, and/or mortality. The measures that Venture Global Calcasieu Pass would implement to minimize ship traffic impacts on marine mammals are described in section 4.7.1. Based on the modest increase in ship traffic over current conditions resulting from the construction and operation of the Terminal, the current commonality of such activities in the vicinity of the Terminal, and vessel strike avoidance measures that would be communicated by Venture Global Calcasieu Pass to LNG carriers (described in section 4.7.1), we have determined that impacts on marine mammals and turtles would not be significant.

Hydrostatic Testing

Prior to being placed into service, the LNG tanks would require hydrostatic testing. Hydrostatic test water would be withdrawn from the Calcasieu River Ship Channel. The water withdrawal process could entrain fish eggs and juvenile fish near the intake hose. Venture Global Calcasieu Pass would screen intake hoses at surface water intakes to eliminate or minimize the entrainment of fingerling and small fish during water withdrawal. Venture Global Calcasieu Pass would regulate the timing, rate, and volume of hydrostatic test water withdrawals to maintain ambient downstream flow in the waterbodies from which hydrostatic test water would be withdrawn.

Venture Global Calcasieu Pass has stated that it would not add chemicals to the test water before or after testing. After testing is completed, the hydrostatic test water would be discharged either on-site or directly into the Calcasieu River Ship Channel. On-site discharge would occur in well-vegetated uplands or upland areas using energy dissipation devices to regulate the discharge rate and minimize the potential for erosion, streambed scour, suspension of sediments, and excessive stream flow. Therefore, impacts on aquatic resources due to hydrostatic testing would be temporary and negligible.

4.6.2.2 Pipeline Facilities

Existing Aquatic Resources

The Pipeline includes 23.4 miles of 42-inch-diameter pipeline, ATWS areas, temporary and permanent access roads, one meter station, and three MLVs. Appendix F lists the waterbodies that would be crossed or affected by the Pipeline, as well as the proposed crossing method and water quality classification for each feature. All of the waterbodies that would be affected by the Pipeline are classified as warmwater fisheries. Of the 123 waterbodies crossed by pipeline construction workspace, TransCameron Pipeline identified 33 waterbodies as having the potential to provide fish habitat, as listed in table 4.6.2.2-1 below. The remaining waterbodies are classified as either intermittent, stock ponds, borrow pits, or ditches/canals, which typically provide limited value or marginal fishery habitat due to restricted water flow regimes and/or anthropogenic influences. TransCameron Pipelines' assessment of each waterbody's fish-bearing potential was based on a combination of field observations and a desktop review of available mapping to determine connectivity and flow path; surveys for fish were not conducted. Representative fish species expected to occur in these waterbodies are presented in table 4.6.2.1-1.

TABLE 4.6.2.2-1

POTENTIAL FISH-BEARING WATERBODIES CROSSED BY THE PROPOSED PIPELINE FACILITIES

Waterbody Name (Feature ID)	MP	Type	Crossing Method	Connection to Gulf of Mexico
Unnamed (WB032)	0.2	Perennial Ditch	HDD	Channelized path from Mermentau River (via road culvert)
Kings Bayou/Little Chenier Canal (WB031)	0.8	Perennial Stream	HDD	Meandering stream from Mermentau River (via holding pond)
Unnamed (WB030)	7.0	Perennial Stream	Open-cut	Meandering stream to channelized path from Mermentau River (via road culverts)
Unnamed (WB033)	7.8	Perennial Canal	Open-cut	Channelized path from Mermentau River (via road culverts and ditches)
Unnamed (WB026)	8.6	Perennial Canal	HDD	Channelized path from Mermentau River (via road culverts)
Unnamed (WB020)	12.5	Perennial Ditch	Open-cut	Channelized path to Calcasieu Lake via Grand Bayou
Unnamed (OW034)	12.9	Permanently Flooded Estuarine Pond	Open-cut	Channelized path to Calcasieu Lake via Grand Bayou
Unnamed (WB017)	13.5	Perennial Canal	Open-cut	Channelized path to Calcasieu Lake via Grand Bayou
Unnamed (WB016)	14.7	Perennial Ditch	Open-cut	Channelized path to Calcasieu Lake via Grand Bayou
Unnamed (WB015)	14.8	Perennial Ditch	Open-cut	Channelized path to Calcasieu Lake via Grand Bayou
Unnamed (OW052dw)	14.9	Permanently Flooded Pond	Open-cut	Pond adjacent to open estuarine marshes
Unnamed (WB014)	15.2	Perennial Ditch	Open-cut	Channelized path to Calcasieu Lake via Grand Bayou
Unnamed (OW030, OW029, OW027, OW026, OW025, OW024, OW023, OW022, OW021, OW020, OW019, OW018, OW017, OW016)	15.2, 15.9, 16.3, 16.4-17.9	Permanently Flooded Estuarine Open Waters	Open-cut	Open estuarine marshes connected to Calcasieu Lake

TABLE 4.6.2.2-1 POTENTIAL FISH-BEARING WATERBODIES CROSSED BY THE PROPOSED PIPELINE FACILITIES				
Waterbody Name (Feature ID)	MP	Type	Crossing Method	Connection to Gulf of Mexico
Unnamed (WB012)	16.0	Perennial Estuarine Channel	Open-cut	Channel to open estuarine marshes connected to Calcasieu Lake
Unnamed (WB011)	16.4	Perennial Estuarine Channel	Open-cut	Channel to open estuarine marshes connected to Calcasieu Lake
Unnamed (OW006)	18.6	Permanently Flooded Estuarine Pond	Open-cut	Open estuarine marsh connected to Calcasieu Lake
Unnamed (OW005)	20.3	Permanently Flooded Estuarine Open Water	Open-cut	Open estuarine marsh connected to channel to Calcasieu River Ship Channel
Unnamed (WB010)	20.5	Perennial Canal	Open-cut	Channelized path to the Calcasieu River Ship Channel
Unnamed (WB009)	21.4	Perennial Canal	HDD	Channelized path to the Calcasieu River Ship Channel (via road culverts)
Unnamed (WB008)	22.1	Perennial Canal	Open-cut	Channelized path to the Calcasieu River Ship Channel (via road culverts)

HDD = horizontal directional drill; MP = milepost

Impacts and Mitigation

Impacts on aquatic resources resulting from construction and operation of the pipeline facilities could include loss or modification of habitat, increased sedimentation and turbidity levels, and alteration of vegetative cover resulting from waterbody crossings; entrainment of small organisms during withdrawal of hydrostatic test water; and introduction of pollutants as a result of inadvertent spills or leaks of hazardous materials. These impacts are discussed in the following sections.

Waterbody Crossings

As detailed in section 4.3.2.2, construction of the proposed new Pipeline would require centerline crossing of 50 waterbodies, including 21 perennial channels (including streams, ditches, and canals), 5 intermittent channels, and 24 permanently flooded open waterbodies (including natural ponds, stock ponds, and borrow areas). Fourteen of these waterbodies would be crossed by HDD and 36 would be crossed by open-cut (see appendix F). No meter stations or MLVs are proposed within a waterbody.

Installing the proposed Pipeline 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 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. If an inadvertent release occurs, TransCameron Pipeline would implement the corrective action and cleanup measures outlined in its HDD Contingency Plan to minimize potential impacts on aquatic resources (see appendix D).

Use of the push and open-cut methods would result in temporary loss or modification of aquatic habitat, increase in sedimentation and turbidity levels, and alteration of vegetative cover. Because no forested lands are crossed by the Pipeline, as identified in section 4.4.2, impacts on vegetative cover would be temporary and would return to preconstruction conditions within one to four growing seasons. Because much of the vegetation is already maintained in a low-growing, herbaceous state and does not provide shade over the waterbodies, changes in water temperature would be minimized. The majority of fish present within the waterbody at the time of construction activities would likely be displaced to similar adjacent habitats up or down stream; 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. This temporary increase in suspended solids would decrease rapidly following the completion of instream activities.

TransCameron Pipeline would implement the measures outlined in its Project-specific Procedures to minimize impacts on waterbodies and aquatic resources during pipeline construction. Once construction is complete, streambeds and banks would be restored to their preconstruction conditions and contours to the maximum extent practicable, which would aid in preventing erosion and minimize long-term impacts on aquatic resources. With implementation of the mitigation measures described above, we anticipate that the Project would have minimal and localized impacts on aquatic resources.

Hydrostatic Testing

Prior to placing the Pipeline into service, each component would be hydrostatically tested to ensure its integrity. Hydrostatic test water would be withdrawn from surface water sources. The water withdrawal process could entrain fish eggs and juvenile fish located near the intake hose. TransCameron Pipeline would screen intake hoses at surface water intakes to eliminate or minimize the entrainment of fingerling and small fish during water withdrawal. TransCameron Pipeline would regulate the timing, rate, and volume of hydrostatic test water withdrawals to maintain ambient downstream flow in the waterbodies from which hydrostatic test water would be withdrawn.

Hydrostatic test water would contact only new pipe and TransCameron Pipeline has stated that it would not add chemicals to the water. After testing is completed, TransCameron Pipeline would discharge the hydrostatic test water to well-vegetated uplands and/or using energy dissipation devices to regulate the discharge rate and minimize the potential for erosion, streambed scour, suspension of sediments, and excessive stream flow. Therefore, impacts on aquatic resources due to hydrostatic testing would be temporary and negligible.

Accidental Spill or Leak of Hazardous Materials

Aquatic resources could be adversely affected by an accidental spill or leak of hazardous materials into or near a waterbody. As described in section 4.3.2.2, TransCameron Pipeline would implement its Project-specific SPCC Plan to minimize the potential for releases to occur. Should a spill or leak occur, implementation of the response measures in the SPCC Plan would reduce response time and ensure appropriate cleanup, thereby minimizing impacts on aquatic resources.

4.6.3 Essential Fish Habitat

In 1996, the U.S. Congress made amendments to the Magnuson-Stevens Act that mandated the identification of EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity” (16 USC 1802(10)). In addition to their ecological significance, EFH areas are of high economic importance due to the dependence of recreational and commercial fisheries associated with them. The Magnuson-Stevens Act granted NMFS legislative authority for fisheries regulation in the U.S. within a jurisdictional area between 3 and 200 miles offshore, depending on geographical location. Federal agencies that authorize, fund, or undertake activities that may adversely impact EFH must consult with NMFS. During scoping, NMFS expressed concern with the potential presence of EFH at the terminal and along the pipeline, and potential impact on EFH from the Project. Although absolute criteria have not been established for conducting EFH consultations, NMFS recommends consolidated EFH consultations with interagency coordination procedures required by other statutes, such as NEPA and the ESA, to reduce duplication and improve efficiency. Generally, the EFH consultation process includes the following steps:

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

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

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

4. **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 any conservation recommendation that is not adopted, the action agency must explain its reason to NMFS for not following the recommendation.

We determined that based on implementation of conservation measures developed by Venture Global Calcasieu Pass and TransCameron Pipeline and development of a final its Compensatory Mitigation Plan, no substantial adverse impacts on EFH or EFH species would occur related to construction and operation of the Terminal and Pipeline. For purposes of reviewing this Project under NEPA, the FERC is the lead federal agency. As such, we request initiation of EFH consultation with NMFS and request that NMFS consider this EIS as our EFH Assessment.

4.6.3.1 Essential Fish Habitat in the Project Area

NMFS was granted legislative authority to establish eight regional fishery management councils, each responsible for the proper management and harvest of finfish and shellfish resources within their respective geographic regions. The Project area lies within the management jurisdiction of the GMFMC. Between 1979 and 1987, the GMFMC prepared fishery management plans (FMPs) for seven marine groups within the Gulf of Mexico: reef fish, migratory pelagic fish, red drum, shrimp, spiny lobster, stone crab, and corals. The FMPs outline measures to ensure the proper management and harvest of finfish and shellfish. Each FMP has undergone several amendments, including an amendment in 1998 that involved the identification of EFH for each fisheries group.

Recognizing that fish and shellfish distribution and environmental factors vary across the Gulf of Mexico, the GMFMC subdivided the Gulf of Mexico into five sub-units it identified as "eco-regions." The Project is in the Gulf of Mexico EFH Eco-Region 4 – East Texas and West Louisiana, Mississippi Delta to Freeport. This eco-region is directly influenced by the Mississippi and Atchafalaya Rivers and contains extensive areas of marsh. Within Eco-Region 4, the GMFMC has further subdivided the coastal zone as estuarine, nearshore, or offshore. Estuarine waters occur inside estuaries or bays and areas on or inshore of barrier islands; nearshore waters occur in marine waters 60-feet or less in depth; and offshore waters occur in marine waters greater than 60 feet deep. Through the FMPs and their amendments, the GMFMC has identified and delineated EFH by life stage for each managed species, and has identified in which coastal zone each life stage may occur. Life stages include: eggs, larvae, post-larvae, early juveniles, late juveniles, adults, and spawning adults.

The GMFMC has designated EFH in the Gulf of Mexico and the Calcasieu River Ship Channel from the Gulf of Mexico north to Lake Charles for shrimp, coastal migratory pelagics, reef fish, and stone crab. The Calcasieu River Ship Channel is also designated EFH for red drum. High Migratory Species may occur in the nearshore zone of the Gulf of Mexico temporarily affected by hydroacoustic impacts during Project construction.

On September 9, 2015, Venture Global conducted a site visit with representatives from NMFS to determine what portions of the project area were considered EFH. It was concluded that at the Terminal site, the Calcasieu River Ship Channel and all marshlands west of Davis Road are EFH; this area would include the location of the proposed LNG berthing area and associated marine facilities, and the turning basin. The Terminal site east of Davis Road was determined to have no tidal connections and considered too high in elevation to allow tidal flux to wetlands and surface waters; and therefore, does not contain EFH. Along the Pipeline, wetlands and waterbodies were determined to be EFH if there is tidal connectivity. The NMFS concurred that wetlands and surface waters between Pipeline MPs 15–19 are considered EFH due to the tidal connectivity to the area north of the proposed pipeline route. EFH was also determined to be present in an area east of Mermentau Road at MP 0.2, reflecting the connectivity of local wetlands and waters with the Mermentau River. No additional EFH along the Pipeline was identified, excluding the vast majority of the wetlands and surface waters along the pipeline as EFH.

4.6.3.2 Federally Managed Species

Of the FMPs developed in GMFMC's jurisdiction, five are for fisheries that may be found in the Calcasieu River Ship Channel and adjacent nearshore habitat, including shrimp, coastal migratory pelagics, reef fish, red drum, and stone crab. Table 4.6.3.2-1 identifies the EFH-managed species and associated fisheries found in the Project area; a description of the EFH in which they occur in the Gulf of Mexico; a summary of each species' occurrence in Eco-Region 4 by life stage; and an assessment of the potential occurrence of each species and life stage within the Calcasieu River Ship Channel and the Project's tidal wetlands and waterbodies.

TABLE 4.6.3.2-1

SPECIES WITH DESIGNATED EFH IN THE VENTURE GLOBAL CALCASIEU PASS AND TRANSCAMERON PIPELINE PROJECT AREA

				Potential Occurrence		
				Terminal Site		Pipeline
Fishery/Species	Life Stage	Gulf of Mexico EFH Characteristics	Summary of Occurrence in Eco-Region 4	Calcasieu River Ship Channel	Tidal Wetlands (West of Davis Road)	Tidal Wetlands/Surface Waters Pipeline
Brown shrimp						
(*Penaeus aztecus*)	Post-larvae and juvenile	Estuarine Zone: growth and feeding in emergent marsh, submerged aquatic vegetation, sand/shell and soft bottom, and oyster reef habitats; depth preference of 0 to 18 meters	Nursery area	Yes	Yes	Yes
	Adults	Nearshore Zone: feeding in sand/shell and soft bottom habitats; depth preference of 14 to 110 meters	Major adult area and commercial fishing ground	Yes	No	No
White shrimp						
(*Penaeus setiferus*)	Eggs	Nearshore Zone: growth in sand/shell and soft bottom habitats; depth preference of 9 to 34 meters	Common	Yes	No	No
	Post-larvae and juvenile	Estuarine Zone: growth and feeding in emergent marsh and soft bottom habitats; depth preference of 1 to 30 meters	Post-larvae are common and is a nursery area for juveniles	Yes	Yes	Yes
	Adult	Nearshore Zone: feeding in soft bottom habitat; depth preference of 9 to 27 meters	Major adult area and commercial fishing ground	Yes	No	No
	Spawners	Nearshore Zone: spawning in soft bottoms; depth preference of 9 to 34 meters	Major adult area and commercial fishing ground	Yes	No	No
Pink shrimp						
(*Penaeus duorarum*)	Eggs	Nearshore Zone: growth in sand/shell bottom habitats; depth preference of 9 to 48 meters	Occurrence	Yes	No	No
	Post-larvae and juvenile	Nearshore Zone: growth and feeding in sand/shell bottom and submerged aquatic vegetation habitats; depth preference of 1 to 65 meters	Occurrence	Yes	No	No
	Adult	Nearshore Zone: feeding in sand/shell bottom habitats; depth preference of 1 to 110 meters	Occurrence	Yes	No	No
	Spawners	Nearshore Zone: spawning in sand/shell bottom habitats; depth preference of 9 to 48 meters	Occurrence	Yes	No	No

TABLE 4.6.3.2-1

SPECIES WITH DESIGNATED EFH IN THE VENTURE GLOBAL CALCASIEU PASS AND TRANSCAMERON PIPELINE PROJECT AREA

				Potential Occurrence		
				Terminal Site		Pipeline
Fishery/Species	Life Stage	Gulf of Mexico EFH Characteristics	Summary of Occurrence in Eco-Region 4	Calcasieu River Ship Channel	Tidal Wetlands (West of Davis Road)	Tidal Wetlands/Surface Waters Pipeline
COASTAL MIGRATORY PELAGICS						
Spanish Mackerel (*Scomberomorus maculatus*)	Eggs	Nearshore Zone: growth in pelagic habitat; maximum depth preference of 50 meters	Occurrence	Yes	No	No
	Larvae	Nearshore Zone: growth and feeding in pelagic habitat; depth preference of 9 to 84 meters	Occurrence	Yes	No	No
	Juvenile	Estuarine and Nearshore Zones: growth and feeding in pelagic (open water) habitat; maximum depth preference of 50 meters	Occurrence	Yes	No	No
	Adult	Estuarine and Nearshore Zones: feeding in pelagic habitat; depth preference of 3 to 75 meters	Occurrence	Yes	No	No
	Spawning	Nearshore Zone: spawning in pelagic habitat; maximum depth preference of 50 meters	Occurrence	Yes	No	No
Gray (mangrove) snapper (*Lutjanus griseus*)	Juvenile	Estuarine and Nearshore Zones: growth and feeding in submerged aquatic vegetation, emergent marsh, and mangrove habitats; no depth preferences provided	Occurrence	Yes	Yes	Yes
	Adult	Estuarine and Nearshore Zones: feeding in sand/shell, hard, and soft bottom habitats; no depth preference provided	Occurrence	Yes	No	No
Mutton snapper (*Lutjanus analis*)	Juvenile	Estuarine Zone: growth and feeding in submerged aquatic vegetation, emergent marsh, and mangrove habitats; no depth preferences provided	Occurrence	Yes	Yes	Yes
Cubera snapper (*Lutjanus cyanopterus*)	Juvenile	Estuarine and Nearshore Zones: growth and feeding in submerged aquatic vegetation, emergent marsh, and mangrove habitats; depth preference of 0 to 85 meters	Occurrence	Yes	Yes	Yes
	Adult	Estuarine and Nearshore Zones: feeding in submerged aquatic vegetation habitats; no depth preferences provided	Occurrence	Yes	No	No
Lane snapper (*Lutjanus synagris*)	Post- Larvae and Juvenile	Estuarine and Nearshore Zones: growth and feeding in submerged aquatic vegetation, mangroves, sand/shell and soft bottom habitats; depth preference of 0 to 20 meters	Post-larvae are common; also a nursery area for juveniles	Yes	No	No

TABLE 4.6.3.2-1

SPECIES WITH DESIGNATED EFH IN THE VENTURE GLOBAL CALCASIEU PASS AND TRANSCAMERON PIPELINE PROJECT AREA

				Potential Occurrence		
				Terminal Site		Pipeline
Fishery/Species	Life Stage	Gulf of Mexico EFH Characteristics	Summary of Occurrence in Eco-Region 4	Calcasieu River Ship Channel	Tidal Wetlands (West of Davis Road)	Tidal Wetlands/Surface Waters Pipeline
Yellowtail snapper (*Ocyurus chrysurus*)	Juvenile	Estuarine and Nearshore Zones: growth and feeding in submerged aquatic vegetation, mangroves, and soft bottom habitats; no depth preference provided	Occurrence	Yes	No	No
	Adult	Nearshore Zone: feeding in hard bottom habitats; depth preference of 1 to 183 meters	Occurrence	Yes	No	No
Goliath grouper (*Epinephelus itajara*)	Juvenile	Estuarine and Nearshore Zones: growth and feeding in submerged aquatic vegetation, mangroves, and hard bottom habitats; no depth preference provided	Not available	Yes	No	No
Red grouper (*Epinephelus morio*)	Juvenile	Estuarine and Nearshore Zones: growth and feeding in submerged aquatic vegetation and hard bottom habitats; depth preference of 0 to 50 meters	Occurrence	Yes	No	No
	Adult	Nearshore Zone: feeding in hard bottom habitats; depth preference of 3 to 190 meters	Occurrence	Yes	No	No
RED DRUM						
Red Drum (*Sciaenops ocellatus*)	Larvae	Estuarine Zone: growth and feeding in submerged aquatic vegetation and soft bottom habitats; no depth preference provided	Common	Yes	No	No
	Post-larvae and juvenile	Estuarine Zone: growth and feeding in submerged aquatic vegetation, emergent marsh, sand/shell and soft bottom habitats; depth preference of 0 to 5 meters	Post-larvae are common; also a nursery area for juveniles	Yes	Yes	Yes
	Adult	Estuarine and Nearshore Zones: feeding in submerged aquatic vegetation, emergent marsh, sand/shell, soft and hard bottom habitats; depth preference of 1 to 70 meters	Major adult area and commercial fishing ground	Yes	Yes	Yes
	Spawners	Nearshore Zone: spawning in sand/shell and hard bottom habitats; depth preference of 40 to 70 meters	Spawning area	No	No	No
STONE CRAB						
Gulf stone crab (*Menippe adina*)	Eggs	Estuarine and Nearshore Zones: growth in sand/shell and soft bottom habitats; depth preference of 0 to 40 meters	Common	Yes	No	No
	Larvae	Estuarine and Nearshore Zones: growth in pelagic habitats; depth preference of 0 to 40 meters	Common	Yes	No	No
	Juvenile	Estuarine Zone: growth and feeding in sand/shell and soft bottom, and oyster reef habitats; depth preference of 0 to 40 meters	Nursery area	Yes	No	No
	Adults	Estuarine Zone: feeding in soft bottom, and oyster reef habitats; depth preference of 0 to 4000 meters	Adult area	Yes	No	No
	Spawning	Estuarine Zone: spawning and feeding in sand/shell and soft bottom habitats; depth preference of 0 to 40 meters	Not available	Yes	No	No

TABLE 4.6.3.2-1

SPECIES WITH DESIGNATED EFH IN THE VENTURE GLOBAL CALCASIEU PASS AND TRANSCAMERON PIPELINE PROJECT AREA

				Potential Occurrence		
				Terminal Site		Pipeline
Fishery/Species	Life Stage	Gulf of Mexico EFH Characteristics	Summary of Occurrence in Eco-Region 4	Calcasieu River Ship Channel	Tidal Wetlands (West of Davis Road)	Tidal Wetlands/Surface Waters Pipeline
ATLANTIC HIGHLY MIGRATORY SPECIES						
Atlanta sharpnose shark (*Rhizoprionodon terraenovae*)	Neonate	Gulf of Mexico coastal areas from Texas through the Florida Keys.	Common in coastal waters beginning in June until fall	No	No	No
	Juvenile	Gulf of Mexico coastal areas from Texas through the Florida Keys	Common in coastal waters beginning in April until fall	No	No	No
	Adult	Gulf of Mexico from Texas through the Florida Keys out to a depth of 200 meters	Common year-round resident	No	No	No
Blacktip shark (*Carcharhinus limbatus*)	Neonate	Coastal areas in the Gulf of Mexico from Texas through the Florida Keys	Estuaries are primary nurseries between May and early September	No	No	No
	Juvenile	Coastal areas in the Gulf of Mexico from Texas through the Florida Keys	Estuaries and nearshore waters used as secondary nurseries	No	No	No
	Adult	Coastal areas in the Gulf of Mexico from Texas through the Florida Keys	Observed in estuaries from May to October	No	No	No
Scalloped hammerhead shark (*Sphyrna lewini*)	Neonate	Coastal areas in the Gulf of Mexico from Texas to the southern west coast of Florida	Presumably rare along the Gulf Coast	No	No	No
Spinner shark (*Carcharhinus brevipinna*)	Juvenile	Gulf of Mexico coastal areas from Texas to the Florida Panhandle, and the mid-west coast of Florida to the Florida Keys	Common in coastal areas during the summer months	No	No	No

Sources: NOAA, 2012; GMFMC, 2004; NOAA, 2009.

KEY:

Spawning area = An area in which courting, mating, spawning, fertilization, and other reproductive activities of a species occur Adult Area = An area where sexually mature individuals of a species occur or congregate

Major adult area = An area where sexually mature individuals of a species occur or congregate, and are relatively more abundant than in other adult areas they occupy

Commercial fishing ground = An area in which a species is harvested for its economic value

Nursery area = An area where young stages (juveniles) of a species occur or concentrate for feeding and/or refuge

Occurrence = An area which a species is known to inhabit, but where the species is relatively less abundant than in other parts of its distribution

Common = not defined, presumed to mean habitat areas commonly used by the species

4.6.3.3 Impacts and Mitigation

EFH within the Project area includes habitats within the estuarine and nearshore zones. Direct Project impacts include impacts on estuarine wetlands, estuarine channels, estuarine ponds, benthic substrate, and the estuarine water column. In the Calcasieu River Ship Channel, the benthic substrate and estuarine water column provide EFH for spawning, breeding, feeding, growth, and shelter for various life stages of several managed species and their prey. Estuarine wetlands, mudflats, and estuarine ponds/open water habitats provide nursery areas, foraging, and growth opportunities for various stages of shrimp, reef fish, and red drum. Estuarine channels may provide travel corridors for managed species between habitats. Temporary and permanent Project impacts on EFH are summarized below by waterbody type. Appendix H provides additional information on wetlands and waterbodies with EFH habitat, including MP, temporary and permanent impact areas, and impact description.

Terminal Facilities

As discussed in section 4.6.3.1, EFH is present in the Calcasieu River Ship Channel and the tidal wetlands and waterbodies west of Davis Road. Impacts on EFH would result from dredging and excavating of the Calcasieu River Ship Channel and shoreline wetlands for the creation of the turning basin and berthing area; placement of dredge material in nearshore benthic habitat 2 miles southwest of the Terminal; maintenance dredging and prop wash from the LNG carriers during operations; construction of the loading docks and berths, including pile driving activities; ballast water discharges; hydrostatic test water withdrawal; and hazardous materials spills. These activities may impact EFH in the following ways:

- **Displacement and mortality –** The Project would require dredging to construct the turning basin and berthing area, followed by periodic maintenance dredging. Maintenance dredging is anticipated to occur on a 2-year cycle, but may vary due to a number of factors, including channel water flows, tidal movements, ship traffic, and severe weather occurrences. It is anticipated that most juveniles and adults of FMP species would avoid construction areas, and that potential direct impacts from dredging would be temporary and minor resulting in the displacement of, followed by rapid post-construction recolonization by these species. Dredging may result in direct loss of eggs and larvae of those FMP species that may occur in the Calcasieu River Ship Channel; however, the impacts on populations would be minor because mortality would be limited to the dredge footprint and nearby downstream from turbidity and sedimentation and spawning occurs over broad areas.

The proposed dredging activities and placement of dredge material in nearshore benthic habitat would also result in direct mortality of benthic invertebrates, an important food source for many species of fish, within the dredge and dredge placement footprints. This loss of benthic food resources within the EFH would be temporary and we would expect the benthic community to rebound within a few seasons (Wilber and Clarke 2007). Because the construction and maintenance dredging effects would be temporary and limited to the dredge footprint and dredge placement footprint (see *Habitat modification* below), we conclude that this would be a minor adverse impact on EFH.

- **Habitat modification** – Construction of the LNG berthing area and turning basin at the Terminal site would require dredging/excavation of 94.1 acres, of which approximately 83.3 acres are EFH. This includes approximately 17.4 acres of shoreline tidal wetlands, of which 14 acres would be permanently converted to estuarine water column and deepwater benthic habitat, while approximately 3.4 acres would be permanently filled through development of the marine berm. Dredging between the shoreline and the edge of the Calcasieu River Ship Channel would result in 65.9 acres of permanent benthic habitat impacts on EFH through the alteration of the depth profile from the shoreline to the edge of the navigation channel; the increased water depth would continue to provide deepwater EFH habitat after dredging is completed. The loss of benthic invertebrates would be a temporary and minor adverse impact on EFH as the benthic invertebrate population would be anticipated to recolonize the disturbed area. Approximately 1 acre of this habitat would be permanently shaded by new overwater structures.

Placement of dredge material over approximately 1,328 acres of nearshore benthic habitat 2 miles southwest of the Terminal would temporarily affect benthic EFH habitat. Benthic habitat and organisms would be covered from the placement of the dredge material. However, nearshore benthic habitat typically consists of fine sediments similar to the dredge material, and these fine sediments are routinely moved by natural processes. The benthic ecosystem has evolved around those patterns of sediment movement and disturbance and we would expect them to recover quickly after dredge material placement.

The most geographically extensive effects of the Project on EFH are temporary hydroacoustic impacts from vibratory and impact pile driving during project construction. The nearshore habitat area exposed to potential injury and disturbance level impacts on fish would extend approximately 6.2 and 28.8 miles offshore from the site, respectively, in a cone shaped zone determined by the proximity of pile driving to the mouth of the ship channel. These distances are worst case scenarios and do not account for the underwater noise attenuation plan that would be developed and implemented in consultation with NMFS, FWS, and LDWF (see condition in section 4.6.2.1). The zone of injury-level impacts within the Ship Channel itself would be constrained by the channel geography.

The geographic extent of underwater noise impacts would be limited by the geography of the Calcasieu River Ship Channel and its opening into the Gulf of Mexico. The Monkey Island shoreline would block noise from reaching the northern end of the ship channel and Lake Calcasieu. Underwater noise can propagate through the mouth of the ship channel into the Gulf of Mexico unabated. The highest intensity impact pile driving could produce hydroacoustic impacts sufficient to alter fish behavior in a cone-shaped impact zone extending up to 28.8 miles into the Gulf of Mexico from the Project site. Impact pile driving would produce underwater noise of sufficient intensity to deter migration and most likely injure or kill larval and adult fish in the southern end of the ship channel and a cone-shaped impact zone potentially extending up to 6.2 miles (worst-case, unattenuated) into the Gulf of Mexico.

- **Underwater noise and vibration –** Pile driving may result in noise and vibration levels above established thresholds for disturbance and injury to fish. This would result in both direct effects on EFH species and indirect effects on EFH through impacts on predator and prey species. An assessment of the Project's impacts on fish from pile driving is provided in section 4.6.2.1. Venture Global Calcasieu Pass' coordination with the LDWF and NMFS to identify appropriate impact avoidance and minimization measures to limit potential noise-related effects on EFH is ongoing. Our recommendation in section 4.6.2.1, Terminal Facilities, would ensure that the effects of pile driving noise are minimized. These measures may include timing restrictions, noise attenuation devices, and operational guidelines.

- **Temporary water quality impacts** – Dredging, placement of dredge material in nearshore benthic habitat, and pile driving activities would temporarily increase turbidity and suspended solids within the water column, which could adversely affect fish eggs and juvenile survival, benthic community diversity and health, foraging success, and suitability of spawning habitat. Additionally, sediments in the water column could be deposited on nearby substrates, burying demersal eggs and larvae and aquatic macroinvertebrates, an important food source for many species of fish. In-water work may cause localized increases in nutrient levels in the water column and decreases in dissolved oxygen. Additionally, ballast water discharges may have a localized effect on salinity levels. In the lower Calcasieu River, the waters are subject to significant fluctuations in water quality (including turbidity, salinity, and nutrient levels) due to tidal action, significant weather events, ship traffic, maintenance dredging, and the confluence of the Calcasieu River Ship Channel and Calcasieu Pass. The FMP species that occur in this area are adapted to water quality fluctuations. Further, Venture Global Calcasieu Pass would minimize impacts on EFH by utilizing a hydraulic dredge with a suction cutter head, which would minimize resuspension of sediments and the resulting increases in turbidity and suspended sediment levels; by requiring that ballast water discharges be undertaken in accordance with federal regulations; and by adhering to water quality thresholds specified in CWA permits and certifications. We have therefore determined that impacts on water quality would have temporary, minor impacts on EFH.

- **Introduction of pollutants** – EFH could be adversely affected by an accidental spill or leak of hazardous materials into or near a waterbody. To minimize impacts on EFH, Venture Global Calcasieu Pass would implement its SPCC Plan (see section 4.2.3). Implementation of the SPCC Plan would minimize the potential for releases to occur. Should a spill or leak occur, implementation of the response measures in the SPCC Plan and SOPEP would reduce response time and ensure appropriate cleanup, thereby minimizing impacts on EFH.

- **Entrainment/impingement –** Hydrostatic test water would be withdrawn from the Calcasieu River Ship Channel. The water withdrawal process could entrain fish eggs, juvenile fish, and food resources near the intake hose. Venture Global Calcasieu Pass would screen intake hoses at surface water intakes and regulate intake velocity to eliminate or minimize the entrainment of FMP species and their food resources during water withdrawal. Therefore, we have determined that impacts on EFH resulting from entrainment/impingement during hydrostatic test water withdrawals would be temporary and negligible.

Some impacts on EFH resulting from the proposed Terminal facilities are recognized as permanent, including habitat modification from the deepening of 65.9 acres of the Calcasieu River Ship Channel and the conversion of 14 acres of tidal wetlands and waterbodies to open water riverine habitat, which would alter the use of this EFH by FMP species. Impacts on the FMP species themselves would be temporary, resulting from construction-related activities, as populations of FMP species and their food sources would be expected to recover quickly following construction. Based on a preliminary analysis, adverse impacts from pile driving noise and vibration would extend for a distance of 6.2 miles without mitigation measures (see section 4.6.2.1). However, we have included a recommendation that Venture Global Calcasieu Pass consult with LDWF and NMFS to develop and file with the FERC prior to the end of the draft EIS comment period noise mitigation measures that would minimize impacts on fish species. With this mitigation, we conclude impacts on EFH would not be significant. Venture Global Calcasieu Pass would also provide dredged material to agency-sponsored beneficial use sites as compensatory mitigation for the Project, thereby facilitating the creation/restoration of EFH at these sites (see appendix E). Venture Global's proposal to create/restore 136.4 acres of high quality estuarine marsh wetland at the CPNWR would provide compensation for loss of EFH. Therefore, we conclude that the proposed mitigation would mitigate permanent impacts on EFH resulting from Project construction and operation.

Pipeline Facilities

Construction of the meter station and permanent access road at MP 0.0 would permanently fill approximately 1.3 acres of estuarine scrub-shrub and estuarine emergent wetland that is considered EFH. Installation of the Pipeline would only result in temporary impacts on wetlands and surface waters considered EFH because these wetlands and surface waters would be returned to preconstruction condition in accordance with applicable USACE and LDNR permit conditions and requirements. Approximately 9.0 acres of EFH east of Mermentau Road would be temporarily impacted. Approximately 47.9 acres of estuarine scrub-shrub wetlands, estuarine emergent wetlands, and other waterbodies considered to be EFH would be temporarily impacted between MP 15.2 and MP 18.2 from construction of the Pipeline. These activities may impact EFH in the following way:

- **Displacement and mortality** – It is anticipated that most juveniles and adults of FMP species would avoid construction areas, and that potential direct impacts from pipeline construction would be temporary and minor resulting in the displacement of, followed by rapid post-construction recolonization by these species. As shown in table 4.6.3.2-1, the tidal wetlands associated with the Pipeline are not expected to provide EFH for eggs or larvae; therefore, mortality of these less mobile life stages are not expected. Impacts on EFH would further be minimized by the use of the HDD method for a number of waterbody and wetland crossings.

The proposed activities could result in direct mortality of aquatic invertebrates, an important food source for many species of fish, within the Project footprint. This loss of food resources would be temporary and would be expected to rebound within a few seasons. Because the effects would be temporary and limited to the Project footprint, we conclude that this would be a minor adverse impact on EFH.

- **Habitat loss** – The proposed Project would result in the permanent loss of 1.3 acres of estuarine scrub-shrub and estuarine emergent wetland that provide EFH from the construction of aboveground facilities and permanent access roads. The footprints of these aboveground facilities and permanent access roads have been minimized to limit habitat fragmentation and potential loss of EFH. All permanent wetland impacts would also be mitigated through the section 404 permitting process with the USACE. Currently, Venture Global proposes as part of its Compensatory Mitigation Plan wetland creation and restoration which would provide a direct benefit to EFH. A mitigation ratio of 1.72:1 is proposed by Venture Global.

- **Temporary water quality impacts –** TransCameron Pipeline would cross 50 waterbodies via the HDD, or open-cut method. Pipeline construction could result in a temporary increase in turbidity and suspended solids, which could impact EFH. These impacts would be temporary and localized and would be minimized through the implementation of Venture Global's Project-specific Procedures and permit conditions. See section 4.3.2 for further information on surface water resources.

- **Introduction of pollutants** – EFH could be adversely affected by an accidental spill or leak of hazardous materials (e.g., release of petrochemicals during construction) into or near a wetland or waterbody. To minimize impacts on EFH, TransCameron Pipeline would implement its SPCC Plan (see section 4.2.3). Implementation of the SPCC Plan would minimize the potential for releases to occur. Should a spill or leak occur, implementation of the response measures in the SPCC Plan would reduce response time and ensure appropriate cleanup. Therefore, the likelihood of adverse impacts on EFH is insignificant and discountable.

- **Entrainment/impingement –** Water for hydrostatic testing and HDD activities would be withdrawn from surface water sources. The water withdrawal process could entrain fish eggs, juvenile fish, and food resources near the intake hose. TransCameron Pipeline would screen intake hoses at surface water intakes and control intake velocity to eliminate or minimize the entrainment of FMP species and their food resources during water withdrawal. Therefore, we have determined that impacts on EFH resulting from entrainment/impingement during hydrostatic test water withdrawals would be insignificant.

- **Inadvertent return** – Installing the proposed Pipeline using the HDD method across certain sensitive resources would avoid or minimize impacts on EFH within waterbodies and wetlands. However, an inadvertent release of drilling mud into a wetland or waterbody could affect water quality and could impede the movement of FMP species, potentially resulting in stress, injury, and/or direct mortality of individuals in the vicinity of a release. If an inadvertent release occurs, TransCameron Pipeline would implement the corrective action and cleanup measures outlined in its HDD Contingency Plan to minimize potential impacts on EFH. Therefore, the likelihood of adverse impacts on EFH is insignificant and discountable.

The Project would result in 4.7 acres of permanent impacts on EFH associated with the construction of the Terminal berm and Pipeline's aboveground facilities and permanent access roads. These permanent impacts on wetlands and waterbodies potentially containing EFH would be mitigated through Venture Global's Compensatory Mitigation Plan, which would include the beneficial use of dredged material. The Project is also expected to result in temporary impacts associated with in-water construction, turbidity, and pile driving-related underwater noise affecting estuarine and nearshore habitat. Underwater noise would account for the majority of this impact area. These impacts are expected to be of short duration, as populations of FMP 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, the SPCC Plan, development of an agency-approved noise attenuation plan (see condition in section 4.6.2), and the HDD Contingency Plan. Therefore, we conclude that the Project would adversely affect EFH, but these adverse effects would be temporary.

4.7 THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

Federal agencies are required under section 7 of the ESA, as amended, 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 destruction or adverse modification of the designated critical habitat of a federally listed species. As the lead federal agency, the FERC is required to consult with the FWS and NMFS to determine whether federally listed threatened or endangered species or designated critical habitat are found in the vicinity of the Project, and to determine the proposed action's potential effects on those species or critical habitats. During scoping, the FWS, LDFW, and members of the public expressed concern with potential Project impacts on threatened and endangered species and critical habitat, and recommended measures to avoid and minimize these impacts.

For actions involving major construction activities with the potential to affect listed species and/or its designated critical habitat, the lead federal agency must prepare a BA and submit its BA to the FWS and/or NMFS. If the action would adversely affect a listed species and/or its critical habitat, 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 request that the FWS and NMFS consider the information provided in this EIS as the BA for the Project.

Venture Global, acting as the FERC's non-federal representative, initiated informal consultation with the FWS Louisiana Ecological Services Field Office and with NMFS regarding federally listed species and critical habitat in the Project area. Venture Global also reviewed LNHP data regarding state-listed or other special status species in the Project area. Based on this agency consultation, a review of publicly available information, and field surveys, a total of sixteen federally listed threatened and endangered species and twelve state-listed threatened and endangered species (all of which are also federally listed) could occur in the Project area (table 4.7.1-1). In addition, critical habitat has been designated for one species in the

Project area. Table 4.7.1-1 summarizes the potential for the Project to affect these species and our determinations of effect. Further discussion of federally and state-listed species and our assessment of potential impacts are provided in section 4.7.1 and 4.7.2. Species noted by LNHP (2015) in the Project area as being imperiled or critically imperiled are not discussed in this section of the EIS, as they are afforded no legal protection under federal or state statute; however, sensitive species are discussed in section 4.5 (vegetation) and section 4.6 (wildlife and aquatic resources). Marine mammals that are protected under the MMPA, but not listed under the ESA, are discussed in section 4.6.2.

4.7.1 Federally Listed Threatened and Endangered Species

Based on information obtained from consultation with the FWS and NMFS, as well as publicly available data obtained from the FWS' Information, Planning, and Conservation system, sixteen federally listed threatened and endangered species may occur within the parishes affected by the Project. Each of these species is discussed in further detail below.

TABLE 4.7.1-1

FEDERALLY AND STATE-LISTED SPECIES POTENTIALLY OCCURRING IN THE VICINITY OF THE VENTURE GLOBAL CALCASIEU PASS PROJECT

Common Name Scientific Name	Federal Status	State Status	Habitat Requirements	Determination of Effect
Marine/Aquatic Mammals				
West Indian manatee *Trichechus manatus*	T	E	Inhabits large, slow-moving rivers, river mouths, and shallow coastal areas such as coves and bays.	*not likely to adversely affect*
Blue whale (*Balaenoptera musculus*)	E	E	Open ocean.	*not likely to adversely affect*
False killer whale (*Pseudorca crassidens*)	E	-	Tropical to temperate waters that are deeper than 3,300 feet.	*not likely to adversely affect*
Finback whale (*Balaenoptera physalus*)	E	E	Open ocean.	*not likely to adversely affect*
Humpback whale (*Megaptera novaeangliae*)	E	-	Open ocean, coastal waters, and sometimes inshore areas such as bays.	*not likely to adversely affect*
Killer whale (*Orcinus orca*)	E	-	Tropical, subtropical, and offshore waters.	*not likely to adversely affect*
Sei whale (*Balaenoptera borealis*)	E	E	Open ocean.	*not likely to adversely affect*
Sperm whale (*Physeter microcephalus*)	E	E	Open ocean.	*not likely to adversely affect*
Birds				
Red knot *Calidris canutus rufa*	T	--	Found in Louisiana during spring and fall migrations and the winter months. Forages along sandy beaches, tidal mudflats, salt marshes, and peat banks.	*not likely to adversely affect*
Piping plover *Charadrius melodus*	T/CH	T	Winters in Louisiana at intertidal beaches, mudflats, and sandflats with sparse emergent vegetation.	*not likely to adversely affect*
Fish				
Gulf sturgeon *Acipenser oxyrhinchus desotoi*	T	T	Spawns in large, free-flowing freshwater rivers in southeastern Louisiana with hard substrates composed of sand, rock, or rubble in spring and forages in lower rivers during summer months before returning to coastal waters during the winter.	*not likely to adversely affect*

TABLE 4.7.1-1

FEDERALLY AND STATE-LISTED SPECIES POTENTIALLY OCCURRING IN THE VICINITY OF THE VENTURE GLOBAL CALCASIEU PASS PROJECT

Common Name Scientific Name	Federal Status	State Status	Habitat Requirements	Determination of Effect
Reptiles				
Loggerhead sea turtle *Caretta caretta*	T	T	Coastal areas and the open ocean	*not likely to adversely affect*
Green sea turtle *Chelonia mydas*	T	T	Coastal areas and the open ocean	*not likely to adversely affect*
Leatherback sea turtle *Dermochelys coriacea*	E	E	Coastal areas and the open ocean	*not likely to adversely affect*
Hawksbill sea turtle *Eretmochelys imbricata*	E	E	Coastal areas and the open ocean	*not likely to adversely affect*
Kemp's Ridley sea turtle *Lepidochelys kempii*	E	E	Coastal areas and the open ocean	*not likely to adversely affect*

E = endangered; T = threatened; CH = Critical Habitat

4.7.1.1 Marine Mammals

West Indian Manatee

The West Indian manatee is a federally listed threatened and state-listed endangered species that is protected under MMPA. Manatees are found in rivers, estuaries, and coastal areas of the tropical and subtropical New World. They may be found from the southeastern United States coast along Central America and the West Indies to the northern coastline of South America. They occur mainly in larger rivers and brackish bays. In Louisiana, the West Indian manatee is known to regularly occur in Lakes Pontchartrain and Maurepas and their associated coastal areas. They have also been regularly reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of southeastern Louisiana. They are infrequently observed in the coastal areas of SWLA. The initial decline of manatee populations was a result of over-hunting; however, today population declines may be attributed to collisions with power boats, entrapment in floodgates, navigation locks, fishing nets, and water pipes. Loss of warmwater habitat along with ingestion of marine debris is also a threat to the continued survival of the West Indian manatee.

While extremely rare, manatees have been sighted within the Calcasieu River. They would most likely be present, if at all, during the warmer summer months. Manatees would not be expected to be encountered during Pipeline construction. The potential impacts on manatees resulting from the Project would be disturbance or injury from pile driving noise and collision with vessels. Impacts and proposed mitigation measures for these activities are discussed below.

<u>Impacts and Mitigation Measures</u>

Pile Driving

As described in section 4.6.2.1, Venture Global Calcasieu Pass has completed a preliminary analysis of pile-driving noise impacts on marine mammals. Venture Global Calcasieu Pass proposes to drive 20 96-inch-diameter steel piles, 153 48-inch-diameter steel piles, and 6 20-inch-diameter steel piles; a total of 179 piles for construction of the marine berthing facility. The 96-inch and 48-inch-diameter steel piles would be installed by impact hammer and the 20-inch-diameter piles would be installed with a vibracore tool. The 96-inch and 48-inch-diameter steel piles would be installed at a rate of one per day, with each pile requiring up to 2 hours of impact pile driving. The 20-inch-diameter piles would be installed at a rate of up to two per day, with each pile requiring approximately 2 hours to install.

The proposed plan is a total of 346 hours of impact hammering and 12 hours of vibracoring. A detailed analysis of potential pile driving-related underwater noise impacts on marine mammals is provided in section 4.6.2. That analysis describes the extent of potential injury-level noise impacts for low-frequency and mid-frequency cetaceans using recently revised underwater noise impact assessment guidance developed by the NMFS (NMFS, 2016). This guidance is specifically intended to apply to marine mammal species under NMFS jurisdiction and does not cover manatees and other Sirenians because current understanding of the hearing sensitivity of these species is limited. Manatees are believed to be most similar to mid-frequency cetaceans but generally less sensitive overall (NMFS, 2016).

The hydroacoustic impact analysis indicates that noise levels produced by vibratory pile driving are unlikely to cause injury or significant behavioral alteration. In contrast, impact pile driving would produce underwater noise of sufficient intensity to alter the behavior of mid-frequency cetaceans up to 6.2 miles from the activity, and could potentially cause temporary hearing injury at a distance of up to 4 miles. Impact hammer installation of the 48-inch-diameter piles could permanently injure the hearing of mid-frequency cetaceans occurring within 0.08 mile of construction, and cause temporary injury at a threshold distance of 0.85 mile. Installation of the 96-inch-diameter piles could cause temporary or permanent injury at threshold distances of 4.0 miles and 0.4 mile, respectively. These values assume that the affected individual would remain within the exposure area for an entire day of pile driving activity. While manatees are believed to be less sensitive to noise than mid-frequency cetaceans, these results suggest that manatees occurring in the immediate proximity of the project site could potentially experience sufficient noise exposure to cause temporary or permanent hearing injury. Pile driving noise sufficient to cause behavioral alteration would likely extend several miles from the Project site.

As part of the ESA section 7 consultation process, Venture Global Calcasieu Pass committed to implementing the FWS' *Standard Manatee Conditions for In-Water Work* guidance to avoid and minimize impacts on manatees. Prior to construction, Venture Global Calcasieu Pass would train an EI in the techniques and distances required for marine mammal monitoring. The trained EI would scan the channel waters for marine mammals for 20 minutes prior to the onset of, and continuously during, pile driving activities. Venture Global Calcasieu Pass stated that a buffer zone greater than 50 feet around pile-driving areas would be monitored prior to and during pile driving. If a manatee is spotted in the buffer zone, work would not begin or would be halted until the manatee has left the area or has not been observed in the buffer for 30 minutes. Since Venture Global Calcasieu Pass has not specified a buffer zone or finalized its mitigation, we have included a recommendation (in section 4.6.2) that Venture Global Calcasieu Pass develop a plan to mitigate noise impacts from pile driving activities, which would further minimize impacts on the manatee.

Vessel Collision

Venture Global Calcasieu Pass would minimize impacts on the West Indian manatee by implementing conservation measures recommended by the FWS, including providing training to all personnel associated with the Project during in-water work in areas that potentially support the manatee. Personnel would be instructed about the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees and other marine mammals. Training information would advise contractors and staff that there are civil and criminal penalties for harming, harassing, or killing manatees due to their protection under the MMPA and the ESA. Additionally, personnel would be instructed not to attempt to feed or otherwise interact with the animals. Should a manatee be observed within a 50-foot minimum radius (buffer zone) of the active work area, all work, equipment, and vessel operation would cease until the manatee has left the buffer zone of its own accord or after 30 minutes have passed without additional sightings of the manatee(s) within the buffer zone. If a manatee is sighted in or near the Project area, all construction vessels associated with the Project would operate at "no wake/idle" speeds within the construction area and at all times while in waters where the draft of the vessel provides less than a 4-foot clearance from the bottom; vessels would follow routes of deep water whenever possible. When used, siltation or turbidity barriers would be properly secured, made of material in which manatees cannot become entangled, and monitored to avoid manatee entrapment or impeding their movement. Temporary signs concerning manatees and other marine mammals would be posted prior to and during all in-water Project activities and removed upon completion, in accordance with the FWS guidelines. Finally, personnel would be instructed to call the FWS Louisiana Ecological Services Field Office and the LDWF to report any sightings of or injury to manatees. Construction of the Project would also increase turbidity and sedimentation and remove shallow water habitat in the Project area. In addition, operation of the Project would increase lighting and ship traffic in the Project area. These impacts would also affect manatees in the area.

Based on Venture Global Calcasieu Pass' proposed mitigation discussed above and our recommendation regarding pile driving (section 4.6.2), we conclude that the Project *is not likely to adversely affect* the West Indian manatee.

Whale Species

Seven federally listed whale species occur in the coastal waters off of Louisiana (blue, false killer, fin, humpback, killer, sei, and sperm). Information about the habitat requirements for these species can be found in table 4.7.1-1. We have determined that the noise and vessel traffic associated with construction of the LNG terminal would not affect these whale species. Suitable habitat for these whale species is present along the vessel transit route for the LNG ships. FERC does not have jurisdiction over the vessels and ship routing may change at the discretion of the captain and because of market conditions at the time. While the only potential impact on these species is outside of FERC's jurisdiction, the applicant has committed to some mitigation measures (outlined below) to help minimize the potential for vessel/whale interactions.

These species inhabit the offshore waters of the Gulf of Mexico and the open ocean and would only be potentially affected by the transit of LNG vessels during operation of the facility. To address the potential impacts associated with offshore spills of fuel, lubricants, or other hazardous materials, LNG carriers are required to develop and implement a SOPEP which includes measures to be taken when an oil pollution incident has occurred or a ship is at risk of one. To help reduce the risk of strikes or other potential disturbances associated with the presence of construction vessels, Venture Global Calcasieu Pass would adhere to the measures outlined in the NMFS' *Vessel Strike Avoidance Measures and Reporting for Mariners* (revised February 2008). Therefore, we conclude that the Project *may affect, but is not likely to adversely affect* federally listed whales.

4.7.1.2 Birds

Red Knot

The red knot is a federally threatened shorebird that breeds in the central Canadian arctic but is found in Louisiana during spring and fall migrations, and during the winter months (generally September through March). During migration and on their wintering grounds, red knots forage along sandy beaches, tidal mudflats, salt marshes, and peat banks. They roost on high sand flats, reefs, and other sites protected from high tides. In wintering and migration habitats, red knots commonly feed on bivalves, gastropods, and crustaceans. Major threats to this species along the Gulf of Mexico include the loss and degradation of habitat due to erosion, shoreline stabilization, and development; disturbance by humans and pets; and predation (FWS, 2014).

Because the red knot does not breed in the Gulf region, construction-related impacts on this species would primarily be limited to temporary displacement from areas of active construction. This species is mobile and would likely avoid areas of ongoing construction activity during migration and wintering. Construction and operation related impacts would be similar to what is described for wildlife in section 4.6.1.2. Impacts on this species would primarily result from the permanent loss of 189.1 acres of coastal wetlands on the Terminal facility site. As discussed in section 4.6.1.2, the wildlife habitat provided by the Terminal site's wetlands has been degraded from past disturbance, including cattle grazing and the placement of fill. Further, Venture Global would provide compensatory mitigation for wetland loss through consultation with the USACE as part of the sections 404 and 401 CWA permitting.

The Project would result in the permanent loss of 1.4 acres of wetlands as a result of construction of the Pipeline's aboveground facilities and access roads. Venture Global would provide compensatory mitigation for permanent wetland loss through consultation with the USACE as part of the sections 404 and 401 CWA permitting. Wetland impacts from pipeline construction would be temporary and wetlands would be restored following pipeline installation in accordance with Venture Global's Project-specific Procedures.

Based on the lack of quality foraging habitat on the Terminal site, the wetland mitigation that would be provided through the requirements of the CWA, the restoration of temporary impacts from pipeline installation in accordance with the Project-specific Procedures, the abundance of suitable wetland habitat in this region for foraging during construction and the species ability to avoid the Project area, we conclude that the Project *is not likely to adversely affect* the red knot.

Piping Plover

The piping plover is a federally and state-listed threatened species that occurs in the Project area. Critical habitat for this species has been designated along the Louisiana coast. Piping plovers winter in Louisiana and feed at intertidal beaches, mudflats, and sand flats with sparse emergent vegetation. The primary threats on this species are destruction and degradation of wintering habitat, habitat alteration through shoreline erosion, woody species encroachment of lake shorelines and riverbanks, and human disturbance of foraging birds.

Designated critical habitat, including critical foraging and wintering habitat, for the piping plover occurs along the beach shoreline of the Gulf of Mexico south of the Terminal site. The Project would not directly impact this habitat; however, portions of this habitat occur approximately 250 feet from the Project's construction workspaces. Construction and operation related impacts would be similar to what is described for wildlife in section 4.6.1.2. Because the piping plover does not breed in this region, construction-related impacts on this species would primarily be limited to temporary displacement from foraging/wintering due to noise in the vicinity of active construction on the southern portions of the Terminal facility. This species is mobile, and would likely avoid areas of ongoing construction activity. The Project would not result in the permanent loss of suitable piping plover habitat. Operation of the LNG facility 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 Calcasieu River Ship Channel, most wildlife in the area are acclimated to the noise and artificial lighting associated with these activities. Therefore, we conclude that the Project *is not likely to adversely affect* the piping plover. There would be *no effect* on piping plover designated critical habitat because no part of the Project is located in this habitat.

4.7.1.3 Fish

Gulf Sturgeon

The FWS' Information, Planning, and Conservation database indicates that the Gulf sturgeon may occur in the Project area. The Gulf sturgeon is a federally and state-listed threatened subspecies under the joint jurisdiction of the NMFS and FWS.[18] This anadromous fish inhabits coastal rivers from Louisiana to Florida during warmer months and the Gulf of Mexico and its estuaries and bays in cooler months. Gulf sturgeon are typically 4 to 8 feet long, weigh up to 200 pounds, and can live for up to 60 years, though the average lifespan is 20–25 years. Gulf sturgeon are bottom feeders, and eat primarily macroinvertebrates, including brachiopods, mollusks, worms, and crustaceans. Foraging occurs in brackish or marine waters of the Gulf of Mexico and its estuaries. Sturgeons do not forage in riverine habitat. Gulf sturgeons migrate into rivers to spawn in the spring; spawning occurs in freshwater in areas of clean substrate composed of rock and rubble. Their eggs are sticky, sink to the bottom, and adhere in clumps to clean surfaces such as snags and outcroppings. Threats to Gulf sturgeon were historically overfishing, but today the threats include construction of water control structures that exacerbate habitat loss, dredging, groundwater

[18] NMFS has jurisdiction in the estuarine environment for consultations and full jurisdiction in the marine environment. The FWS has jurisdiction in the estuarine environment and full jurisdiction in fresh water (68 FR13370). NMFS would have jurisdiction over this species for this Project.

extraction, irrigation, flow alterations, poor water quality, and contaminants, primarily from industrial sources (NMFS, 2014).

Gulf sturgeon have been found in the bays, estuarine areas, and Gulf of Mexico during the overwintering period. While in the bays, they show a preference for sandy shoreline habitats with water depths less than 11 feet. Gulf sturgeon overwintering in the Gulf of Mexico were generally in near-shore areas, from 0.5 to 2 miles from shore at water depths of 15 to 40 feet (FWS, 2015c). In Louisiana, Gulf sturgeon spawning habitat is limited to freshwater rivers in the southeastern portion of the state; most records of the Gulf sturgeon are from outside the Project area in the Pearl, Bogue Chitto, and Tchefuncte Rivers, although it is likely to be found in any large river in the Lake Pontchartrain drainage (LDWF, 2015d). There are no known records of Gulf sturgeon in the Calcasieu River (LDWF, 2014b). Gulf sturgeon' occurrence within the Calcasieu River Ship Channel is highly unlikely, and its presence in the Project area would only be incidental due to the Terminal site's proximity to potential overwintering habitat in the Gulf of Mexico.

While the presence of the Gulf sturgeon in the Project area would be rare and incidental, the potential presence of Gulf sturgeon in the Project area cannot be completely ruled out. Therefore, we conclude that the Project *is not likely to adversely affect* the Gulf sturgeon.

4.7.1.4 Sea Turtles

Five species of federally listed sea turtles under the joint jurisdiction of the NMFS and the FWS inhabit the Gulf of Mexico.[19] These sea turtles occasionally occupy inlets and shallow bays, occurring on land only to nest on sandy beaches. There are no documented nesting occurrences in the Project area; the nearest documented nesting occurrence is greater than 70 miles west of the Project (SWOT 2018). No suitable nesting habitat would be impacted by the proposed Project. Potential impacts on sea turtles would be related to dredging operations, LNG carrier strikes with swimming turtles, and noise from pile driving during construction of the berthing docks. Potential impacts are discussed in more detail below.

Loggerhead Sea Turtle

Loggerhead sea turtles are a federally and state-listed threatened species. In the Atlantic, the range of the loggerhead sea turtle extends from Newfoundland to Argentina. Although the major nesting concentrations in the U.S. are found from North Carolina through southwest Florida, minimal nesting occurs outside of this range westward to Texas and northward to Virginia (NMFS, 2015b). The greatest threats to this sea turtle are erosion of barrier islands on which the species nest; take of eggs, young, and adult turtles as food for people; incidental take of turtles by fishing and shrimping gear; and coastal land loss (LDWF, 2015e). Loggerhead sea turtles inhabit continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters.

In the southeastern U.S., mating takes place from late March to early June and eggs are laid between late April and early September. Loggerheads nest on ocean beaches, generally preferring high energy, relatively narrow, steeply sloped, coarse-grained beaches. The eggs incubate for approximately 2 months between late June and mid-November. Loggerhead hatchlings move from their nest to the sea and often float on sargassum masses for 3 to 5 years. Juveniles occupy near-shore and estuarine habitats and continue maturing until adulthood (NMFS, 2015b). The young feed on prey such as gastropods, crustacean fragments, and sargassum.

[19] FWS has jurisdiction over nesting beaches and NMFS has jurisdiction over the marine environment.

Adults occupy a variety of habitats that range from turbid bays to clear water, foraging mainly on the bottom on whelks and conch, though they may also feed on jellyfish from the surface. Loggerheads generally inhabit warm water over the continental shelf and regularly enter marshes, estuaries, and coastal rivers. In Louisiana, this species has been found throughout the coastal region, but nesting has only been recorded on the Chandeleur Islands (LDWF, 2015e). Suitable nesting habitat is not available at or near the Project site; therefore, we conclude no impacts on nesting habitat or nesting behavior would occur from this Project.

Green Sea Turtle

Green sea turtles are a federally and state-threatened sea turtle that are found throughout the warmer waters of the world. Preferred habitats include shallow water bays, estuaries, and shoals containing an abundance of submerged aquatic vegetation. The greatest threats to this species are harvesting of eggs, young, and adults for food; erosion of barrier islands and other loss of seagrass beds; development of beachfront property; and incidental capture in fishing gear (LDWF, 2015f).

Females generally nest in the summer between June and September, with peak nesting occurring in June and July. Females lay eggs on the same beaches where they were born ("natal" beaches). After emerging from the nest, hatchlings swim to offshore areas, where they are believed to live for several years, feeding close to the surface on a variety of pelagic plants and animals. Once the juveniles reach a certain age/size range, they leave the pelagic habitat and travel to nearshore foraging grounds; adults are almost exclusively herbivores, feeding on seagrasses and algae (NMFS, 2015b).

In U.S. Atlantic and Gulf of Mexico waters, green turtles are found in inshore and nearshore waters from Texas to Massachusetts, the U.S. Virgin Islands, and Puerto Rico (NMFS, 2015b). In Louisiana, this species is relatively rare, with most sightings from the eastern coast. There are no known nesting records of this species in Louisiana (LDWF, 2015f). Therefore, we conclude no impacts on nesting habitat or nesting behavior would occur from this Project.

Leatherback Sea Turtle

Leatherback sea turtles are a federally and state endangered species. They are the largest turtle in the world, and the only sea turtle that doesn't have a hard, bony shell. They spend most of their time in the open ocean, but they also forage in coastal waters; jellyfish are the primary food source of adults. Leatherbacks are the most migratory and wide ranging of sea turtle species, and are distributed worldwide in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans (NMFS, 2015b). Threats to this species include harvesting of eggs and turtles for food and/or oil, incidental capture in fishing gear, ingestion of indigestible materials such as plastics, and beach erosion resulting in loss of nesting habitat (LDWF, 2015g).

Leatherbacks mate in the waters adjacent to nesting beaches and along migratory corridors. Females nest on coastal beaches and barrier islands, and prefer sandy beaches with a deepwater approach for nesting. Leatherbacks have been known to nest in Georgia and South Carolina, but only on rare occasions. There are also historic records of nesting on Padre Island, Texas, but no nesting has been reported since the 1930s. Leatherback nesting was once considered extremely rare, but the leatherback is now known to nest regularly in small numbers on Florida's east coast and nesting has been reported on the west coast and in south Florida. Little is known of the distribution of hatchling or juvenile leatherback turtles (FWS, 1999). Based on the lack of suitable nesting habitat crossed by the Project and the absence of known nesting sites in Louisiana for this species, we conclude no impacts on nesting habitat or nesting behavior would occur from this Project.

Hawksbill Sea Turtle

Hawksbill sea turtles are a federally and state-listed endangered species. They frequent warm, shallow water habitats such as bays, shoals, seagrass beds, estuaries, and coral reefs where sponges, their primary food source, are abundant. They are found in warm water regions worldwide. In Louisiana and other coastal regions of the Gulf of Mexico, this is one of the most infrequently encountered sea turtles and is considered one of the most endangered sea turtles. Threats to this species include harvesting of eggs and adults for food or tortoise shell; loss of coral reefs; and erosion of barrier islands and other factors that decrease available seagrass beds (LDWF, 2004; NMFS, 2015b).

Female hawksbills are solitary nesters and return to the beaches where they were born every 2 to 3 years to nest. Nesting habitat includes exposed sandy beaches. Because of its inclination to nest in small isolated areas, there are no reliable estimates of history or current abundance (LDWF, 2004). The most significant nesting within the U.S. occurs in Puerto Rico and the U.S. Virgin Islands; nesting also occurs on other beaches in the Caribbean islands. Within the continental U.S., nesting is restricted to the southeast coast of Florida and the Florida Keys, but nesting is rare in these areas (NMFS, 2015b). Based on the lack of suitable nesting habitat crossed by the Project and the absence of known nesting sites in Louisiana for this species, we conclude no impacts on nesting habitat or nesting behavior would occur from this Project.

Kemp's Ridley Sea Turtle

Kemp's ridley sea turtles are federally and state-listed as endangered. They inhabit warm bays and coastal waters, tidal rivers, estuaries, and seagrass beds, and are typically found near the bottom where they feed on a variety of aquatic animals, such as crustaceans, mollusks, fish, jellyfish, squid, and sea stars. Kemp's ridleys are distributed throughout the Gulf of Mexico and U.S. Atlantic seaboard, from Florida to New England. Threats to this species include harvesting of eggs and adults for food, and incidental catch in fishing gear (LDWF, 2015h).

Kemp's ridleys display one of the most unique synchronized nesting habits in the natural world. Large groups of individuals gather off a particular nesting beach near Rancho Nuevo, Mexico in the State of Tamaulipas. Then waves of females come ashore and nest in what is known as an "arribada." Nesting occurs in May to July, and the eggs incubate for 50 to 60 days. Approximately 95 percent of nesting occurs at one confirmed arribada in the State of Tamaulipas, Mexico; nesting also occurs near Veracruz, Mexico and in Texas, but on a much smaller scale, and occasional nesting has been documented in North Carolina, South Carolina, and Florida. Newly emerged hatchlings enter the water and swim immediately to the open ocean to escape near shore predators. Some hatchlings remain in currents within the Gulf of Mexico, while others may be swept out of the Gulf and into the Atlantic Ocean by the Gulf Stream. Juveniles drift on floating sargassum seaweed for approximately 2 years before returning to neritic zones of the Gulf of Mexico or northwestern Atlantic Ocean to feed and develop until they reach adulthood (NMFS, 2015b).

Although this species does not nest in Louisiana, the estuarine and offshore waters of Louisiana may provide key feeding and developmental sites. In addition, some of the deepwater channels and estuaries in Louisiana may provide important hibernation sites (LDWF, 2015h). However, based on the lack of suitable nesting habitat crossed by the Project and the absence of known nesting sites in Louisiana for this species, we conclude no impacts on nesting habitat or nesting behavior would occur from this Project.

Sea Turtle Impacts

Due to the specific nesting habitat requirements that are absent in the Project area, sea turtles would not likely be present onshore within the Project area; therefore, no direct impacts on sea turtles would be anticipated from land-based construction activities. Further, due to the absence of known nesting locations in the Project area for any of the listed sea turtles and the lack of suitable nesting habitat in the vicinity of the Project, we conclude indirect impacts on nesting behavior would not occur from construction or operational noise or lighting. In general, sea turtles would be rare visitors to the Project area. However, they may be occasional visitors to the Calcasieu River Ship Channel. Potential impacts on sea turtles from the Project may result from dredging activities, vessel strikes, and pile driving.

Dredging impacts on sea turtles may include entrainment of adults, subadults, and juveniles and disruption of foraging grounds. Impacts on sea turtles from dredging have been well documented. Between 1980 and 2011, there were 693 documented sea turtle takes by hopper dredges; 68 percent of these were loggerheads, 12 percent were green sea turtles, 11 percent were Kemp's ridley, and 9 percent were unknown. The USACE implements the following protection methods to reduce the likelihood of a take: minimization of hopper use; timing restrictions; use of draghead turtle deflectors; reduction of pumps in water column; and relocation trawling. Since the implementation of many of these protection methods in 1992, the USACE has substantially reduced the average annual turtle takes per project from 13.8 between 1980 and 1991 to 0.8 between 1992 and 2008 (Dickerson, 2009). Venture Global Calcasieu Pass does not propose the use of a hopper dredge as part of this Project, which substantially minimizes the potential to impact sea turtles. Instead, dredging would be accomplished through the use of a hydraulic suction cutter head. Dredging activities during construction would be temporary and local in nature because dredging would be confined to the proposed turning basin and marine berths, and maintenance dredging would only occur about every 2 years. Activities at dredge spoil placement areas would similarly not affect sea turtles because suitable nesting areas are not present in the placement areas.

Many of the sea turtles have feeding, swimming, or resting behaviors that keep them near the surface, where they may be vulnerable to vessel strikes, especially if the turtles are cold-stunned from cold weather events. To help reduce the risk of strikes or other potential disturbances associated with the presence of construction vessels, Venture Global Calcasieu Pass would adhere to the measures outlined in the NMFS' *Vessel Strike Avoidance Measures and Reporting for Mariners* (revised February 2008).

Pile driving noise has the potential to affect sea turtles. Although sea turtles would be expected to largely avoid the Project area during pile driving activities, a potential exists for sea turtles to be injured during the first several strikes of the pile driving hammer, especially if the turtles are cold-stunned from cold weather events. FERC has included a recommendation (in section 4.6.2) that Venture Global Calcasieu Pass develop a plan to mitigate noise impacts from pile driving activities, which would further minimize impacts on sea turtles.

If the rare occurrence of the species were to overlap with the rare incidence of a spill, a turtle could be at risk due to effects on respiration, skin, blood chemistry, and salt gland function. To address the potential impacts associated with offshore spills of fuel, lubricants, or other hazardous materials, LNG carriers are required to develop and implement a SOPEP which includes measures to be taken when an oil pollution incident has occurred or a ship is at risk of one.

With adherence to the mitigation measures identified above and our recommendation, we conclude that the Project *is not likely to adversely affect* federally listed sea turtles.

4.7.1.5 Conclusion

As noted in table 1.6.8-1, the FWS provided concurrence to Venture Global dated September 24, 2016, and November 1, 2016 for species under FWS jurisdiction in the Project area (i.e., West Indian manatee, piping plover, and red knot). However, because this correspondence is more than one year old, this clearance should be updated with the FWS to confirm that no new species have been listed that could be present in the Project area. In addition, ESA consultation with the NMFS is not yet complete. Therefore, **we recommend that:**

- **Venture Global should not begin construction of the Project facilities until:**

  a. the FERC staff receives comments from the FWS/NMFS regarding the proposed action;

  b. the FERC staff completes any necessary ESA section 7 consultation with FWS/NMFS; and

  c. Venture Global has received written notification from the Director of the OEP that construction and/or use of mitigation may begin.

4.7.2 State-Listed Threatened and Endangered Species

In letters dated February 3, 2015 and August 30, 2016, the LDWF noted the following wildlife species of concern in the Project area: piping plover (*Charadrius melodus*), Wilson's plover (*Charadrius wilsonia*), snowy plover (*Charadrius alexandrinus*), and diamondback terrapin (*Malaclemys terrapin*). Piping plover is a federally and state-listed threatened species and is discussed in section 4.7.1.2. Both the Wilson's and snowy plovers are considered critically imperiled to imperiled in the state, and diamondback terrapin is considered rare in the state; however, they are not listed as state threatened or endangered and their state ranking does not afford them protection under Title 56 of the Louisiana Revised Statues: Wildlife and Fisheries. A discussion of these species is therefore included with wildlife in section 4.6.1.3. LDWF also notes six plant species in the Project area that are critically imperiled to imperiled, including saltflat grass (*Monanthochloe littoralis*), narrow-leaved puccoon (*Lithospermum incisum*), punctate cupgrass (*Eriochloa punctata*), sea oats (*Uniola paniculata*), wedge-leaf prairie-clover (*Dalea emarginata*), and woolly honeysweet (*Tidestromia lanuginosa*). These species are not state threatened or endangered; therefore, they are discussed in the vegetation section (section 4.5).

4.8 LAND USE, RECREATION, AND VISUAL RESOURCES

4.8.1 Terminal Facilities

4.8.1.1 Land Use

Venture Global Calcasieu Pass leased the Terminal property and would construct its facilities on primarily undeveloped land approximately 1.5 miles south-southwest of the Town of Cameron and on the eastern shore of the Calcasieu River Ship Channel. The Terminal would be on land bounded by coastal terrain fringing the Gulf of Mexico to the south, and undeveloped land and coastal marshlands to the north and east.

Existing land uses at the 828.6-acre site consist primarily of agriculture and herbaceous land, and emergent wetland. Approximately 464.6 acres would be affected by constructing the Terminal facilities, including the on-site and off-site areas. Approximately 314 acres would be permanently impacted by the operation of the Terminal facilities. Venture Global Calcasieu pass would return approximately 99.2 acres on-site to preconstruction conditions following construction. Details regarding acreage impacts on land use are provided in table 4.8.1.1-1.

A total of 94.1 acres would be excavated or dredged to construct the berthing area and the ship turning basin. Approximately 29.3 acres of land would be excavated and 64.8 acres of existing water bottom would be dredged along the eastern edge of the Calcasieu River Ship Channel to construct the berthing facility. Approximately 5 million yd^3 of soil would be excavated or dredged to construct the LNG berthing area as well as the ship turning basin associated with the berthing area. Venture Global Calcasieu Pass proposes to reuse 716,000 yd^3 of the dredge material as a beneficial use for marsh creation and restoration, and the remaining dredge material for nearshore placement along the West Beach adjacent to the Calcasieu Bar Channel, as discussed in its CMP/BUDM (appendix E).

Venture Global Calcasieu Pass plans to utilize existing dock facilities at the proposed off-site Liberty, Martin, DeHyCo and Baker Hughes Support Centers (figure 1-1) for module loading, heavy equipment loading, barge deliveries, concrete batch plants, storage, laydown, warehousing, and offices during initial site preparation and Project construction. The off-site Mudd Support Center would provide staging areas and off-site construction parking during construction of the Terminal site.

The majority of the Terminal facilities would be located on agricultural and herbaceous land (31 percent), developed land (15 percent), and emergent wetland (44 percent) that is surrounded by open water and land that is currently occupied by or proposed for similar industrial activities. The open water along the Calcasieu Pass Ship Channel that Venture Global Calcasieu Pass would use for the LNG berthing area would remain open water, though it would be dredged to a greater depth to maximize safety relative to ship traffic within the channel. The mitigation of impacts on coastal marshes and wetlands as a result of the construction of the Terminal facilities, including the berthing area, is discussed in section 4.4 of this EIS. Construction of the Terminal would result in a conversion of the existing land use to industrial use. However, due to the industrial use of adjacent land and the previously disturbed nature of the surrounding area, impacts on land use from the Terminal would be minor.

TABLE 4.8.1.1-1

LAND USE REQUIRED TO CONSTRUCT AND OPERATE THE TERMINAL (ACRES)

Facility	Hay / Pasture		Herbaceous		Barren		Developed		Open Water [a]		Wetland [a]		Shrub/Scrub		Total	
	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm
On-Site																
Terminal Site	0.0	1.7	0.0	57.3	0.0	1.9	0.0	8.1	0.0	0.0	0.0	167.1	0.0	33.1	0.0	269.2
Northeast Access Road	0.0	2.5	0.0	0.0	0.0	0.0	0.0	7.9	0.0	0.0	0.0	2.6	0.0	0.0	0.0	13.0
Southwest Service Road	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	1.0
Martin Access Road	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	1.3	0.0	0.0	0.0	1.5
DeHyCo Access Road	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	0.1	0.0
Eastern TWS	59.6	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.7	0.0
Floodwall TWS	2.7	0.0	1.4	0.0	<0.1	0.0	2.1	0.0	0.0	0.0	14.0	0.0	2.8	0.0	23.0	0.0
Southwest TWS	0.0	0.0	0.5	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.6	0.0	0.0	0.0	2.5	0.0
Northeastern TWS	2.2	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	<0.1	0.0	2.7	0.0	5.2	0.0
Northwestern TWS	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	1.2	0.0
Pipeline within Property Boundary	7.4	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.0
Marine Facilities	0.0	0.0	0.0	4.2	0.0	1.0	0.0	5.7	0.0	0.4	0.0	18.0	0.0	0.0	0.0	29.3
Subtotal	*71.9*	*4.3*	*1.9*	*61.8*	*<0.1*	*2.9*	*5.3*	*22.4*	*0.0*	*0.4*	*14.6*	*189.1*	*5.5*	*33.1*	*99.2*	*314.0*
Off-Site																
Liberty Support Facility	4.0	0.0	0.0	0.0	0.0	0.0	13.2	0.0	0.0	0.0	1.5	0.0	3.4	0.0	22.1[b]	0.0
Martin Support Facility	0.0	0.0	0.0	0.0	0.0	0.0	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.5	0.0
DeHyCo Support Facility	0.0	0.0	0.0	0.0	0.0	0.0	9.1	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	9.1	0.0
Mudd Support Facility	0.0	0.0	0.0	0.0	<0.1	0.0	5.3	0.0	1.8	0.0	<0.1	0.0	0.0	0.0	7.1	0.0
Baker Hughes Support Facility	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0
Subtotal	*4.0*	*0.0*	*0.0*	*0.0*	*<0.1*	*0.0*	*40.7*	*0.0*	*1.8*	*0.0*	*1.5*	*0.0*	*3.4*	*0.0*	*51.4*	*0.0*
Total	**75.9**	**4.3**	**1.9**	**61.8**	**<0.1**	**2.9**	**46.0**	**22.4**	**1.8**	**0.4**	**16.1**	**189.1**	**8.9**	**33.1**	**150.6**	**314.0**

Source: USGS, 2012.

[a] These acreages reflect Land Use / Land Cover Data. Field delineated acreages provided in section 4.3.2.

[b] 0.1-acre rounding discrepancy.

4.8.1.2 Existing and Planned Residences and Commercial Developments

The Terminal would be in agricultural/open land and wetlands surrounded by existing wetlands, open land, and industrial and commercial development. There are currently no existing or planned residential or commercial developments within 0.25 mile of the Terminal. The nearest residential property is approximately 0.9 mile east of the Terminal site.

There are both existing and planned industrial developments within the vicinity of the Project. Existing industrial businesses along Davis Road and the Calcasieu River Ship Channel include petrochemical plants, commercial enterprises, and a shrimp-boat dock. The existing petrochemical facilities in the vicinity of the proposed Terminal site include aboveground storage tanks, metal office buildings, temporary office trailers, berthing areas, dock loading arms/cranes, and large graveled parking and laydown areas.

Planned industrial developments within 1 mile of the Terminal site include two LNG liquefaction/export facilities, and associated pipelines. Commonwealth (formerly Waller Point) LNG, LLC and Southern California Telephone and Energy LNG, LLC (SCT&E) are each proposing to construct LNG Terminal facilities along the Calcasieu River Ship Channel within the vicinity of the proposed Project. However, they have not yet initiated pre-filing and therefore their development is speculative at this time. If constructed, these planned developments would increase the industrial setting along the Calcasieu River Ship Channel and surrounding area.

In its scoping comments, the EPA recommended the EIS discuss how the project would conflict with or support land use planning in the project area. Currently there is no zoning or land use plans guiding development within Cameron Parish. The Project is similar to other existing and planned industrial development in the vicinity of the Terminal site; therefore, we believe that the Project would not conflict with land use planning in the Project area.

4.8.1.3 Recreation and Special Interest Areas

All of the land that would be used for the Terminal is privately owned. No federally managed public or conservation lands, including national historic landmarks, national forests, national parks, national recreational trails, national wild and scenic rivers, NWRs, Indian Lands, or wilderness areas have been identified within 0.25 mile of the proposed Terminal. Likewise, no state-managed lands, including historic sites, natural and scenic rivers, state parks, preservation areas, or other state-recognized public areas would be within 0.25 mile of the Terminal. In addition, no public or private conservation easements or land trusts are within 0.25 mile of the proposed Terminal. Venture Global Calcasieu Pass proposes wetland mitigation banking at the South Fork Coastal Mitigation Bank; the marsh creation/restoration is proposed at the East Cove Unit of the Cameron Prairie NWR approximately 3 miles from the Terminal, and managed by the FWS.

Cameron Parish hosts numerous recreational opportunities for birding and wildlife viewing, beach use, boating, camping, hunting, and fishing. The Davis Road Public Boat Launch and the Cameron Jetty Fishing Pier and Recreational Vehicle (RV) Facility are within 0.25 mile of the proposed Terminal. During scoping, several members of the public expressed concern with the Project impacts on the RV facility and jetty pier, and recreation associated with these facilities.

The public boat launch is currently to the southwest of the proposed Terminal footprint. This public access point to the Calcasieu River Ship Channel lies within the Venture Global property boundary and would be removed as a result of the Project. The Jetty Pier and RV facility are also to the southwest of the Terminal site, at the confluence of the Calcasieu River Ship Channel and the Gulf of Mexico. This recreational area features a fishing pier, RV park, playground, beach walkway, observation tower, and pavilion. These facilities would no longer be accessible from Davis Road as a result of the Project.

Venture Global Calcasieu Pass and TransCameron Pipeline entered into a cooperative endeavor agreement (the "CEA") with the Cameron Parish Police Jury on June 21, 2016 (validated September 15, 2016) that contemplates the potential enhancement of recreational opportunities in the town and parish of Cameron. Should the Cameron Policy Jury elect to proceed with development, the CEA allows Venture Global Calcasieu Pass and TransCameron Pipeline to fund the development of 58.1 acres of land, known as the Cameron Development Property. Pursuant to the CEA, the Cameron Police Jury has agreed to support Venture Global Calcasieu Pass and TransCameron Pipeline's efforts to close Davis Road at the northern border of the proposed Terminal site. The Cameron Parish Police Jury intends to relocate the public boat launch from the current location to a new location off of Davis Road. The Cameron Parish Police Jury further intends to develop a new location for the RV facility.

The CEA also addresses the public's use of the existing Jetty Pier Facility. To accommodate waterborne access to the Jetty Pier Facility, the Police Jury would commence the operation and maintenance of a water shuttle service from a potential marina to be developed at the Cameron Development Property to the Jetty Pier Facility. The shuttle service would begin upon the latter of the closure of Davis Road at the commencement of construction of the Project or the completion of the construction of the Cameron Development Property. The Cameron Parish Police Jury has also indicated that the use of the Jetty Pier during construction and subsequent operation would be dependent on the availability of utilities to allow the Jetty Pier to be open for public use. We believe the CEA addresses the Project's potential impacts on the Jetty Pier Facility; however, we have not received an update on consultation since October 2016. Therefore, **we recommend that:**

- **<u>Prior to the end of the draft EIS comment period,</u> Venture Global Calcasieu Pass should file with the Secretary any updates to the Cooperative Endeavor Agreement and any updated correspondence with the Cameron Parish Police Jury, regarding its plans to enhance and/or maintain recreation opportunities in the project area.**

Cameron Parish is home to vital fishery resources as described in sections 4.6.2 and 4.6.3, and serves as a conduit for access to such resources in the Calcasieu River Ship Channel and the Gulf of Mexico. Construction associated with the Terminal may temporarily impact local recreational fishing, bird watching, trapping, hunting, and boating activities. Temporary impact would occur throughout the 35-month construction period. During this time, material and equipment deliveries during construction may delay or impede recreational boat traffic due to increased ship/barge traffic within the Calcasieu River Ship Channel. An estimated 4,028 barge trips would occur during the 35-month construction period. While there would be impacts on numerous recreational resources associated with the construction and operation of the Terminal site, Venture Global indicates that it would mitigate for these impacts through implementation of the CEA as discussed above, thus minimizing impacts on these resources. Due to the proposed mitigation measures proposed by Venture Global, we have determined the Project would not have any significant adverse impacts on recreation, including boating and fishing along the Calcasieu River Ship Channel and Gulf of Mexico.

4.8.1.4 Visual Resources

The degree of visual impact that may result from a Project is typically determined by considering the general character of the existing landscape and the visually prominent features of the proposed facilities. The proposed Terminal would be visible to users of the Calcasieu River Ship Channel, users of the fishing pier and RV facility, and employees of the existing industrial businesses along Davis Road. The facilities associated with the Terminal would likely also be visible to visitors to nearby beaches. While the perimeter berm and wall are proposed for purposes of handling projected maximum flood cresting, they would also help partially obscure the industrial facilities on the Terminal site from offsite views, including partial obstruction of the proposed 200-foot high LNG tank. The perimeter berm and wall are estimated to be approximately 31.5 feet high on three sides of the facility and 26-feet high on the west, dock-side of the site. Due to the existing industrial setting in the area, the visual effect of the new facility would not significantly alter the visual character in the region. Additionally, as the distance to the Cameron Jetty fishing pier and the nearest beach are approximately 1 mile from the proposed Terminal, less of the facility would be visible.

Increased lighting around the Terminal facility would have an influence on visual resources. The surrounding developed areas along the Calcasieu River Ship Channel, including Cameron and the facilities along the channel north of Cameron, are currently heavily lit during the night-time hours. Lighting is integral to the safety of ship navigation, perimeter security, and operational safety and would be shielded and pointed downward so as not to interfere with navigational lighting. Proper installation of lighting fixtures would keep significant light from reflecting off the water and thereby avoid any significant impacts on fish or wildlife (refer also to Section 4.6 Wildlife and Aquatic Resources). The proposed lighting at the Terminal site would be consistent with nearby industrial/commercial facilities and would follow all federal, state, and local ordinances per Venture Global Calcasieu Pass' project specific Facility Lighting Plan.

The remaining land surrounding the proposed Terminal is currently occupied by industrial facilities along the Calcasieu River Ship Channel as well as open marshland and pasture land. Numerous proposed industrial facilities are also planned in the immediate vicinity of the Terminal. Due to the limited recreational use of the surrounding area, the proposed mitigation measures mentioned above for the fishing pier and RV facility, as well as the existing industrial land use on adjacent areas, we have concluded that construction and operation impacts would not have a significant adverse impact on the local viewshed.

4.8.1.5 Coastal Zone Management

The Terminal and the Pipeline 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 CZMP, which is delegated to the states. The Terminal would require a Coastal Use Permit from the LDNR OCM. Consultation for the Coastal Use Permit would be performed throughout the JPA review process and the LDNR would issue its coastal zone consistency determination based on its JPA review. Venture Global submitted its most recent and revised JPA on September 8, 2017; the JPA is currently under review (see table 1.6.8-1). 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 Coastal Use Permit. Venture Global would be required to obtain all relevant federal permits before receiving FERC authorization to proceed with construction. Additionally, **we recommend that:**

- **<u>Prior to construction of the Project</u>, Venture Global should file with the Secretary a copy of the determination of consistency with the Coastal Zone Management Plan issued by the LDNR.**

4.8.1.6 Agricultural and Pasture Land

Construction and operation of the Terminal site would affect approximately 76.2 acres of hay/pasture land. This is approximately 45 percent of the 171 acres of hay/pasture land within the Venture Global property, all of which would be removed from production. Venture Global Calcasieu Pass would compensate landowners for the use of their land and for production loss.

4.8.2 Pipeline Facilities

4.8.2.1 Land Use

The Pipeline associated with the Project would consist of a new 42-inch-diameter lateral natural gas pipeline. The Pipeline would originate near the Town of Grand Chenier at the ANR Interconnect and run west for approximately 23.4 miles toward the proposed Terminal. The entire Pipeline would be within Cameron Parish, Louisiana and collocated, overlapped, or paralleled with existing rights-of-way for approximately 20.1 miles, or 86 percent of the total route. Locations where the pipeline would be collocated with existing rights-of-way are provided in table 4.6.1.3-2.

TABLE 4.8.2.1-1

LOCATIONS WHERE THE PIPELINE WOULD BE COLLOCATED, OVERLAP, OR PARALLELED WITH EXISTING RIGHTS-OF-WAY

Facility / Existing Rights-of-Way	Begin Milepost	End Milepost	Segment Length (miles)
Lateral Pipeline			
Tennessee Gas – 20-inch Pipeline Bridgeline – 16-inch Pipeline Bridgeline – 20-inch Pipeline	0.0	6.0	6.0
Tennessee Gas – 20-inch Pipeline Bridgeline – 12-inch Pipeline Bridgeline – 20-inch Pipeline	6.0	8.3	2.3
Tennessee Gas – 20-inch Pipeline Bridgeline – 16-inch Pipeline Bridgeline – 20-inch Pipeline	8.3	17.3	9.0
ANR – 16-inch Pipeline Tennessee Gas – 6-inch Pipeline Bridgeline – 12-inch Pipeline Bridgeline – 20-inch Pipeline	17.3	20.1	2.8
		Total	**20.1**

Constructing the Pipeline and appurtenant facilities would impact a total of approximately 370.9 acres of land. Land use impacts associated with the Pipeline facilities would include disturbance of existing land use, the creation of new easements, and the conversion of some land to a different land use type. Construction of the Pipeline would require a 110-foot-wide construction work area, which comprises a 50-foot-wide permanent easement for operation and a 60-foot-wide temporary easement for construction. ATWS would be necessary in certain locations along the pipeline routes for setup and construction across roadways, waterbodies, wetlands, and other features that require specialized construction procedures (section 2.6). Pipeline construction and operational impacts on land use are listed in table 4.8.2.1-2.

Construction of the Pipeline, including only the construction right-of-way and ATWS, would impact 349.9 acres of land. Approximately 9.9 acres of access roads would be used during construction. Details on temporary and permanent access roads to be used for the pipeline are listed in table 4.8.2.1-3. Constructing the aboveground facilities associated with the pipeline would impact approximately 1.3 acres. Temporary pipe storage and contractor yards would impact approximately 9.8 acres. No compressor facilities beyond the Terminal would be required for the Project.

Wetlands would be the primary land use impacted by construction of the Pipeline and associated facilities. During pipeline construction, topsoil segregation would occur where appropriate to preserve native seed banks. Surface disturbance in wetlands and open areas would be avoided through use of the

HDD construction method in some areas and minimized by use of the push method in some additional areas. With the exception of lands associated with the permanent aboveground facilities, all lands disturbed during pipeline construction would be restored to preconstruction contours and conditions.

TABLE 4.8.2.1-2

LAND USE AFFECTED BY CONSTRUCTION AND OPERATION OF THE PIPELINE (ACRES) [a]

	Hay Pasture, Cultivated Crops		Herbaceous		Barren		Developed		Open Water		Wetland		Shrub/Scrub		Total	
Facility	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp [b]	Perm [c]
Lateral Pipeline																
Pipeline Facilities	13.9	13.3	3.7	5.2	0.0	<0.1	2.5	3.8	7.8	4.0	111.6	108.0	0.9	0.7	140.4	135.0[d]
Aboveground Facilities (Meter Stations and MLVs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.3
ATWS	2.5	0.0	8.7	0.0	0.0	0.0	1.1	0.0	3.0	0.0	59.2	0.0	0.1	0.0	74.5[d]	0.0
Contractor Yards	0.0	0.0	8.7	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.8	0.0
Access Roads	1.2	0.0	5.1	0.0	0.1	0.0	1.1	<0.1	0.0	0.0	2.2	0.2	0.0	0.0	9.7[d]	0.2
Project Total	**17.6**	**13.3**	**26.2**	**5.2**	**0.1**	**<0.1**	**5.8**	**4.2**	**10.8**	**4.0**	**173.0**	**109.2**	**1.0**	**0.7**	**234.4**	**136.5**

[a] Pipeline workspaces within the Terminal site boundary are removed and included in the Terminal site land use table to not duplicate acreages at Project areas.
[b] Temporary workspace acreage is exclusive of permanent easement acreage.
[c] Acreages at Permanent Easement include HDD areas not affected at the surface as well as temporarily affected lands at the permanent easement and will remain a part of the existing land use at the TransCameron Pipeline easement areas.
[d] A 0.1-acre rounding discrepancy.

TABLE 4.8.2.1-3							
ACCESS ROADS TO BE USED FOR CONSTRUCTION AND OPERATION OF THE PIPELINE							
Access Road ID	Milepost	Temp / Perm	Existing	Improvements Needed	Length (feet)	Width (feet)	Acres
Lateral Pipeline							
East PAR 1	0.0	Permanent	No	Aggregate Fill	35	20	<0.1
East TAR 2	0.1	Temporary	Yes	Timber Matting	840	16	0.3
East TAR 3	0.5	Temporary	Yes	Timber Matting	530	16	0.2
East TAR 4	1.0	Temporary	No	Timber Matting	1,095	16	0.4
East TAR 5	2.8	Temporary	No	Timber Matting	1,675	16	0.6
East TAR 6	3.5	Temporary	Yes	None	1,565	12	0.0
East TAR 7	4.2	Temporary	Yes	None	1,890	12	0.0
East TAR 8	4.9	Temporary	Yes	None	1,400	12	0.0
East TAR 9	6.8	Temporary	Yes	Timber Matting	2,085	16	0.8
East TAR 10	7.9	Temporary	No	Timber Matting	1,460	16	0.5
East PAR 11	8.3	Permanent	Yes	Aggregate Fill	860	12	0.2
East TAR 11	8.3	Temporary	Yes	Timber Matting	860	4[b]	0.1
East TAR 12	9.5	Temporary	No	Timber Matting	1,075	16	0.4
East TAR 13	10.0	Temporary	No	Timber Matting	865	16	0.3
East TAR 14	12.9	Temporary	Yes	None	1,330	12	0.0
East TAR 15	15.2	Temporary	Yes	None	3,065	12	0.0
East TAR 16	15.8	Temporary	Yes	None	2,750	10	0.0
East TAR 17	16.8	Temporary	Yes	May require leveling for final 215 feet	7,020	12	0.1
East TAR 18	17.8	Temporary	Yes	None	10,600	12	0.0
East TAR 19	19.0	Temporary	Yes	Timber Matting	12,150	16	4.4
East TAR 20	19.2	Temporary	No	Timber Matting	1,295	16	0.4
East TAR 21	21.3	Temporary	No	Timber Matting	1,095	16	0.4
East TAR 22	21.6	Temporary	No	Timber Matting	2,000[a]	16	0.8
East TAR 23	23.0	Temporary	Yes	None	4,750	16	N/A[b]
					Total (Temporary)[c]		**9.7**
					Total (Permanent)[c]		**0.2**

[a] 940 feet of TAR 22 length are within the Liberty Support Facility. Impacts are included under Terminal Facilities.
[b] Inside Terminal site.
[c] Does not include area of disturbance where no road upgrades or improvements on existing roads are required for Pipeline construction or operations.
PAR = Permanent Access Road; TAR = Temporary Access Road; CY = Contractor Yard

TransCameron Pipeline would obtain easements from landowners prior to constructing the Pipeline. Easements would give TransCameron Pipeline access to properties and the rights to construct, operate, and maintain the Pipeline and establish a permanent right-of-way. TransCameron Pipeline would compensate landowners for the use of their land. The easement agreements would specify compensation for the loss of use during construction, loss of nonrenewable or other resources, and allowable uses and restrictions on the permanent rights-of-way after construction. These restrictions could include prohibition of construction of aboveground structures including house additions, garages, patios, pools, or any other objects not easily removable; roads or driveways over the pipeline; or the planting and cultivating of trees or orchards within the permanent easement. The areas used as temporary construction right-of-way and ATWS would be allowed to revert to preconstruction uses with no restrictions.

In their scoping comments the EPA recommended the EIS discuss the applicable eminent domain authority for the pipeline. If an easement cannot be negotiated with a landowner and the Project has been certificated by the Commission, TransCameron Pipeline could use its right to eminent domain under section 7(h) of the NGA and the procedure set forth under the Federal Rules of Civil Procedure (Rule 71A) to obtain the right-of-way. This right would apply to all project-related workspace covered by the approval, including the temporary and permanent rights-of-way, aboveground facility sites, contractor yards, access roads, and extra workspaces. TransCameron Pipeline would still be required to compensate the landowner for the right of-way and any damages incurred during construction; however, the level of compensation would be determined by a court according to state or federal law.

TransCameron Pipeline would construct and maintain the Pipeline according to measures contained in its Project-Specific Plan and Procedures. TransCameron Pipeline would maintain vegetation on the permanent right-of-way in non-agricultural areas by mowing, cutting, or trimming, as necessary. All lands affected by pipeline construction, with the exception of lands identified for aboveground facilities, would be restored to preconstruction contours, and would thus not result in a change in land use. The pipeline right-of-way would be allowed to revegetate. TransCameron Pipeline would conduct routine vegetation maintenance along the full permanent pipeline right-of-way no more frequently than every 3 years. However, to facilitate periodic corrosion/leak surveys, TransCameron Pipeline would clear a corridor not exceeding 10 feet in width centered on the pipeline at a frequency necessary to maintain the 10-foot corridor in an herbaceous state.

4.8.2.2 Existing and Planned Residences and Commercial Developments

There are no existing residences within 50 feet of the construction work area for the Pipeline. Although two non-residential buildings and/or other aboveground structures were identified within 50 feet of the pipeline construction workspaces, they are associated with existing oil and gas facilities, including an aboveground portion of an existing oil and gas facility immediately adjacent to and east of the proposed meter station at MP 0.0. The proposed Pipeline would be in close proximity (approximately 100 feet away) from a fire station and would cross a portion of its associated parking lot near MP 8.1, off of LA-1143. The parking lot is proposed to be crossed via the HDD method and would not be impacted by construction. Residences were identified along proposed construction access roads. TransCameron Pipeline would work with those landowners to ensure that any additional impacts would be appropriately mitigated. No planned commercial or industrial developments are within 0.25 mile of the Pipeline. Therefore, the Pipeline would not adversely impact existing residences or planned developments.

4.8.2.3 Recreation and Special Interest Areas

No federal or state wildlife refuges are within 0.25 mile of the proposed pipeline route. The Creole Nature Trail National Scenic Byway would be crossed twice by the Pipeline (at MP 8.6 and MP 21.3). The Creole Nature Trail is classified as an “All-American Road,” the highest designation of national scenic byways. The National Scenic Byways Program is part of the DOT Federal Highway Administration and was established to help recognize, preserve and enhance selected roads throughout the United States. Locally, the road is promoted by the Southwest Louisiana/Lake Charles Convention and Visitors Bureau to highlight Cajun culture and wildlife found in the bayous and marshes of SWLA. Physical disturbance to this roadway would be avoided by use of the HDD construction technique at each crossing location. The viewshed adjacent to the Creole Nature Trail Scenic Byway would only be temporarily impacted during the construction of the Pipeline because the pipeline would be buried and no forest would be cleared, allowing the landscape to return to preconstruction conditions. HDD entry and exit pits would be set back between 500 and 1,500 feet from the byway.

Apart from The Creole Nature Trail Scenic Byway mentioned above, no federally managed public or conservation lands, including national historic landmarks, national forests, national parks, national recreational trails, national wild and scenic rivers, NWRs, Indian Lands, or wilderness areas have been identified within 0.25 mile of the proposed Pipeline. Likewise, no state-managed lands, including historic sites, natural and scenic rivers, state parks, preservation areas, or other state-recognized public areas would be within 0.25 mile of the Pipeline. In addition, no public or private conservation easements or land trusts are within 0.25 mile of the proposed Pipeline.

Cameron Parish offers many recreational opportunities for birding and wildlife viewing, beach use, boating, camping, hunting, and fishing. The closest beaches near the Pipeline are over 2 miles away and are therefore not likely to be impacted during construction or operation of the Pipeline.

While several RV camping sites are in Cameron Parish, none are within 0.25 mile of the proposed Pipeline. The nearest RV parks, Cameron Oaks RV Park and Olive's RV Camper Park, are 0.7 mile east and 0.9 mile southwest of the Pipeline. Other than potential use of these parks by workers (discussed in section 4.9.6 below), these sites are not likely to be impacted during construction or operation of the Pipeline.

Besides the recreational beaches and RV parks along the coast, outdoor activities such as fishing and hunting are offered on public and private lands within Cameron Parish. Public hunting primarily occurs on NWRs; none of which are within 0.25 mile of the proposed Pipeline. The nearest refuge is the CPNWR East Cove Unit located 0.6 mile north of the Pipeline.

Pipeline construction impacts would be short-term and confined to the period of active construction, which would be limited to several days up to several weeks in any one area. Once pipeline construction is completed, TransCameron Pipeline would restore the disturbed right-of-way to preconstruction conditions. The majority of the proposed Pipeline would be collocated with other utilities; therefore minimizing the likelihood of impacting recreational opportunities in the vicinity of the construction activities. No recreational use areas would be crossed by pipeline construction. Due to the temporary nature of pipeline construction, the proximity of the proposed construction to known recreational areas, collocation of the proposed pipeline route, and restoration/revegetation of the Pipeline expected to occur within 2-4 years, we conclude that construction and operation of the Pipeline would be short-term and would not adversely impact recreation or special use areas.

4.8.2.4 Visual Resources

Constructing and operating the Pipeline may impact visual resources by altering the terrain and vegetation patterns during construction or right-of-way maintenance and from the presence of new aboveground facilities. The landscape setting along the proposed pipeline route is generally flat. The majority of the proposed pipeline route would be within marshland and/or adjacent to existing rights-of-way, which would not alter the landscape of the region.

As mentioned above in section 4.8.2.3, construction of the Pipeline could result in a temporary visual impact within the viewshed of the Creole Nature Trail National Scenic Byway. Impacts within this viewshed and other visual resources due to the pipeline would be primarily temporary and short-term, occurring during construction. The terrain over the majority of the Project area is flat; therefore, during construction, the cleared and graded right-of-way, as well as construction equipment, would be visible from nearby residences and local roads. The Project area is not forested; therefore, no visual corridor would be created as a result of the pipeline installation. Following the completion of construction activities, TransCameron Pipeline would restore areas disturbed by construction and allow activities that previously occurred in the area to resume. Therefore, the construction and operation of the Pipeline would not result in long-term visual impacts.

TransCameron Pipeline would also install a meter station and MLV along the pipeline right-of way. The meter station would be installed adjacent to an existing industrial facility. The MLV would be within the permanent pipeline right-of-way and would utilize a relatively small footprint. Visual screening is not planned at the meter station or the MLV location. Because the meter would be collocated with existing aboveground facilities, the MLV would be relatively small, and the nearest residence is located over 0.25-mile away, we conclude that the visual impact of the aboveground facilities would not have a significant impact on the aesthetics of the landscape along the Pipeline route.

The majority of the land impacted by the Pipeline would be allowed to revert to preconstruction conditions following completion of construction. Some areas, including those used for aboveground facilities, would permanently convert to an industrial use. The implementation of the measures discussed above, including collocation of the majority of the Pipeline, would result in minimization of impacts on land use. Most impacts on visual resources would be temporary and associated with the construction phase of the Pipeline.

Construction and operation of aboveground facilities would have a minor impact on visual resources. Overall, land use, recreation, and visual resource impacts associated with the Pipeline would be minor.

4.8.2.5 Coastal Zone Management

The Pipeline would be within the Louisiana CZMP jurisdiction. All activities or developments that may affect Louisiana's coastal zone require a federal consistency review under the National CZMP. The entirety of the lateral would be within the Louisiana Coastal Zone Management Boundary and would require a Coastal Use Permit from the LDNR OCM. Venture Global submitted its most recent and revised JPA on September 8, 2017; the JPA is currently under review (see table 1.6.8-1). TransCameron Pipeline agrees to construct and operate the Pipeline in compliance with conditions set forth in our authorization, the USACE section 404/10 and 408 permits, and the LDNR OCM's Coastal Use Permit. As with the Terminal facilities, Venture Global Calcasieu Pass would be required to obtain all relevant Federal permits before receiving FERC authorization to proceed with construction and file the CZMP Determination and approval with the Secretary (see condition in section 4.8.1.5).

4.8.2.6 Agricultural and Pasture Land

Construction of the Pipeline would temporarily affect agricultural land; however, these lands would be allowed to revegetate and return to preconstruction conditions and uses. Therefore, no significant long-term impact on agricultural lands is anticipated, as overall production should not be affected beyond the construction season.

4.9 SOCIOECONOMICS

Construction and operation of the LNG Terminal and Pipeline could impact socioeconomic conditions, either adversely or positively, in the general vicinity of the proposed facilities. These potential impacts include increased population levels, increased employment opportunities, increased demand for housing and public services, increased traffic on area roadways and waterways, and an increase in government revenue associated with sales and payroll taxes.

Although all of the Project facilities are proposed in Cameron Parish, these socioeconomic impacts may affect the surrounding parishes and counties, including Calcasieu and Jefferson Davis Parishes in Louisiana, and Orange and Jefferson Counties in Texas. For the purposes of our socioeconomic analysis, these five parishes and counties constitute the affected environment and are defined as the “Project area” or “Project Study Area.”

4.9.1 Population

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

The U.S. Census Bureau (U.S. Census Bureau, 2015a) reported that in 2014, the population of Calcasieu Parish was 197,204, with a population density of 183.5 persons per square mile. The average population density for Louisiana in 2014 was 107.1 persons per square mile.

Venture Global Calcasieu Pass estimates that construction of the Terminal site would require an average of 1,275 workers over approximately 38 months with an estimated peak of 1,410 workers. Construction of the Pipeline would require an estimated 150 workers over approximately 10 months, peaking at 200 workers. Construction schedules for the Terminal site and Pipeline would likely overlap with the total number of workers on the Project averaging 1,425 and peaking at 1,610 workers. During operation, Venture Global Calcasieu Pass anticipates adding approximately 130 full-time positions to operate the Terminal site facilities. No additional employees are anticipated for the Pipeline. The Project workforce and anticipated construction schedules for the Terminal and Pipeline are summarized in table 4.9.1-2.

TABLE 4.9.1-1

EXISTING SOCIOECONOMIC CONDITIONS IN THE PROJECT AREA

	Population		Population Density (per square mile)		Per Capita Income	Civilian Labor Force	Unemployment Rate (percent)	Top Two Major Industries [a]
State/ Parish	2000 [b]	2014 [c]	2000 [b]	2013 [c]	2013 [c]	July 2014 [d]	July 2014 [d]	2013 [c]
Cameron	9,991	6,679	7.7	5.2	$29,559	3,510	4.8	1) Agriculture 2) Construction
Calcasieu	183,577	197,204	172.5	183.5	$24,355	94,601	5.9	1) Agriculture 2) Construction
Jefferson Davis	31,435	31,477	48.2	48.1	$21,132	13,603	5.9	1) Agriculture 2) Retail Trade
Orange	84,966	83,433	254.6	248.6	$24,946	38,114	7.9	1) Manufacturing 2) Retail Trade
Jefferson	252,051	252,235	287.6	287.9	$23,236	111,452	8.2	1) Manufacturing 2) Retail Trade
Louisiana	4,468,976	4,649,676	102.6	107.1	$24,442	2,157,232	6.4	1) Retail Trade 2) Entertainment [e]

[a] Excludes Education and Health Service industry, which is the number one industry group for the Project area.
[b] From U.S. Census Bureau (2000).
[c] From U.S. Census Bureau (2015b).
[d] From Louisiana Workforce Commission (2015), Texas Workforce Commission (2015).
[e] Entertainment refers to the Entertainment Accommodation and Food Services industry.

TABLE 4.9.1-2 NUMBER OF WORKERS DURING PROJECT CONSTRUCTION AND OPERATION				
Facility	Average Number of Workers During Construction	Number of Workers at Peak Construction	Total Duration (months)	Number of Permanent Workers During Operation
Terminal Site	1,275	1,410	35	130
Pipeline	150	200	10	0
Total	**1,425**	**1,610**	**N/A**	**130**

The total population change would equal the total number of non-local workers, plus any family members accompanying them, that move into the area. As discussed further in sections 4.9.2 and 4.9.6, Venture Global would attempt to utilize predominantly local workers during construction, but in a worst case scenario of all non-local workers, the increase to the total population in the Project area as a result of Project construction would be less than 1 percent. Once the Project is in operation, the workforce and their families would represent a minor but permanent increase in the population in the vicinity of the Terminal.

As part of a comprehensive public outreach program, representatives from Venture Global have met with agencies (federal, state, and local); landowners; elected officials (federal, state, parish, and local); tribes; community leaders; agricultural, business, and civic groups; and nongovernmental organizations. In addition, Venture Global representatives have met with Lake Charles Pilots, Inc., Cameron Parish officials, the SWLA Economic Development Alliance,[20] and regional community leaders to address the potential impacts of construction and operation of the Project. The community leaders have expressed support for the Project, citing job opportunities that would allow residents displaced by Hurricanes Rita (2005) and Ike (2008) to return home (Kidder, 2014).

Constructing the Project would result in a short-term, minimal increase to the population in the Project area, and operating would result in a slight permanent increase that is consistent with growth plans for SWLA. Therefore, we determined the Project, as a whole, would not significantly affect local population size.

4.9.2 Economy and Employment

Table 4.9.1-1 above provides selected employment and income statistics for the Project area. The top industry group in the Project area and state is education and health. Agriculture, construction, retail, and manufacturing are the other top industries in the Project area.

The estimated (2014) civilian labor workforce for the Project area is a combined total of 261,280, the majority of which resides in Calcasieu Parish, Louisiana (36.2 percent) and Jefferson County, Texas (42.7 percent) (Louisiana Workforce Commission, 2015; Texas Workforce Commission, 2015). The number of unemployed persons is estimated as 18,784, which is 7.2 percent of the total civilian workforce in the Project area. This rate is higher than the percent unemployment for the State of Louisiana (6.4 percent), primarily due to higher unemployment rates in Orange and Jefferson Counties, Texas. The unemployment rates in the three parishes in Louisiana are all lower than the state average as shown in table 4.9.1-1. Constructing the Project would positively affect employment opportunities for the state and in the surrounding counties. The Project would not have an adverse impact on the unemployment rate, and

[20] The SWLA Economic Development Alliance is a 501(c)(3) organization founded in 2006 to support industrial and economic growth in the southwest region, including Allen, Beauregard, Calcasieu, Cameron, and Jefferson Davis Parishes. It consists of the Southwest Louisiana Chamber of Commerce, the Southwest Louisiana Economic Alliance Foundation, and the Southwest Louisiana Partnership for Economic Development.

would more likely decrease the unemployment rate due to hiring a predominantly local workforce where feasible.

Table 4.9.2-1 shows income and poverty data for the Project area. Per capita income represents the average wealth of the population within the given geographic area. The per capita income in the Project area 2009-2013 averaged $24,646. The per capita income in Cameron Parish is higher than the state per capita income of $24,442. The per capita income in Calcasieu Parish and Orange and Jefferson Counties is similar to the state average. The per capita income in Jefferson Davis Parish is lower than the state average.

Median worker earnings (i.e., the salary that falls at the midpoint of the range of all salaries) reported by the U.S. Census Bureau (2015a) over the same period indicated that only Cameron Parish, Louisiana had median earnings greater than Louisiana. The other parishes and counties had median earnings lower than the state (table 4.9.2-1). The average median worker earnings of $28,394 for the Project area was nearly equal to the state median.

Venture Global Calcasieu Pass anticipates average salaries during construction and operation at the Terminal site of $70,000 per year. The U.S. Bureau of Labor Statistics (2015) reports average annual construction worker earnings in the Project area for the 4th Quarter of 2014 as $67,122 (table 4.9.2-1). These earnings are well above the state average of $48,828 for construction workers. Locally, Cameron Parish construction worker earnings of $87,152 annually are greater than the surrounding parishes and counties (U.S. Bureau of Labor Statistics, 2015). The proposed salary may influence the pool of available workers, during construction.

TABLE 4.9.2-1

EXISTING INCOME AND POVERTY CHARACTERISTICS IN THE CALCASIEU PASS PROJECT AREA

State, Parish or County	Per Capita Income, 2009-2013 (2013 dollars)	Median Worker Earnings, 2009- 2013 (2013 dollars)	Construction Worker Earnings (4th Quarter, 2014, dollars)	Persons Below Poverty Level, 2009-2013 (percent)
Louisiana	$24,442	$28,391	$48,828	19.1
Cameron Parish, LA	$29,559	$35,387	$87,152	8.7
Calcasieu Parish, LA	$24,355	$26,876	$65,156	17.4
Jefferson Davis Parish, LA	$21,132	$27,234	$44,408	18.8
Orange County, TX	$24,946	$26,472	$68,692	18.5
Jefferson County, TX	$23,236	$25,999	$70,200	21.0
Project Area Averages:	**$24,646**	**$28,394**	**$67,122**	**16.9**

Sources: U.S. Bureau of Labor Statistics, 2015; U.S. Census Bureau, 2015a.
LA = Louisiana; TX = Texas

Venture Global intends to hire the majority of construction workers from within the Project area, though primarily from outside the Town of Cameron. However, the SWLA Economic Development Alliance (2014) determined that about 70 percent of the overall construction workforce in SWLA consists of journeyman travelers. Overall, the percentage of local workers would be dependent upon several factors, including the availability of local workers, timing of need for different skilled trades, and other proposed or ongoing projects in the Project area.

In order to address the anticipated need for a skilled construction workforce in the Project area due to the large number of proposed LNG projects, the SWLA Economic Development Alliance has established the following training resources:

- SOWELA Technical Community College in Lake Charles;
- South Louisiana Technical Community College in Lafayette, part of the Louisiana Community and Technical College System;
- Associated Builders and Contractors, Inc.; and
- Louisiana Workforce Commission Online Tools.

Venture Global met with some of these organizations and anticipates the creation of a training program to meet construction needs. Working with local education providers would increase the availability of trained local workers for the Project. The training and hiring of a local workforce at an annual salary that is higher than the Project area per capita income would reduce unemployment and provide an economic benefit to the local economy.

4.9.3 Property Values

The Terminal site would be in an undeveloped area surrounded by industrial and agricultural development. The nearest residential property is approximately 1 mile east of the Terminal site. There are currently no planned residential developments within 0.25 mile of the Terminal site. The Pipeline would primarily cross undeveloped and rural residential portions of Cameron Parish. There are no existing residences within 50 feet of the pipeline construction work area. At the aboveground facilities associated with the Pipeline, the residences closest to the meter stations are approximately 0.85 mile from the pipeline.

Land values would be determined by appraisals that take into account objective characteristics of the property such as size, location, and any improvements. The value of a tract of land would be related to many tract-specific variables, including the current value of the land, the utilities and services available or accessible, the current land use, and the values of the adjacent properties. The valuations generally do not consider subjective aspects such as the potential effect of a pipeline or LNG terminal.

That is not to say that the presence of a pipeline, and the restrictions associated with a pipeline easement, could not influence a potential buyer’s decision to purchase a property. If a buyer is looking for a property for a specific use, and the presence of the pipeline renders that use infeasible, then the buyer may decide to purchase another property more suitable to their objectives. For example, a buyer wanting to develop the land for a commercial property with sub-surface structures may not find the property suitable, but a farmer looking for land for grazing or additional cropland could find it suitable for their needs. This would be similar to other buyer-specific preferences that not all properties have, such as close proximity to shopping, relative seclusion, or access to high-quality school districts.

Property taxes are generally based on the actual use of the land. Construction and operation of the Pipeline would not typically change the general use of the land, but would preclude construction of aboveground structures on the permanent right-of-way. If a landowner feels that the presence of a pipeline easement reduces the values of the land, resulting in an overpayment of property taxes, the landowner may appeal the issue of the assessment and subsequent property taxation to the local property tax agency.

Based on the factors discussed above, no significant impacts on property values are anticipated from construction and operation of the Project.

4.9.4 Construction Payroll and Material Purchase

The Project would have an estimated total construction payroll of approximately $500 million over the 35-month construction period. Because the region supports infrastructure for the energy and shipping industries, many construction materials and equipment supplies would be purchased locally. Additionally, Venture Global expects that construction and other pre-operational activities associated with the Project would result in beneficial cumulative impacts on the local economy and tax revenues based on its estimated investment of $4.25 billion. Venture Global would expend additional capital on maintenance material and contracts over the minimum 30 years of Project operation, resulting in secondary effects producing a positive economic benefit.

4.9.5 Tax Revenues

Construction of the Project would result in increased tax revenues for the Project area. Revenue sources include operating grants, property taxes, *ad valorem* taxes, sales tax, and income taxes. Venture Global estimates that a portion of the $500 million annual construction payroll would be spent locally for the purchase of housing, food, gasoline, entertainment, and luxury items. If 60 percent of the gross workforce income is spent locally, that could translate into approximately $300 million, annually and before taxes, spent in the Project area, creating positive economic benefits.

Worker spending would also generate state sales tax revenue. Though it is not possible to predict what amount of worker expenditures would be subject to state sales tax, a conservative estimate can be made for demonstration purposes. Assuming 20 percent of workers' gross income is spent on items subject to the state sales tax of 4 percent, an estimated $500,000 annually would accrue to the State of Louisiana.

Worker income would also be subject to the state income tax. The income tax rate for the State of Louisiana varies from 2 to 6 percent based on income earned. State income tax revenue would range from $10 million to $30 million. The State of Texas does not levy a personal income tax.

Venture Global states that the Project plan calls for purchasing a portion of required construction materials locally. Locally purchased concrete, miscellaneous consumable materials, and fuel supply would have a positive impact on local economies and would stimulate indirect expenditures within the region, as inventories are restocked and additional business earnings are reinvested.

During operation, the Project would pay property taxes to Cameron Parish. Initially, the Terminal is anticipated to have a 10-year tax abatement period while the Pipeline would be subject to taxes from the start of operations. It is anticipated that the Project would generate in excess of $20 million in local property tax revenue every year.

The Project would boost local economies by creating jobs, purchasing construction materials locally, hiring local firms and contractors, and directly or indirectly supporting other regional suppliers in the industry. With additional spending and the employment of workers, ripple effects would perpetuate throughout the communities. The estimated 130 full-time workers hired during operation are estimated to earn average salaries of $70,000 per year, which is up to $9 million annually. It is anticipated that these workers would spend a portion of their combined earnings in the Project area, supporting local economies by purchasing goods and services and paying rents and mortgages, all of which would generate direct and indirect socioeconomic benefits.

4.9.6 Housing

It is anticipated that non-local temporary construction workers would be more likely to live in rental units than to purchase homes. A variety of temporary housing units is available in the Project area including single-family homes, apartments, hotels/motels, campgrounds, and RV parks. The number of temporary housing units available is provided in table 4.9.6-1 below. Due to the rural nature of Cameron and Jefferson Davis Parishes, there are a limited number of available units and non-local workers would likely have to disperse to the surrounding communities to meet all of the housing needs during construction. Calcasieu Parish, Louisiana, and Orange and Jefferson Counties, Texas provide greater sources of temporary housing units.

TABLE 4.9.6-1

TEMPORARY HOUSING UNITS [A] AVAILABLE IN THE CALCASIEU PASS PROJECT AREA

State, Parish or County	2009 to 2013 Vacant Housing Units [b]	2009 to 2013 Rental Vacancy Rate (percent)	2009 to 2013 Number of Vacant Rental Units	Number of Hotel/Motel Units	Number of Campgrounds and RV Park Spaces
Louisiana	266,461	8.2	13,275	N/A	N/A
Cameron Parish, LA	1,064	10.3	29	75	909
Calcasieu Parish, LA	9,272	9.9	2,407	6,638	1,269
Jefferson Davis Parish, LA	1,743	4.6	148	34	273
Orange County, TX	4,353	12.3	1,080	1,126	279 [c]
Jefferson County, TX	12,787	9.7	3,637	5,163	696 [c]
Project Area Total:	**29,219**	**N/A**	**7,301**	**13,036**	**3,426**

Sources: U.S. Census Bureau, 2015a; Louisiana Office of Tourism, 2015; Cameron Parish Tourist Commission, 2015; Texas Association of Campground Owners, 2015; Jefferson Davis Parish Economic Development Tourist Commission, 2015; Jefferson County Appraisal District, 2015; Orange County Appraisal District, 2015.

[a] Housing Unit: According to the U.S. Census Bureau's website glossary, a housing unit may be a house, apartment, mobile home or trailer, group of rooms, or a single room occupied as separate living quarters or vacant, intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants live separately from other individuals in the building and which have direct access from outside the building or through a common hall.

[b] Vacant Housing Unit: According to the U.S. Census Bureau's website glossary, a housing unit is vacant if no one is living in it at the time of enumeration, unless its occupants are only temporarily absent. Units temporarily occupied at the time of enumeration entirely by people who have a usual residence elsewhere are also classified as vacant.

[c] Estimate based on search of Texas Appraisal District databases and Campground Owners information. Texas appraisal districts classify mobile home and recreational vehicle (RV) parks under the same classification. Numbers also include mobile home parks.

LA = Louisiana; N/A = not applicable; TX = Texas

In addition to the temporary housing units available, a number of new housing projects have been proposed in the Project area. The SWLA Economic Development Alliance created a strategic plan for temporary housing for the parishes of Allen, Beauregard, Calcasieu, Cameron, and Jefferson Davis (2014). The strategic plan was created in recognition of a growing need for temporary worker housing. The analysis noted that worker villages were the preferred alternative to meet short-term, but temporary, demand for housing. Planned housing projects are summarized in table 4.9.6-2. If all of the proposed housing projects were to be constructed, an additional 13,348 housing units would be available in the Project Study Area.

TABLE 4.9.6-2

PLANNED HOUSING PROJECTS IN THE CALCASIEU PASS PROJECT AREA

Parish or County	Project Name	Housing Type	Number of Proposed Units or Rooms	Project Status
Cameron Parish, LA	No projects proposed at this time			
Calcasieu Parish, LA	Audubon Trace Subdivision	Single-family homes	182	Permitted
	Audubon Trace Subdivision Phase II	Additional units	518	Development
	Beau Blanc Subdivision	Single-family homes	238	Permitted
	Belle Savanne	Multi-family homes	208	Permitted
	Berdon – Campbell Building Lofts	Lofts homes	16	Development
	Bridalwoods Country Estates	Single-family homes	18	Permitted
	C. Wait Estates	Single-family homes	22	Completed
	Charleston Point	Multi-family homes	24	Under construction
	Chateau Ridge Subdivision	Single-family homes	38	Development
	Coffey Pines	Single-family homes	37	Under construction
	Cooling Springs Residential Community	Manufactured homes	130	Completed
	Country Meadows Estates, Phase I Subdivision	Single-family homes	15	Development
	Deerfield Lodge	Temporary housing [a]	1,566	Permitted
	DR Horton America's Builders – Graywood	Single-family homes	93	Under construction
	Dream View Estates, Phase III	Single-family homes	33	Development
	Ella Lane Subdivision	Single-family homes	16	Permitted
	Ellsye Estates	Single-family homes	10	Development
	Elm Street Apartment Complex	Single- and multi-family homes	37	Completed
	Homeplace Subdivision	Single-family homes	18	Development
	Horse Park Acres	Single-family homes	103	Permitted
	Grey Stone Estates Subdivision	Single-family homes	208	Development
	La Bordeaux Subdivision	Single-family homes	14	Permitted
	Lac Development	Multi-family homes	17	Development
	Lagniappe Estate Subdivision	Single-family homes	17	Development
	Lake Charles Civic Center Hotel	Hotel	150	Permitted
	Lakes at Morganfield	Single- and multi-family homes	1,000	Under construction
	McMillin Place Subdivision	Single-family homes	22	Development
	Moss Lake Worker Village	Temporary housing [a]	2,500	Under construction
	Mossville Lodge	Temporary housing [a]	2,980	Under construction
	Oak Grove/Highland Hills	Single-family homes	128	Under construction
	Pentangeli Row Subdivision	Single-family homes	48	Development
	Roseville Estates	Single-family homes	45	Development
	Sears Building	Multi-family homes	170	Under agreement
	Shadows at Bayou Oaks	Single-family homes	57	Under construction
	Shady Oaks Subdivision	Single-family homes	65	Development
	Stone Bridge Subdivision	Single-family homes	448	Development
	Sugarcane Subdivision	Single- and multi-family homes	661	Development
	Sutherlands Subdivision	Single-family homes	99	Development
	Taylor Estates Subdivision	Single-family homes	33	Development
	Terre Sainte	Single-family homes	85	Under construction

TABLE 4.9.6-2 PLANNED HOUSING PROJECTS IN THE CALCASIEU PASS PROJECT AREA				
Parish or County	Project Name	Housing Type	Number of Proposed Units or Rooms	Project Status
	The Isles	Multi-family homes	64	Under construction
	Wait Estates	Single-family homes	22	Development
	Walnut Grove Development	Single- and multi-family homes	180	Under construction
	Weeping Willow Estates	Single-family homes	36	Development
	West End	Single-family homes	105	Development
	West M Expansion	Multi-family homes	200	Under construction
	Willow Brook	Single-family homes	138	Under construction
	Wisteria Vine, Phase 3 Subdivision	Single-family homes	63	Development
Jefferson Davis Parish, LA	No projects proposed at this time			
		Total for Louisiana:	**12,877**	
Orange County, TX [b]	Citrus Cove	Multi-family homes	80	N/A
	Craig Homes	Multi-family homes	50	N/A
	Pine Grove	Multi-family homes	66	N/A
	Royal Gardens	Multi-family homes	49	N/A
	Whispering Oaks	Multi-family homes	70	N/A
Jefferson County, TX	The Carlyle	Multi-family homes	80	N/A
	Cypress Place	Multi-family homes	76	N/A
		Total for Texas:	**471**	
		Project Area Total:	**13,348**	

Sources: SWLA Economic Development Alliance, 2014, 2015, 2016; Texas Department of Housing and Community Affairs, 2016.
[a] Temporary housing specific to construction workers.
[b] Information from Texas Department of Housing and Community Affairs and includes only 2014 numbers.
LA = Louisiana; N/A = information not available; TX = Texas

Impacts on local housing markets during construction would depend on the number of workers commuting from remote locations versus the number of workers housed locally. Venture Global anticipates that the majority of the construction and operational workforce would be sourced from the five parish/county Project Study Area. Considering the number of temporary housing units available (table 4.9.6-1) and the number of proposed units (table 4.9.6-2), sufficient units would be available for the temporary construction workforce (peak 1,610 workers). This would assume the most conservative number and assume that all of the construction workforce is non-local.

Additionally, the proposed permanent staff of 130 to operate the proposed Project facilities is primarily anticipated to come from current local residents and therefore would not create pressure on the local housing market. Therefore, we conclude that construction and operation of the Project would not have a significant impact on housing in the Project area.

4.9.7 Commercial Fisheries

Construction and operation of the Terminal site would require some closures of the channel during construction and use of exclusion zones during operation that would affect commercial fisheries in the Calcasieu River Ship Channel. The commercial fisheries in Louisiana include crab, crawfish, finfish, oyster, and shrimp. The LDWF manages commercial fisheries in the state out to 9 nm. Offshore federal waters extend from 9 to 200 nm. During scoping, a member of the public expressed concern with the terminal's potential impacts on commercial fisheries.

The only managed fishery in the Calcasieu River Ship Channel is shrimp. Shrimping areas in Louisiana are divided into inside waters, outside territorial seas, and the federal EEZ. The shrimp line as described in Louisiana Revised Statues §56:495 (A) is a line that separates inside waters from outside territorial waters and generally follows the coastline. The LDWF manages three categories for shrimp fishing: inshore (from the beach inland), beach (from the beach out to 3 nm), and nearshore (3 to 9 nm) waters (LDWF, 2016c). The Terminal site would be in inshore waters. The inshore shrimping seasons are the spring season (May to July) and the fall season (August to December).

Given the location of the Terminal site within the inshore shrimping area, Venture Global Calcasieu Pass has conducted meetings with Cameron Parish fishermen to discuss the potential impacts of the Project on local commercial fishing. Project staff met with Mr. Kevin Savoie, the area agent for the Louisiana Sea Grant College (LSU Agricultural Center), as well as several commercial fishermen in the area (Savoie, 2015). From those conversations, it is estimated that there are 35 to 40 commercial fishing vessels based in Cameron and 30 to 35 commercial fishing vessels based in Hackberry, thus comprising a local commercial fishing fleet of 65 to 75 vessels in Cameron Parish. The commercial fishermen reportedly rotate through the different seasons of inshore/offshore shrimping and inland oyster harvesting, resulting in year-round commercial fishing.

Mr. Savoie, commercial fishing captains, and the Lake Charles Pilot's Association indicated to Venture Global Calcasieu Pass that commercial fishermen routinely share the Calcasieu River Ship Channel with industrial vessels without incident. There are however two times during the year, for approximately 2 weeks each time, when there is an excess of shrimp movement through the Calcasieu River Ship Channel. During these times that occur typically at night and during the full moon from May to July and from mid-August to mid-December, the fishing vessels cluster in the ship channel in order to catch as many shrimp as possible. This Inside/Outside Shrimp Line known as the "Firing Line" was moved by the LDWF in 2015 from its previous location northward 2.37 nm to a position in the Calcasieu River Ship Channel located north of Monkey Island and south of the Ferry Landing due to safety concerns (LDWF, 2015i). With movement of the firing line north of Monkey Island, potential impacts from Project vessel traffic would be minimized.

During construction, Venture Global Calcasieu Pass would deliver major material supplies and equipment by barge to existing dock facilities at the four marine construction support facilities (Martin, DeHyCo, Baker Hughes, and Liberty). Based on the construction traffic assumptions used in the air quality analysis, an estimated 4,028 barge trips would occur throughout the Project's 35-month construction period, with a portion of this number unloading at existing docks within 30 miles of the Project site and the remaining barges unloading at Project facilities. Barge delivery of material supplies and equipment has the potential to affect commercial fishing due to the additional number of barges and the seasonal aspect of the fisheries. The Calcasieu River Ship Channel was specifically created to provide deepwater access for maritime commerce. As such, use of the channel by barges and support vessels to deliver materials during construction of the liquefaction facility would be consistent with the planned purpose and use of this active shipping channel, and managed by the Port of Lake Charles in partnership with the Lake Charles Pilots Association. Furthermore, the COTP has jurisdiction over navigational safety considerations. We conclude this oversight is adequate to ensure impacts on commercial fishing are appropriately minimized.

During operations, Venture Global Calcasieu Pass estimates up to 12 LNG carrier visits per month at the Terminal site. Twelve LNG carrier visits per month translates to three visits per week, plus turning operations. Given the relatively short transit, the short duration of turning operations (approximately 30 minutes), and the limited number of LNG carrier visits per month, operation of the Project is not likely to significantly affect inshore shrimping or commercial fishing in general in Cameron Parish.

No commercial fisheries are along the Pipeline route; therefore, the Pipeline would not impact any commercial fishing operations during construction or operation.

4.9.8 Public Services

The parishes and counties in the Project area have infrastructure that provide health, police, fire, emergency, and social services near the Project site. Cameron and Jefferson Davis Parishes, Louisiana and Orange County, Texas each have one general hospital. Five general medical and surgical hospitals are in Calcasieu Parish: three in Lake Charles, one in Sulphur, and one in DeQuincy. South Cameron Memorial Hospital is the closest hospital, approximately 12 miles from the Terminal site. This hospital has 25 licensed beds (Louisiana Hospital Association, 2015). The nearest trauma center is the Christus Saint Mary Hospital in Port Arthur, Jefferson County, Texas, a Level IV Trauma Center located approximately 60 miles from the Terminal site (Carr, Branas, 2015). Urgent care facilities are present in the Project study area, primarily in Calcasieu Parish. The primary Emergency Medical Service operator in Cameron is Cameron Parish Emergency Medical Service. Jefferson County, Texas offers the greatest number of hospitals in the Project study area with 7 facilities and 1,399 beds available. Table 4.9.8-1 below provides a summary of the public services provided in the Calcasieu Pass Project area.

Law enforcement in Cameron Parish is provided by the local sheriff's office. The Cameron Parish Sheriff's Office works with the LDWF to patrol the parish's waterways and lakes. Other law enforcement services are provided by the sheriff offices in Calcasieu and Jefferson Davis Parishes, and, to a lesser extent, by local police departments, the McNeese University Police Department, and the Lake Charles Harbor Police Department. Additional law enforcement services are available in Texas.

TABLE 4.9.8-1

PUBLIC SERVICES IN THE CALCASIEU PASS PROJECT AREA

Parish, State	Number of Police/Sheriff's Departments	Number of Fire and Rescue Departments	Number of General Hospitals [b]	Number of Staffed Hospital Beds
Cameron Parish, LA	1 [a]	6	1	25
Calcasieu Parish, LA	8	17	5	784
Jefferson Davis Parish, LA	6	13	1	60
Orange County, TX	6	15	1	0 [c]
Jefferson, TX	6	31	7	1,399
Project Area Total:	**27**	**79**	**15**	**2,268**

Sources: American Hospital Directory, 2015; Calcasieu Parish Sheriff's Office, 2015; Cameron Parish Sheriff's Office, 2015; Jefferson Davis Parish, 2015; Louisiana Office of State Fire Marshal, 2015; Louisiana Hospital Association, 2015; Louisiana Office of State Fire Marshal, 2014; Texas Department of State Health Services, 2015; U.S. Fire Administration, 2015; USACOPS, 2015.

[a] Cameron Parish is unincorporated, the Cameron Parish Sheriff's Office is the local law enforcement entity.

[b] Totals do not include long-term extended-care, psychiatric, rehabilitation, or labor delivery and women's services hospitals.

[c] Orange County in-patient care ended June 2015. Other services continue.

LA = Louisiana; TX = Texas

The Cameron Parish Fire Department provides fire protection through six fire stations (three of which are volunteer departments) and nine fire protection districts (Cameron Parish, 2015; Louisiana Office of State Fire Marshal, 2015). Calcasieu Parish has 17 fire departments. The fire departments of Lake Charles and Sulphur are both manned wholly by career staff, while the other 15 departments are manned by volunteers or a combination of career staff and volunteers (Louisiana Office of State Fire Marshal, 2015). Jefferson Davis Parish has 13 fire departments. The fire department of Jennings has career staff; the remaining 11 departments are manned by volunteer or a combination of volunteers and career firemen (Louisiana Office of State Fire Marshal, 2015). In Texas, Orange County has 15 fire stations within 9 different fire departments and Jefferson County has 31 fire stations operated by 11 fire departments (U.S. Fire Administration, 2015).

In total, the Project study area has 27 police and sheriff departments and 79 fire departments to protect 568,656 citizens and associated property in a geographic area of 4,201 square miles. This information is summarized in table 4.9.8-1.

Impacts on public services would be greatest while constructing the Project, as the greatest number of workers would be present. Cameron Parish public services would be in highest demand during construction because the Terminal site is within this parish.

According to Cameron Parish Police Jury officials, the Cameron Parish Sheriff's Department anticipates that it may require up to three new positions during construction in order to maintain its current level of service (Cameron Parish Police Jury, 2015). If needed, the Cameron Parish Sheriff's Department would request these positions to the Cameron Parish Police Jury. With regard to fire protection resources, Cameron Fire Department officials indicate that the equipment and stations already located in the parish are adequate; however, additional staffing resources would be needed. Venture Global is coordinating with local officials regarding emergency services staffing as discussed in section 2.

4.9.9 Public Schools

Cameron Parish has four public schools serving students from pre-kindergarten through 12th grade. Total enrollment as of February 2015 was 1,302 students (Louisiana Department of Education, 2015). Table 4.9.9-1 below provides information on schools and school enrollment in the Project area. In total, the Project area offers 180 schools providing educational services to over 96,000 students.

TABLE 4.9.9-1

PUBLIC SCHOOLS IN THE CALCASIEU PASS PROJECT AREA

Parish or County	Number of Public Schools	Total Enrollment (February 2015)	Total Enrollment (2004/2005)	Percent Change (2004/2005 to October 2014)
Cameron Parish, LA	4	1,302	1,843	-29.4
Calcasieu Parish, LA	57	32,565	32,792	-0.7
Jefferson Davis Parish, LA	13	5,885	5,927	-0.7
Total for Louisiana:	**74**	**39,752**	**40,562**	**-2.0**
Orange County, TX	25	15,234	16,190	-5.9
Jefferson County, TX	81	41,715	43,523	-4.2
Total for Texas:	**106**	**56,949**	**59,713**	**-4.6**
Project Area Total:	**180**	**96,701**	**100,275**	**-3.6**

Sources: Calcasieu Parish School Board, 2014; Cameron Parish School District, 2015; Jefferson Davis Parish Schools, 2015; KIDS COUNT, 2015; Louisiana Department of Education, 2015; Texas Education Agency, 2015.
LA = Louisiana; TX = Texas

In Louisiana, Calcasieu Parish had the highest enrollment, whereas Cameron Parish had the lowest enrollment. Jefferson County, Texas had the highest overall enrollment. Current enrollment in the Project area is lower than enrollment from 2004. The decrease in enrollment has been attributed to population reductions following Hurricanes Rita (2005) and Ike (2008). In its District Improvement Plan for the School Year 2011–2012, the Cameron Parish School System noted that the system was challenged by the lack of physical plant needs, as some schools were still in the process of building and recovering from the two major hurricanes (Cameron Parish School System, 2012). More recently, the Cameron Parish school system noted that it was in the final stages of a rebuild process following Hurricanes Rita and Ike and would be able to accommodate an increase in students over the next few years (Cameron Parish School Board, 2015). Additionally, in a letter of support for the Project, the Cameron Parish School Superintendent, Mr. Atkins (Cameron Parish School Superintendent, June 2015), stated that the Cameron Parish school system's 2014–2015 enrollment only filled their schools to 71 percent capacity. Mr. Atkins noted that the Cameron Parish school system has the ability to accommodate an extra 533 students.

As a conservative estimate of new students that could be added to the local school system due to the Project, we looked at the expected influx of workers and estimated number of school-aged children that would accompany them. Venture Global stated that it would predominantly utilize local workers during construction, and employ a relatively small full-time operational staff at the Terminal. The construction workforce would average approximately 1,425 workers, peaking at approximately 1,610 workers. If sixty percent of the workforce consisted of local workers, then forty percent, or 644 workers, would be non-local. Because construction would be temporary, it is unlikely that the non-local construction workforce would relocate families to the Project area. Assuming that 20 percent of the non-local workers relocated their families with an average of two children per family, then 258 students would be added to the local school system. If all of the students were in Cameron Parish, then enrollment would increase by 20 percent, which is within the capacity of the existing school system. We believe this represents an overly conservative estimate, as we would anticipate far fewer students enrolling in the school system, resulting in minor, temporary impact on the schools.

During operation, Venture Global Calcasieu Pass anticipates adding approximately 130 full-time positions to operate the Terminal site facilities. Venture Global Calcasieu Pass expects that this workforce would be sourced predominantly from the local population. However, if all 130 permanent workers were non-local and had two children each, this would result in 260 additional children in local parish school systems. This addition would represent a 20 percent increase in total enrollment if all of the students were in Cameron Parish, or a 0.3 percent increase for the Project area.

Based on existing enrollments, existing school capacity, the letter of support from the Cameron Parish School Superintendent, and the limited increase to the local population, operation of the Project would not have a significant impact on local schools.

4.9.10 Public Utilities

Entergy Corporation serves as the electric provider for the Project area. During construction at the Terminal site, Venture Global Calcasieu Pass would install a short utility line on site to provide electrical power, which would be in addition to that power provided by diesel-fired generators. Once the Terminal's electrical generation facility is placed in service, Venture Global Calcasieu Pass proposes that electric power for facility operation would be generated onsite. Thus, operation of the Terminal would not add any additional load to the local electric distribution grid.

The water and wastewater district in the Project area (Cameron Parish Water Works District) is operated by Cameron Parish. In a letter dated August 18, 2015, the Cameron Parish Police Jury Administrator noted that the system could adequately service the potential increase in residential users (Cameron Parish Police Jury, 2015). The Cameron Parish Police Jury, noted that a new water well and storage tank would be required for a larger industrial development such as the Terminal site. Venture Global Calcasieu Pass is coordinating with local officials regarding utilities as discussed in section 1.5 and is also considering drilling and developing its own water supply well on the Terminal site (see section 4.3.1.4, Groundwater Impacts and Mitigation). Venture Global Calcasieu Pass anticipates that sewage service with portable toilets would be provided through a third-party contractor during construction and operation.

Cameron Parish operates waste transfer collection stations in several areas across the Parish. The two closest transfer stations to the Terminal site are about 14 miles to the east and 16 miles to the north. Waste Management Services operates a full-service landfill capable of handling all types of waste, including chemical waste, in Calcasieu Parish, approximately 25 miles north of the site. This fully permitted landfill has 6 million yd^3 of capacity and has an estimated projected life of more than 30 years remaining. Based on existing capacity, the Project would not have a significant impact on the waste handling capability of the landfill.

4.9.11 Environmental Justice

Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (EPA, 2015a). Environmental justice considers disproportionately high and adverse impacts on minority or low-income populations in the surrounding community resulting from the programs, policies, or activities of federal agencies. Items considered in the evaluation of environmental justice include human health or environmental hazards, the natural physical environment, and associated social, economic, and cultural factors. Environmental justice analysis is conducted in compliance with Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*. During scoping the EPA recommended the EIS include an evaluation of environmental justice populations in the project area and that the *Promising Practices for EJ Methodologies in NEPA Reviews* be used to guide the evaluation (EPA, 2016b).

The EPA provides guidance on determining whether there is a minority or low-income community to be addressed in an analysis. According to this guidance, minority population issues must be addressed when they comprise over 50 percent of an affected area or when the minority population percentage of the affected area is substantially greater than the minority percentage in the larger area of the general population. Low-income populations are those that fall within the annual statistical poverty thresholds from the U.S. Department of Commerce, Bureau of the Census Population Reports, Series P-60 on Income and Poverty.

In accordance with the EPA guidelines, we prepared an environmental justice analysis for the Project. This analysis is in keeping with the recommendations for conducting environmental justice analyses for NEPA review as compiled in the Federal Interagency Working Group on Environmental Justice & NEPA Committee publication entitled *Promising Practices for EJ Methodologies in NEPA Reviews* (EPA, 2016b). Specifically, meaningful engagement was conducted with local communities, interested individuals and organizations through notice in local publications, direct mailings to interested parties and landowners, an agency scoping meeting, and an open house held in Cameron, Louisiana. The public outreach conducted for the Project is discussed in section 1.4 of this EIS.

Table 4.9.11-1 presents the general ethnic composition of the Project area as well as the State of Louisiana based on data from the U.S. Census Bureau (2015a). Cameron Parish, the directly affected area, has the highest percentage of White, not Hispanic or Latino populations in the Project area. The minority percentages in the Project area, individually and collectively, are below the 50 percent threshold and are not substantially greater than the minority percentage in the larger area of the general population. The table also shows the percent of the population below the poverty level. The majority of communities in the

Project area have fewer persons below the poverty level than the state average; Jefferson County, Texas has a higher percent.

TABLE 4.9.11-1

DEMOGRAPHIC COMPOSITION WITHIN THE CALCASIEU PASS PROJECT STUDY AREA

State or Parish	White, not Hispanic or Latino [b] (percent)	Hispanic or Latino [b] (percent)	Black or African-American [a] (percent)	Asian [a] (percent)	American Indian and Alaska Native [a] (percent)	Native Hawaiian and Other Pacific Islander [a] (percent)	Two or More Races (percent)	Population Below Poverty Level (percent)
Louisiana	59.6	4.7	32.4	1.7	0.8	0.1	1.5	19.1
Cameron Parish	93.1	3.2	2.1	0.2	0.6	0.0	1.0	8.7
Calcasieu Parish	68.9	2.9	25.2	1.2	0.6	0.1	1.7	17.4
Jefferson Davis Parish	78.4	2.0	17.1	0.3	0.7	<0.1	1.8	18.8
Orange County, TX	88.1	6.7	8.6	1.0	0.7	0.1	1.4	14.4
Jefferson, TX	59.3	18.5	34.4	3.8	1.0	0.1	1.5	21.0

Source: U.S. Census Bureau, 2015a.
[a] Includes persons reporting only one race.
[b] Also included in applicable race categories, therefore totals may not equal 100 percent.
LA = Louisiana; TX = Texas

In order to evaluate information more specific to the area directly affected by the Terminal and Pipeline, we assessed environmental justice statistics at the U.S. Census tract block group level, which is the smallest geographic census unit for which information was available. Table 4.9.11-2 presents poverty and minority population status in the Project area based on data from the 2009–2013 5-Year American Community Survey (U.S. Census Bureau, 2015a).

TABLE 4.9.11-2

POVERTY AND MINORITY POPULATIONS IN CENSUS TRACTS WITHIN 0.5 MILE OF THE CALCASIEU PASS PROJECT AREA

State/Parish/Census Tract	Total Population (2009-2013 5-Year Estimate) [a]	Population Below Poverty Level (percent) [a]	Minority Population (percent) [a]
Louisiana	4,567,968	19.1	40.4
Cameron Parish	6,789	8.7	6.9
Census Tract 9702.01	4,929	6.2	1.3
Block Group 2	272	11.8	1.1
Block Group 3	290	16.1	1.4
Census Tract 9701.00	1,816	9.6	2.3
Block Group 1	360	19.9	8.5
Block Group 3	310	0	2.4

Sources: U.S. Census Bureau, 2015a; EPA, 2015b.
[a] All data are from the 2009-2013 5-Year American Community Survey to allow for consistent comparison.

Overall, Cameron Parish has a much lower percentage of minority populations than the State of Louisiana (U.S. Census Bureau, 2015a). Generally, the same trends hold true at the census tract and block group levels. There are two populated census tracts in Cameron Parish: 9702.01 to the west and east of the Calcasieu River Ship Channel and 9701.00 to the north of census tract 9702.01 and east of the ship channel (U.S. Census Bureau, 2015c). The Town of Cameron and the Terminal site fall within the small portion of census tract 9702.01 that lies to the east of the ship channel. The Terminal site would be in block group 3 of Census Tract 9702.01. The Pipeline would be located in Census Tract 9701.00 within block groups 1 and 3.

The minority populations in all of these block groups fall well below that of the State of Louisiana. Block group 1 in Census Tract 9701.00 has minority populations at percentages that are slightly higher than the average for Cameron Parish; however, the percent is well below the state percentage. The single digit minority populations found within the Project area are well below the 50-percent threshold as defined by the guidelines in the *Promising Practices for EJ Methodologies in NEPA Reviews*; therefore, the Project would not disproportionately affect any minority populations.

The percentage of the population living below the poverty threshold is lower in Cameron Parish than in the State of Louisiana as a whole (see table 4.9.11-2); however, in portions of the Project area poverty levels are comparable with that of the state. In particular, a disparate percentage of the population living below the poverty level is seen in block group 1 in Census Tract 9701.00, which is slightly higher than the state level. The Terminal site, located in block group 3 in Census Tract 9702.01 has lower percentages of population below the poverty level than the state and higher than Cameron Parish as a whole. The Project would have an impact on low income populations; therefore, we conducted an impact analysis in accordance with the guidelines in the *Promising Practices for EJ Methodologies in NEPA Reviews*. Potential environmental impacts encompass both the natural and physical environment and can include ecological, aesthetic, historic, cultural, economic, social, or health impacts. As discussed throughout the EIS, potential adverse impacts on the natural and physical environment have been described and mitigated through plans such as the Applicant’s Project-specific Plan and Procedures and their CMP/BUDM, as well as by regulatory permitting requirements and conditions and recommendations we have applied where necessary. We have also determined that there would be no direct impact on residential properties. Consequently, the low income populations identified within the Project area would not be adversely impacted.

Overall, there is no trend toward placing facilities near minority populations or populations below the poverty level. We have determined that the Project would not disproportionately affect low-income or minority populations.

4.9.12 Transportation and Traffic

4.9.12.1 Terminal Facilities

Land Transportation

There would be an increase in heavy truck traffic and workforce traffic to the Terminal site during the Terminal construction phase. Venture Global Calcasieu Pass anticipates that, during construction, most major material supplies and equipment would be delivered by barge, using a planned utility dock to be located in the northwest corner of the Terminal site. In its Traffic Management Plan (Tecnicas Reunidas, 2015), Venture Global Calcasieu Pass estimates an average of 360 deliveries of construction materials per day during the initial twelve months of construction, for a 6-day work week. Venture Global Calcasieu Pass estimates that deliveries would decrease to 137 trucks per day during months 12 to 38 due to the proposed utilization of the utility dock for barge delivery of heavy construction materials. During peak construction, an addition of 360 trucks (720 trips) per day on Davis Road would be a 27.2 percent increase over existing conditions.

In addition to truck deliveries, the Project's peak construction workforce of 1,610 workers would also generate new traffic. Of these 1,610 workers, 1,410 workers represent the peak workforce at the Terminal site. Venture Global Calcasieu Pass' construction work would be scheduled to take advantage of daylight hours, usually starting at 7:00 a.m. and finishing at 6:00 p.m. (6 days a week). Therefore, most workers would commute to and from the Terminal site during off-peak hours. If the peak workforce were to commute individually to the Project site, this would increase the average daily traffic count (ADT) by 106.5 percent. Due to this substantial increase in traffic and limited onsite workforce parking, Venture Global Calcasieu Pass proposes to utilize the Mudd Support facility for off-site parking and using a private ferry and bus to move workers to the Terminal site. Venture Global Calcasieu Pass estimates that over 50 buses would be used, adding 100 additional trips for an increase of 3.8 percent.

Construction traffic would use Davis Road, SH 27, and SH 82 to travel to/from the Terminal site. According to the Louisiana Department of Transportation and Development (LaDOTD), SH 27 and SH 82 are both two-lane highways that are classified as major collector roadways, whereas Davis Road is classified as a local road (LaDOTD, 2006). Based on 2005 traffic data from LaDOTD (2015), the most recent data available, the ADT on Davis Road is 2,649 vehicles. For the western approach to the Project on SH 82/27 (Wakefield Road) the ADT at the ferry crossing is 3,266 vehicles. The ADT for the eastern approach to the Project on SH 82/27 (Marshall Street) near West Creole Highway is 5,992 vehicles.

Due to the substantial increase in vehicle traffic to the Terminal site, Venture Global Calcasieu Pass states in its Traffic Management Plan that it has preliminary plans for materials to be transported by barge and delivered to nearby existing aggregate storage and handling facilities prior to completion of the construction berth. Venture Global Calcasieu Pass also states that it plans to address worker and material transport through off-site parking, shuttles, and infrastructure in an updated Traffic Management Plan. To minimize disruption to local traffic flow and communities and to ensure that construction-related road use proceeds in a safe and efficient manner, **we recommend that**:

- **Prior to construction of the Terminal, Venture Global Calcasieu Pass should file with the Secretary, for review and written approval by the Director of OEP, a Final Traffic Management Plan that includes information relative to off-site parking and the use of shuttles.**

Operating the Terminal would require an estimated 130 employees, split among 3 daily shifts. The additional traffic generated by operational employees would not result in a significant increase in traffic volume on area roadways because the increase would be less than 10 percent of the daily traffic volumes in the area and would not all occur at peak traffic times.

Marine Transportation

The Calcasieu River Ship Channel, originally constructed in 1926 by the USACE for navigation in support of industry, allows passage from the Gulf of Mexico to Lake Charles in neighboring Calcasieu Parish. The proposed Terminal site for the Project is at the southernmost extent of the Calcasieu River Ship Channel, approximately 500 feet from its confluence with the Gulf of Mexico, on the eastern shoreline of the ship channel. In 2013, there were 1,022 vessel calls to the Calcasieu River Ship Channel. According to the Calcasieu River Ship Channel Traffic Study (Ausenco, 2014), traffic in the channel is projected to double to 2,183 vessel calls in 2023. Approximately 800 of these new vessel calls are projected to involve LNG carriers. Despite the increase in vessel traffic, Ausenco's study concludes that the Calcasieu River Ship Channel would be able to accommodate the additional traffic.

During scoping, members of the public expressed concern about Project-related increased vessel traffic in the Calcasieu River Ship Channel. During construction, Venture Global Calcasieu Pass estimates that major material supplies and equipment would be delivered to marine construction support facilities with existing docks (Martin, DeHyCo, Baker Hughes, and Liberty) located close to the Terminal facilities. In its Traffic Management Plan (Tecnicas Reunidas, 2015), Venture Global Calcasieu Pass estimates up to 4,028 barge deliveries to the site or within a 30-mile radius. Barge deliveries would occur throughout the Project's 35-month construction period, with a higher number of deliveries to occur at the beginning of construction within the first twelve months. Remaining deliveries would occur after the first year and spread out over the next two years. Barge traffic supporting construction would be addressed in the final Traffic Management Plan to be reviewed by the USCG and Lake Charles Pilot's Association.

During operations, approximately 150 LNG carriers would call per year (a combination of inbound and outbound voyage). In a letter dated January 6, 2016, the USCG issued the LOR for the Project, which stated that the Calcasieu River Ship Channel is considered suitable for LNG marine traffic in accordance with the guidance in the USCG's NVIC 01-11. The WSA review focused on the navigation safety and maritime security aspects of LNG carrier transits along the affected waterway. The WSA itself is designated Sensitive Security Information as defined in 49 CFR 1520. The USCG also indicated that if an increase in port calls is expected, it recommended that appropriate studies showing additional traffic impact on the waterways be conducted.

The proposed increase in vessels over the current estimated number of approximately 1,100 vessels annually and projected future increase in vessels would not likely affect the capability of the channel to handle the proposed ship movements (Ausenco, 2014); however, additional wait times to enter and exit the shipping channel could occur. The wait times are expected to vary seasonally, and would be higher during the winter months and lower during the summer months. The simulation also indicated that additional pilots and tugs would be needed to accommodate the increased vessel traffic.

The USCG's 33 CFR 165.805(a)(2) established a moving security zone for certain designated vessels during transit, which extends 2 miles ahead of and 1 mile behind the vessel. Unless authorized by the USCG Captain of the Port, all vessels are required to avoid or exit the moving security zone established around these vessels.

Inbound LNG carriers to the facility would transit from the pilot boarding station at the channel's entrance sea buoy, approximately 32 nm south of the Cameron Jetties. Once a LNG carrier passes the Cameron Jetties, which marks the mouth of the Calcasieu River, it would travel approximately 0.5 nm before reaching the Project site. Once a LNG carrier reaches the facility, it would turn and maneuver from a northbound heading to a southbound heading with the assistance of four tugs.

To allow for the safe maneuvering of inbound LNG carriers, Venture Global Calcasieu Pass would dredge a 1,500 foot-wide turning basin at a depth of -44.3 feet NAVD88, just east of the main shipping channel. The dimensions and location of the turning basin are based on the results of a maneuvering study conducted by the Lake Charles Pilot's Association at the Marine Pilots Institute in Covington, LA. The proposed turning basin would also distance the facility from the main shipping channel, reducing the effects created by passing vessels. Passing traffic would have almost no impact on moored LNG carriers, improving the overall safety of the marine operations for this Project.

LNG carriers departing from the Project site would maneuver laterally from the docks into the navigation channel using thrusters onboard the LNG carrier and with the assistance of designated towing vessels. Once in the channel, the LNG carrier would proceed outbound.

Each LNG carrier calling on the Project would be required to have a minimum two-tug escort with four tugs assisting in docking the LNG carrier. However, the LNG carrier specific requirements are at the discretion of the Lakes Charles pilots, weather conditions, and the dimensions of the LNG carrier in any given situation. Venture Global Calcasieu Pass expects to lease its tugboats and have them dedicated full-time for the Project's operations.

During operations, security zones for LNG carriers in transit would impact recreational and commercial fishing vessels within the Calcasieu River Ship Channel because they would be required to exit the security zone while the LNG carrier passes. After the moving security zone passes, recreational boaters and fishermen could return and continue their prior activities. Because the LNG carriers would join an existing convoy system, and consist of an additional four vessels a week (eight movements in total), the Project would create only a slight increase in impacts on recreation and commercial fishing along the Calcasieu River Ship Channel.

4.9.12.2 Pipeline Facilities

Construction of the Pipeline would require approximately 150 workers, 200 at peak. The increase in workers would result in an increase in traffic near the Pipeline. An addition of 200 workforce vehicles (400 trips) per day would result in local increases in traffic ranging from approximately 3 to over 300 percent. The construction workforce traffic would utilize offsite parking as described in the project-specific traffic management plans (EN Engineering, 2015; Tecnicas Reunidas, 2015). Construction traffic would primarily occur during off-peak commute times, and would be dispersed along the 23.5-mile pipeline. Based on these factors it would be unlikely that the workforce traffic would significantly affect local traffic.

Constructing the Pipeline would result in some minor, short-term impacts on area roadways. Short-term impacts on traffic flow could occur where the pipeline would be installed beneath roads due to safety precautions for workers crossing and working in the vicinity of the road crossings. Major road crossings would be constructed via HDD and would have no short- or long-term impacts on traffic patterns or road conditions. If necessary, TransCameron Pipeline would use signage and traffic control personnel to manage traffic in areas of active construction, but this would typically only be required for large trucks entering or exiting the pipeline workspaces and the traffic impacts would be of short duration. Vehicles and equipment would be required to operate from, or be parked on, the Project right-of-way or authorized contractor equipment yards. TransCameron Pipeline would repair any damage to public roadways caused by construction activities. Given TransCameron's traffic management plans and the use of offsite parking, we conclude that impacts on traffic during construction of the Pipeline would be short-term and not significant.

No additional employees would be necessary to operate the Pipeline. Therefore, there would be no impact on traffic during operation of the Pipeline.

4.10 CULTURAL RESOURCES

Section 106 of the NHPA, as amended, requires that the FERC take into account the effects of its undertakings on historic properties, and to afford the ACHP an opportunity to comment. The steps in the process to comply with section 106, outlined in the implementing regulations at 36 CFR 800, include consultations, identification of historic properties, assessment of effects, and resolution of adverse effects. Venture Global, as a non-federal party, is assisting us in meeting our obligations under section 106 by preparing the necessary information, analyses, and recommendations, as authorized by 36 CFR 800.2(a)(3). The FERC remains responsible for all findings and determinations under the NHPA. As the lead federal agency for the Project, the FERC will address compliance with section 106 on behalf of all the federal cooperating agencies in this EIS.[21] In their scoping comments, the EPA recommended the EIS address

[21] Pursuant to 36 CFR 800.2(a)(2), the EPAct, and the May 2002 Interagency Agreement on Early Coordination of Required Environmental and Historic Preservation Reviews.

cultural and historic resources in the project area, and to provide a description of the consultations with tribal governments, including any government-to-government consultations.

4.10.1 Consultations

We sent copies of our January 20, 2015 NOI and the August 2, 2016 supplemental NOI for this Project to a wide range of stake holders including federal agencies, such as ACHP, EPA, U.S. Department of the Interior National Park Service (NPS), and Bureau of Indian Affairs (BIA); state agencies, such as the Louisiana SHPO; and federally recognized Indian tribes that may have an interest in the Project. The NOI contained a paragraph about section 106 of the NHPA, and stated that we were using the NOI to initiate consultation with the SHPO, and to solicit its views, and those of other government agencies, interested Indian tribes, and the public, on the Project's potential effects on historic properties. Although, in response to our NOI, we have received comments about the cultural resources and tribal consultation process, we have not received any comments regarding cultural resources issues.

4.10.1.1 Consultations with the SHPO

We did not receive any letters from the SHPO in response to our NOI, or at any time afterwards. Natural Resource Group LLC (NRG), on behalf of Venture Global, wrote a letter to the SHPO on September 17, 2014 introducing the Project. The SHPO responded on September 22, 2014 that it needed additional information. Between January 8, 2015 and November 21, 2016, NRG submitted a series of cultural resources investigation reports to the SHPO. Table 4.10.1.1-1 (below) lists the dates when the SHPO commented on those reports.

TABLE 4.10.1.1-1

CULTURAL RESOURCES INVESTIGATIONS REPORTS SUBMITTED BY NRG TO THE SHPO AND REVIEW STATUS

Cultural Resources Investigation Reports	Report Number	Date Submitted to SHPO	Date of Comments from SHPO
[draft] Phase I Cultural Resources Report LNG Terminal Site (Stanyard and Thomas, 2015a)	22-4862	January 8, 2015	January 20, 2015
Final Technical Report – *Venture Global Calcasieu Pass LLC, Calcasieu Pass Project, Cameron Parish, Louisiana, Phase I Cultural Resources Report, LNG Terminal Site*	22-4862	April 27, 2015	No Comments
Negative Findings Addendum Report – Phase I Cultural Resources Addendum Repot LNG Terminal Site: Additional Acreage (61.1 acres) (Stanyard and Thomas, 2015b)	22-4862-1	April 20, 2015	April 23, 2015
Negative Findings Addendum Report 2 – Phase I Cultural Resources Addendum Repot LNG Terminal Site: 241.6-Acre Extension (Stanyard and Thomas, 2015c)	22-4862-2	July 2, 2015	July 8, 2015
Phase I Cultural Resources Report East and West Lateral Pipelines (Brignac et al., 2015)	22-4975	July 6, 2015	July 15, 2015
Addendum Report 3: Phase I Cultural Resources Addendum Report LNG Terminal Site: 403.7-Acre Addition (Stanyard and Thomas, 2015d)	22-4862-3	September 24, 2015	September 28, 2015
Phase I Marine Archaeological Survey of Proposed LNG Berthing Areas and Turning Basin for Venture Global LNG Terminal Project, Calcasieu Pass. Cameron Parish, Louisiana (Hanks and Enright, 2015)	22-4862-4	October 12, 2015	October 14, 2015
Addendum: Phase II Archaeological Diver Identification of Remote Sensing Targets at the Proposed LNG Berthing Areas and Turning Basin for Venture Global LNG Terminal Project, Calcasieu Pass. Cameron Parish, Louisiana (Hanks, 2015)	22-4862-5	December 3, 2015	December 7, 2015

TABLE 4.10.1.1-1 CULTURAL RESOURCES INVESTIGATIONS REPORTS SUBMITTED BY NRG TO THE SHPO AND REVIEW STATUS			
Cultural Resources Investigation Reports	Report Number	Date Submitted to SHPO	Date of Comments from SHPO
Phase I Cultural Resources Report TransCameron Pipelines – East and West Lateral Pipelines – Addendum I (Brignac et al., 2016)	22-4975-1	January 27, 2016	February 8, 2016
Phase I Cultural Resources Survey Letter Report: Addendum 6 for the Calcasieu Pass Terminal and TransCameron Pipeline Project in Cameron Parish, Louisiana – Construction Support Facilities (Stanyard, 2016a)	22-4862-6	February 15, 2016	February 18, 2016
Phase I Cultural Resources Report TransCameron Pipelines – East and West Lateral Pipelines – Addendum 2 (Brignac et al., 2016)	22-4862-7	June 11, 2016	June 27, 2016
Phase I Cultural Resources Survey Letter Report: Addendum 7 for the Calcasieu Pass Terminal and TransCameron Pipeline Project in Cameron Parish, Louisiana – Mudd Cemetery (Stanyard, 2016b)	22-4862	November 21, 2016	December 6, 2016

LNG = liquefied natural gas; SHPO = State Historic Preservation Office

4.10.1.2 Consultations with Indian Tribes

Through a review of Venture Global's application, and independent research, we identified Indian tribes that historically used or occupied the Project area, and may attach religious or cultural significance to historic properties in the area of potential effect (APE), in accordance with section 101(d)(6)(B) of the NHPA. In addition to sending our NOIs to potentially interested Indian tribes, we wrote letters to the seven tribes listed in table 4.10.1.2-1 on May 1, 2015, describing the Project and requesting comments. No tribes responded on the record to our NOIs or our letters.

In addition to our consultation program, Venture Global, through its cultural resources consultants, separately communicated with Indian tribes it thought may have an interest in the Project. On September 17, 2014, NRG sent letters to the Alabama-Coushatta Tribe of Texas, Chitimacha Tribe of Louisiana, Coushatta Tribe of Louisiana, Jena Band of Choctaw Indians, and Tunica-Biloxi Tribe of Louisiana. NRG also sent letters to the Choctaw Nation of Oklahoma and Mississippi Band of Choctaw Indians on January 21, 2015. Additional letters were sent on February 25, 2015 to the seven tribes listed in table 4.10.1.2-1. Follow up emails were sent to the tribes, except for the Chitimacha Tribe of Louisiana, on March 18, 2015. The Jena Band of Choctaw Indians responded to NRG on April 7, 2015; the Choctaw Nation of Oklahoma on April 22, 2015; the Mississippi Band of Choctaw Indians on March 30, 2015; and the Chitimacha Tribe on March 13, 2015.

TABLE 4.10.1.2-1

INDIAN TRIBES CONTACTED ABOUT THE CALCASIEU PASS LNG TERMINAL AND TRANSCAMERON PIPELINE PROJECTS

Tribes contacted by the FERC through the NOI and May 1, 2015 Letters	Tribes Contacted by Venture Global in Letters or Emails dated September 17, 2014, January 21, February 25 and March 18, 2015	Responses to Letters and Emails from Venture Global/NRG
Chitimacha Tribe of Louisiana, c/o John Paul Darden, Chair	Chitimacha Tribe of Louisiana, c/o John Paul Darden, Chair, and Kimberly Walden, Cultural Director	On March 13, 2015 the tribe indicated to NRG that the Project is located outside of their homelands.
Choctaw Nation of Oklahoma, c/o Gary Batton, Chief	Choctaw Nation of Oklahoma, c/o Gary Batton, Chief, Ian Thompson, THPO	On April 22, 2017, tribe stated to NRG that the Project is in their area of interest, and requested GIS shape files and copies of cultural resources reports.
Jena Band of Choctaw Indians, c/o B. Cheryl Smith, Chief	Jena Band of Choctaw Indians, c/o B. Cheryl Smith, Chief, Dana Masters, THPO	In an April 7, 2015, email to NRG the tribe requested that all staging areas and the pipeline corridor be surveyed and cultural survey reports be made available. On July 14 and 20 and August 20, 2015, the tribe commented to NRG on cultural resources reports.
Mississippi Band of Choctaw Indians, c/o Phyllis J. Anderson, Chief	Mississippi Band of Choctaw Indians, c/o Phyllis J. Anderson, Chief, Kenneth Carleton, THPO	On March 30, 2015 the tribe indicated to NRG that they were not aware of known archaeological or other historic properties in the Project area, and requested copies of cultural resources survey reports.
Tunica-Biloxi Indians of Louisiana, c/o Earl J. Barbry, Chair	Tunica-Biloxi Indians of Louisiana, c/o Earl J. Barbry, Chair, and Marshall Pierite, Chair	No responses filed to date.
Coushatta Tribe of Louisiana, c/o Loveline Poncho, Chair	Coushatta Tribe of Louisiana, c/o Loveline Poncho, Chair, Linda Langley, THPO	No responses filed to date.
Alabama Coushatta Tribe of Texas	Alabama Coushatta Tribe of Texas, c/o Ronni Thomas, Chair, Clayton Sylestine, Chief	No responses filed to date.

FERC = Federal Energy Regulatory Commission; GIS = geographic information system; LNG = liquefied natural gas; NOI = Notice of Intent; NRG = Natural Resource Group LLC; THPO = Tribal Historic Preservation Officer

Venture Global's cultural resources consultants sent copies of cultural resources investigations reports to Indian tribes. Correspondence with tribes regarding report review is summarized below in table 4.10.1.2-2. The Jena Band of Choctaw Indians commented in an email dated July 14, 2015 about the two survey reports sent to them by NRG on May 20, 2015. NRG responded in a July 15, 2015 email to the Jena Band addressing their concerns. In a July 20, 2015 email, the Tribal Historic Preservation Office (THPO) for the Jena Band concurred with the finding of no historic properties during those surveys. On August 20, 2015, the THPO for the Jena Band reviewed two additional survey reports sent by NRG on July 20, 2015, and agreed with the finding of no effect, as long as sites 16CM44, 54, 84, 88, and 162 are avoided.

In a November 17, 2015 email to NRG, the THPO for the Choctaw Nation of Oklahoma stated that it reviewed the Phase I survey report for the LNG terminal and had no objections. In a March 3, 2016 email to NRG, the Choctaw Nation of Oklahoma reviewed the Phase II report and raised no objections.

In response to the March 30, 2015 request by the Mississippi Band of Choctaw Indians, NRG sent an email to this the tribe on May 20, 2015 that included the original survey reports for the terminal site and terminal extension, and then on July 20, 2015 NRG sent the remaining surveys for the terminal extension and pipeline.

TABLE 4.10.1.2-2 CULTURAL RESOURCES INVESTIGATIONS REPORTS SENT TO INDIAN TRIBES AND THEIR REVIEW STATUS			
Facility/Component	Report Number	Date Submitted to Tribes	Date of Comments by Indian Tribes
Phase I Cultural Resources Report LNG Terminal Site (Stanyard and Thomas, 2015a)	22-4862	May 20, 2015	Jena Band July 14 and 20, 2015
Negative Findings Addendum Report – Phase I Cultural Resources Addendum Repot LNG Terminal Site: Additional Acreage (61.1 acres) (Stanyard and Thomas, 2015b)	22-4862-1	May 20, 2015	Jena Band July 14 and 20, 2015
Negative Findings Addendum Report 2 – Phase I Cultural Resources Addendum Repot LNG Terminal Site: 241.6-Acre Extension (Stanyard and Thomas, 2015c)	22-4862-2	July 20, 2015	Jena Band August 20, 2015
Phase I Cultural Resources Report East and West Lateral Pipelines (Brignac et al., 2015)	22-4975	July 20, 2015	Jena Band August 20, 2015
Addendum Report 3: Phase I Cultural Resources Addendum Report LNG Terminal Site: 403.7-Acre Addition (Stanyard and Thomas, 2015d)	22-4862-3	September 30, 2015	Choctaw Nation of Oklahoma November 17, 2015
Phase I Marine Archaeological Survey of Proposed LNG Berthing Areas and Turning Basin for Venture Global LNG Terminal Project, Calcasieu Pass. Cameron Parish, Louisiana (Hanks and Enright, 2015)	22-4862-4	October 23, 2015	Cherokee Nation November 17, 2015
Addendum: Phase II Archaeological Diver Identification of Remote Sensing Targets at the Proposed LNG Berthing Areas and Turning Basin for Venture Global LNG Terminal Project, Calcasieu Pass. Cameron Parish, Louisiana (Hanks, 2015)	22-4862-5	January 15, 2016	Choctaw Nation of Oklahoma March 3, 2016
Phase I Cultural Resources Report TransCameron Pipelines – East and West Lateral Pipelines – Addendum I (Brignac et al., 2016)	22-4975-1	February 12, 2016	No comments received
Phase I Cultural Resources Survey Letter Report: Addendum 6 for the Calcasieu Pass Terminal and TransCameron Pipeline Project in Cameron Parish, Louisiana – Construction Support Facilities (Stanyard, 2016a)	22-4862-6	February 15, 2016	No comments received
Phase I Cultural Resources Report TransCameron Pipelines – East and West Lateral Pipelines – Addendum 2 (Brignac et al., 2016)	22-4975-2	July 7, 2016	No comments received
Phase I Cultural Resources Survey Letter Report: Addendum 7 for the Calcasieu Pass Terminal and TransCameron Pipeline Project in Cameron Parish, Louisiana – Mudd Cemetery (Stanyard, 2016b)	22-4862	January 17, 2017	Choctaw Nation of Oklahoma February 17, 2017

LNG = liquefied natural gas

4.10.2 Overview and Survey Results

4.10.2.1 Area of Potential Effects

Venture Global defined the APE for archaeological resources in section 4.2 of Resource Report 4, filed with its September 4, 2015 application to the FERC. The direct APE covered the areas where ground disturbance would occur. This includes 506 acres at the terminal, 24 acres at the construction support center, and 322 acres east and adjacent to the terminal. The direct APE for the Pipeline was a 250-foot-wide corridor from the centerline.

The indirect APE for historic architectural sites includes a 1-mile radius around the terminal, and a 0.5-mile zone on each side of the Pipeline centerline.

4.10.2.2 Overview

A site file search and literature review was conducted by Venture Global's consultants to cover both the direct and indirect APEs. Research was done at the SHPO files, and the NRHP database maintained by the NPS. Three previous survey reports were identified near the terminal, but they did not overlap with the Project footprint. Thirty-three previous surveys were identified in the vicinity of the Pipeline; all of which partly overlapped with the APE.

Two previously recorded sites were identified within 1 mile of the terminal; none within the direct APE. Nine previously recorded sites were identified along the pipeline system. Two previously recorded archaeological sites (16CM54 and 16CM84) were relocated during surveys along the West Lateral Pipeline, as discussed below.

4.10.2.3 Surveys

Venture Global had its consultants conduct cultural resource surveys for all Project facilities including the terminal, berth, and pipelines. The archaeological survey consisted of pedestrian inventories and shovel testing. The architectural survey reviewed a viewshed consisting of a 1-mile radius from the terminal, and 0.5-mile zone on each side of the pipeline centerline.

4.10.3 Terminal Facilities

Cultural resources surveys for the terminal were conducted in stages and reported in five separate reports (Stanyard and Thomas, 2015a, 2015b, 2015c, 2015d; Stanyard, 2016a, 2016b). In total, about 828 acres were inventoried at the terminal.

Two new sites were recorded during the surveys at the terminal. One site (16CM171) is the remnants of a 20th century biological research station, evaluated as not eligible for the NRHP (Stanyard and Thomas, April 2015a). The other site (16CM172) is a small precontact lithic scatter that was also evaluated as not eligible for the NRHP (Stanyard and Thomas, September 2015d).

In letters dated January 20, 2015, April 23, 2015, July 8, 2015, September 28, 2015, December 7, 2015 and February 18, 2016, the Louisiana SHPO concurred with the finding in the reports that there are no historic properties within the terminal area. We agree.

4.10.4 LNG Berth Area

Venture Global had a contractor (Search) conduct a marine archaeological survey of approximately 81 acres within the Calcasieu River Ship Channel and partially within the eastern portion of the Calcasieu River outside the boundaries of the dredged ship channel. The Phase I marine archaeological survey identified three anomalies that were recommended for avoidance or additional archaeological investigations (Hanks and Enright, 2015).

A Phase II archaeological diver identification survey was conducted to investigate the anomalies identified during the Phase I survey. The diver investigations report indicated that the anomalies were modern debris of no archaeological significance (Hanks, 2015).

In a letter dated December 7, 2015, reviewing the Phase II survey of the LNG Berth Area, the Louisiana SHPO concurred that no historic properties would be affected by the Project. We agree.

4.10.5 Pipeline Facilities

Cultural resources surveys were conducted for the originally proposed pipeline system by NRG, with results provided in three separate reports. During surveys between December 2014 and February 2015, the entire 23.4-mile-long East Lateral Pipeline was inventoried, and 14.3 miles out of the total of 18.5 miles of the West Lateral Pipeline was inspected. No new archaeological sites or historic architectural sites were recorded in the APE during these surveys (Brignac et al., 2015).

NRG conducted additional surveys along the pipeline systems in November 2015, documented in an addendum report. These additional surveys covered pipeline segments, including 0.2-mile along the West Lateral Pipeline, 4 route realignments, 14 ATWS, 2 contractor yards, the East Lateral meter station location, 3 MLVs, and 39 proposed access roads, totaling 191 acres. Two previously recorded sites (16MC54 and 84) were relocated during the surveys of the West Lateral Pipeline. No archaeological material was found at the location where site 16MC54 was previously recorded. The use of an existing access road through site 16MC84 should have no adverse effects (Brignac et al., 2016a). On June 28, 2016, Venture Global filed an amendment to its application that included the removal of the West Lateral Pipeline from the project.

NRG produced a second addendum report that documented the results of surveys conducted in April 2016. Ten new or altered access roads along the East Lateral Pipeline route, totaling about 5 miles, and one contractor yard (about 10 acres) for the East Lateral Pipeline was inspected, with the surveys covering a total of about 38 acres. No new archaeological sites or historic architectural sites were identified in the APE (Brignac et al., 2016b).

The results of the pipeline surveys were submitted to the Louisiana SHPO on July 6, 2015, January 27, 2016, and June 11, 2016. The Louisiana SHPO concurred, in letters dated July 15, 2015, February 8, 2016, and June 27, 2016, with the recommendation that no historic properties would be affected by construction of the Pipeline. We agree.

4.10.6 Unanticipated Discoveries

On February 4, 2015, NRG submitted to the Louisiana SHPO a Plan for the Unanticipated Discovery of Cultural Resources and Human Remains During Construction in Louisiana (Discovery Plan). On March 31, 2015, Venture Global also filed a copy of this plan to the FERC. In an EIR, FERC staff requested that the Discovery Plan be revised, so a new version was filed by Venture Global in December 2015. On June, 10, 2015, the SHPO stated that this plan was "appropriate and sufficient." The FERC staff found the December 2015 version of the Discovery Plan acceptable.

4.10.7 Compliance with the NHPA

No traditional cultural properties, sacred sites, aboriginal burials, or objects of cultural patrimony were identified in the APE by the NPS, BIA, SHPO, Venture Global, NRG, Search, or any Indian tribes. After consultations with the SHPO and Indian tribes, FERC staff concludes that the Project would have no effect on sites of traditional, cultural, or religious importance to Indian tribes; and therefore, we have completed compliance with section 101(d)(6) of the NHPA.

Compliance with section 106 of the NHPA has also been completed for the Project. We and the SHPO agree that construction and operation of the Project should have no effect on historic properties. No additional investigations are necessary at the proposed facilities. Because no historic properties would be adversely affected, we do not have to consult with the ACHP about this Project, in accordance with 36 CFR Part 800.

4.11 AIR QUALITY AND NOISE

4.11.1 Air Quality

Air quality would be affected by construction and operation of the Project. Though air pollutant emissions would be generated by operation of equipment during construction of the Project facilities, most air emissions associated with the Project would result from the long-term operation of the Terminal site. This section of the EIS addresses the construction- and operation-based emissions from the Project, as well as projected impacts on air quality and applicable regulatory requirements. In their scoping comments, the EPA suggested the EIS include a discussion of ambient air quality conditions in the project area, and to address project emissions, including greenhouse gases.

4.11.1.1 Regional Climate

The Project is proposed in Cameron Parish, Louisiana where the climate is humid and subtropical with long, hot summers and short, mild winters (EPA, 2014a). Proximity to the Gulf of Mexico and the Calcasieu River Ship Channel means that humidity in the Project area is relatively high. Wind direction in the Project area is dependent on the time of year. Spring and summer months experience winds coming from the south whereas during the fall and winter months wind direction is typically from the north or northeast. Over the course of the year, typical wind speeds vary from 1 mph to 27 mph, with winds rarely exceeding 32 mph. The highest average wind speed of 17 mph (moderate breeze) occurs around mid-February each year. The lowest average wind speed of 8 mph (gentle breeze) occurs around early August, at which time the average daily maximum wind speed is 15 mph (moderate breeze).

The Project area receives an annual average of 57.2 inches of rain. February is typically the driest month of the year with a monthly mean of 3.3 inches, whereas June tends to be the wettest month with a monthly mean of 6.1 inches. Snow events are rare, with an annual mean of 0.3 inch of snow, which is likely to occur in January or February. Temperatures range from a daytime average of 60.6 °F in February to 91.3 °F in August (NOAA, 2004).

4.11.1.2 Existing Air Quality

Ambient Air Quality Standards

The EPA has established NAAQS for six “criteria” pollutants: CO, Pb, nitrogen dioxide (NO_2), O_3, particulate matter (PM) less than 10 microns in diameter (PM_{10}) and PM less than 2.5 microns in diameter ($PM_{2.5}$), and SO_2. Ozone forms in the atmosphere as a result of a chemical reaction between NO_x and volatile organic compounds (VOCs) in the presence of sunlight. Therefore, NO_x and VOCs are often referred to as ozone precursors. $PM_{2.5}$ may be directly emitted, and can be secondarily formed in the atmosphere as a result of SO_2 and NO_x emissions. SO_2 and NO_x are also referred to as $PM_{2.5}$ precursors.

There are two classifications of NAAQS: primary and secondary standards. Primary standards set limits the EPA believes are necessary to protect human health, including sensitive populations such as children, the elderly, and asthmatics. Secondary standards are set to protect public welfare from detriments such as reduced visibility and damage to crops, vegetation, animals, and buildings. States have the authority to adopt ambient air quality standards if they are at least as stringent as the NAAQS. No state-level ambient air quality standards for criteria pollutants have been adopted in Louisiana. Table 4.11.1.2-1 lists the NAAQS for the six criteria pollutants described above.

On October 26, 2015, the EPA revised the NAAQS for O_3. The rule set the primary and secondary O_3 NAAQS at 70 parts per billion (ppb). As part of that rule, EPA promulgated a grandfathering provision under which the new NAAQS would not be applicable to sources for which air permit applications were declared by a reviewing authority as administratively complete on or before October 1, 2015. The LDEQ declared the Project's air permit application administratively complete on September 2, 2015. The 2015 O_3 NAAQS revisions are accordingly inapplicable to the Project. Instead, the Project will be required to apply Best Available Control Technology (BACT) to all applicable pollutants, demonstrate that the Project emissions will not cause or contribute to a violation of the 2008 O_3 NAAQS, and address any Class I area[22] and additional O_3-related impacts in accordance with the Prevention of Significant Deterioration (PSD) regulatory requirements.

TABLE 4.11.1.2-1

NATIONAL AMBIENT AIR QUALITY STANDARDS

Criteria Pollutant	Primary/ Secondary	Averaging Time	Level	Note
Carbon monoxide (CO)	Primary	8-hour	9 ppm	Not to be exceeded more than once per year
		1-hour	35 ppm	Not to be exceeded more than once per year
Lead (Pb)	Primary and Secondary	Rolling 3-month average	0.15 µg/m^3 [a]	Not to be exceeded
Nitrogen dioxide (NO_2)	Primary	1-hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Primary and Secondary	Annual	53 ppb [b]	Annual mean
Ozone	Primary and Secondary	8-hour	0.070 ppm [c]	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particulate matter of 2.5 microns in diameter or less ($PM_{2.5}$)	Primary	Annual	12 µg/m^3	Annual mean, averaged over 3 years
	Secondary	Annual	15 µg/m^3	Annual mean, averaged over 3 years
	Primary and Secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
Particulate matter of 10 microns in diameter or less (PM_{10})	Primary and Secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur dioxide (SO_2)	Primary	1-hour	75 ppb [d]	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Source: 40 Code of Federal Regulations 50.

[a] In areas designated nonattainment for the Pb standards prior to the promulgation of the previous (2008) standards and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m^3 as a calendar quarter average) also remain in effect.

[b] The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

[c] Final rule signed October 1, 2015 and effective December 28, 2015. The previous (2008) ozone standard of 0.075 ppm remains in effect in some areas. Revocation of the previous (2008) ozone standards and transitioning to the current (2015) standards will be addressed in the U.S. Environmental Protection Agency's (EPA's) implementation rule for the current standards.

[d] The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a State Implementation Plan (SIP) call under the previous SO_2 standards (40 Code of Federal Regulations 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its SIP to demonstrate attainment of the required National Ambient Air Quality Standards. These provisions do not apply to the Project area.

ppb = parts per billion; ppm = parts per million; µg/m^3 = microgram per cubic meter

[22] Class I areas are areas defined by the CAA, such as national parks, where very little deterioration of air quality is allowed.

Air Quality Control Regions and Attainment Status

Air Quality Control Regions (AQCRs) are areas established for air quality planning purposes in which implementation plans describe how ambient air quality standards will be achieved and maintained. AQCRs were established by the EPA and local agencies, in accordance with section 107 of the CAA and its amendments, as a means to implement the CAA and comply with the NAAQS through State Implementation Plans (SIPs). The AQCRs are intrastate and interstate regions, such as large metropolitan areas, where the improvement of the air quality in one portion of the AQCR requires emission reductions throughout the AQCR.

Each AQCR, or portion(s) of an AQCR, is classified as either "attainment," "non-attainment," "unclassifiable," or "maintenance" with respect to the NAAQS. Areas where ambient air concentrations of the criteria pollutants are below the levels listed in the NAAQS are considered in attainment. If ambient air concentrations of criteria pollutants are above the NAAQS levels, then the area is considered to be non-attainment. Areas that have been designated non-attainment but have since demonstrated compliance with the NAAQS are designated maintenance for that pollutant. Maintenance areas are treated similarly to attainment areas for the permitting of stationary sources; however, specific provisions may be incorporated through the state's approved maintenance plan to ensure that air quality would remain in compliance with the NAAQS for that pollutant. Maintenance areas retain the classification for 20 years before being re-classified as attainment areas. Areas where air quality data are not available are considered to be unclassifiable and are treated as attainment areas.

The entire Project area (including the Terminal and Pipeline) is proposed in the Southern Louisiana-Southeast Texas Interstate AQCR. Likewise, ship transit would impact the same AQCR. Cameron Parish is designated as unclassifiable for O_3, $PM_{2.5}$, and NO_2. For all other criteria pollutants, Cameron Parish is considered to be in attainment.

Air Quality Monitoring and Existing Air Quality

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. Data from the air monitoring sites are available through the EPA's AirData database, which collects such monitoring data nationwide. Venture Global has, in consultation with LDEQ, determined that ambient air quality at the following monitoring sites (table 4.11.1.2-2) is representative of ambient air quality at the Terminal site:

TABLE 4.11.1.2-2

NEAREST OR MOST REPRESENTATIVE AIR QUALITY MONITORING STATIONS

Criteria Pollutant	Station Name	Location (Site ID)	Distance and Direction to LNG Terminal
Sulfur dioxide (SO_2) and nitrogen dioxide (NO_2)	Westlake Station	Westlake, Louisiana (220190008)	31 miles North
Particulate matter of 2.5 microns in diameter or less ($PM_{2.5}$)	McNeese University Station	Lake Charles, Louisiana (220190010)	29 miles Northeast
Particulate matter of 10 microns in diameter or less (PM_{10})	Lafayette Station	Lafayette, Louisiana (220550007)	84 miles Northeast
Carbon monoxide (CO) and lead (Pb)	Baton Rouge Station	Baton Rouge, Louisiana (220330009)	137 miles Northeast

Detailed information regarding these representative ambient air quality concentrations from 2014 through 2016 for the Project is provided in table 4.11.1.2-3 below.

TABLE 4.11.1.2-3

EXISTING AMBIENT AIR POLLUTANT CONCENTRATIONS FOR THE PROJECT AREA

Pollutant	Averaging Period	Form	Monitor Location [a]	2016 [b]	2015	2014	Units
CO	1-hour	2nd maximum	Baton Rouge	2.2	2.1	5.0	ppm
	8-hour	2nd maximum	Baton Rouge	1.7	1.6	3.8	ppm
NO_2	1-hour	98th percentile	Westlake	41.3	39.2	29.5	ppb
	Annual	Mean	Westlake	5.4	5.8	5.0	ppb
Ozone	8-hour	4th maximum	Baton Rouge	0.061	0.069	0.070	ppm
$PM_{2.5}$ [c]	24-hour	98th percentile	Lake Charles	17.9	16.9	19.7	µg/m^3
	Annual	Mean	Lake Charles	7.6	8.0	8.3	µg/m^3
PM_{10}	24-hour	2nd maximum	Lafayette	42	66	84	µg/m^3
SO_2	1-hour	99th percentile	Westlake	34.5	33.0	33.4	ppb
	3-hour	2nd maximum	Westlake	22.8	29.9	26.7	ppb
Pb [c]	3-month	Mean	Baton Rouge	0.0017	0.0015	0.0013	µg/m^3

Source: EPA, 2017.

[a] Baton Rouge – EPA ID: 220330009, 1061-A Leesville Avenue, Baton Rouge, Louisiana.
Lafayette – EPA ID: 220550007, 646 Cajundome, Lafayette, Louisiana.
Lake Charles – EPA ID: 2201900010, Common and East McNeese, Lake Charles, Louisiana.
Westlake – EPA ID: 220190008, 2646 John Stine Road, Westlake, Louisiana.

[b] Measurements through December 23, 2016. 2016 data are not final until May 1, 2017.

[c] Data for 2012-2014.

Note: Though the averaging periods for these monitors do not in some cases match the relevant National Ambient Air Quality Standards (NAAQS) averaging periods, these monitors are certified by the EPA as suitable for NAAQS-compliance data gathering. The averaging periods used by these monitors may be used to calculate data expressed in accordance with the NAAQS averaging periods.

µg/m^3 = micrograms per cubic meter; CO = carbon monoxide; EPA = U.S. Environmental Protection Agency; NO_2 = nitrogen dioxide; Pb = lead; PM_{10} = particulate matter of 10 microns in diameter or less; $PM_{2.5}$ = particulate matter of 2.5 microns in diameter or less; ppb = parts per billion; ppm = parts per million; SO_2 = sulfur dioxide

Greenhouse Gases

GHGs occur in the atmosphere both naturally and as a result of human activities, such as the burning of fossil fuels. These gases are the integral components of the atmosphere's greenhouse effect that warms the earth's surface and moderates day/night temperature variation. In general, the most abundant GHGs are water vapor, CO_2, CH_4, nitrous oxide (N_2O), and O_3. On December 7, 2009, the EPA defined air pollution to include the mix of six long-lived and directly emitted GHGs, finding that the presence of the following GHGs in the atmosphere may endanger public health and welfare through climate change: CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

Though the EPA's finding was based on emissions associated with new motor vehicles, the EPA has expanded its regulations to include the emission of GHGs from major stationary sources under the PSD program. The EPA's current rules require that a stationary source that is major for a non-GHG regulated New Source Review (NSR) pollutant must also obtain a GHG PSD permit prior to beginning construction of a new or modified major source with mass-based GHG emissions equal to or greater than 250 tpy and significant net emission increases of CO_2e equal to or greater than 75,000 tpy. There are no NAAQS for GHGs.

As with any fossil-fuel fired project or activity, the Project would contribute GHG emissions. The principal GHGs that would be produced by the Project are CO_2, CH_4, and N_2O. Emissions of GHGs are quantified and regulated in units of CO_2e. The CO_2e unit of measure takes into account the global warming potential (GWP) of each GHG. The GWP is a ratio relative to CO_2 that is based on the particular GHG's ability to absorb solar radiation as well as its residence time within the atmosphere. Thus, CO_2 has a GWP of 1, CH_4 has a GWP of 25, and N_2O has a GWP of 298 (IPCC, 2007). To obtain the CO_2e quantity, the mass of the particular compound is multiplied by the corresponding GWP, the product of which is the CO_2e for that compound. The CO_2e value for each of the GHG compounds is summed to obtain the total CO_2e GHG emissions.

4.11.1.3 Regulatory Requirements for Air Quality

The Project would be potentially subject to a variety of federal and state regulations pertaining to the construction of the Terminal site and Pipeline, and operation of air emission sources. The following sections summarize the applicability of various state and federal regulations.

Federal Air Quality Requirements

The CAA, 42 USC 7401 et seq., as amended in 1977 and 1990, and 40 CFR Parts 50 through 99 are the basic federal statutes and regulations governing air pollution in the U.S. The following federal requirements have been reviewed for applicability to the Project.

- NSR/PSD;
- New Source Performance Standards (NSPS);
- National Emission Standards for Hazardous Air Pollutants (NESHAP);
- Title V Operating Permits;
- General Conformity;
- Greenhouse Gas Reporting; and
- Chemical Accident Prevention Provisions.

<u>New Source Review/Prevention of Significant Deterioration</u>

Separate preconstruction review procedures for major new sources of air pollution (and major modifications of major sources) have been established for projects that are proposed to be built in attainment areas versus nonattainment areas. The preconstruction permit program for new or modified major sources located in attainment areas is called PSD. This review process is intended to keep new air emission sources from causing existing air quality to deteriorate beyond acceptable levels codified in the federal regulations. Construction of major new stationary sources in nonattainment areas must be reviewed in accordance with the nonattainment NSR regulations, which contain stricter thresholds and requirements. Because all of the stationary emission sources at the Project facilities are proposed within an attainment area, nonattainment NSR does not apply. Rather, each facility must be reviewed to determine applicability with the PSD program.

The PSD rule defines a major stationary source as any source with a potential to emit (PTE) 100 tpy or more of any criteria pollutant for source categories listed in 40 CFR 52.21(b)(1)(i) or 250 tpy or more of any criteria pollutant for source categories that are not listed. In addition, with respect to GHG, the major source threshold CO_2e is 100,000 tpy. If a new source is determined to be a major source for any PSD pollutant, then other remaining criteria pollutants would be subject to PSD review if those pollutants are emitted at rates that exceed significant emission thresholds (100 tpy for CO; 40 tpy for NO_x, VOC, and SO_2 each; 25 tpy for total suspended particulate, 15 tpy for PM_{10} and 10 tpy for [direct] $PM_{2.5}$). Sources that exceed the major source threshold are then subject to a PSD review.

The Supreme Court held that the EPA lacked the authority to apply the PSD program to a source that would be a Major Stationary Source only as a result of its GHG emissions (*Utility Air Regulatory Group v. Envtl. Protection Agency,* 135 S. Ct. 2427, 2446 (2014)). The D.C. Circuit issued an amended judgment on April 10, 2015, vacating those parts of the EPA's GHG PSD rules that were inconsistent with the Supreme Court's holding (*Coalition for Responsible Regulation, Inc. v. EPA,* No. 09-1322 (D.C. Cir., Apr. 10, 2015)). Because the Project would be a major source for non-GHG NSR regulated pollutants, the Supreme Court and D.C. Circuit proceedings would not have an effect on the still-valid requirement that the Project obtain a GHG PSD permit.

The results of the PSD applicability analysis for the Terminal site and Pipeline are summarized in table 4.11.1.3-1. The Pipeline does not include any stationary combustion sources of emissions, and would emit only fugitive natural gas during operation.

TABLE 4.11.1.3-1

PREVENTION OF SIGNIFICANT DETERIORATION APPLICABILITY ANALYSIS

NSR Regulated Pollutant	Total Facility Emissions (tpy) [a]	Major Stationary Source Threshold Level (tpy)	Significant Emission Rate (tpy)
PM_{10}	242.85	250	15
$PM_{2.5}$	242.85	250	10
NO_x	677.67	250	40
SO_2	94.77	250	40
CO	1,203.58	250	100
Total VOC	74.10	250	40
H_2S	0.04	N/A	10
CO_2e	3,906,336	N/A	75,000

[a] Totals for each pollutant represent the higher of the final turbine combined cycle operating mode or the interim turbine simple cycle mode.

CO = carbon monoxide; CO_2e = carbon dioxide equivalent; H_2S = hydrogen sulfide; N/A = not applicable; NO_x = nitrogen oxides; NSR = New Source Review; PM_{10} = particulate matter of 10 microns in diameter or less; $PM_{2.5}$ = particulate matter of 2.5 microns in diameter or less; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compound

PSD Requirements

The following PSD requirements would apply to the Terminal site for non-GHG NSR regulated pollutants:

- application of BACT for non-GHG NSR regulated pollutants emitted in excess of the relevant significance levels (40 CFR 52.21(j));
- conduct a source impact analysis showing that increases of regulated NSR pollutants in excess of the relevant significance levels from the Project would not cause or contribute to air pollution in violation of any NAAQS (40 CFR 52.21 (k)(1)(i));

- conduct a source impact analysis showing that increases of regulated NSR pollutants in excess of the relevant significance levels from the Project would not cause or contribute to air pollution in violation of any applicable maximum allowable increase over the baseline concentration in any area (i.e., the "PSD increment analysis") (40 CFR 52.21(k)(1)(ii);

- gather preconstruction air quality monitoring information (40 CFR 52.21(m)(1)) and where necessary, conduct post-construction air quality monitoring (40 CFR 52.21(m)(2)) (based on consultations with LDEQ, preconstruction monitoring for the Terminal site would not be required);

- provide certain information about the proposed source (40 CFR 52.21(n));

- conduct additional impact analyses describing impairments to visibility, soils, and vegetation, as well as those arising from growth associated with the Project (40 CFR 52.21(o));

- conduct an analysis as may be required by a federal land manager of the impact on air quality related values – including visibility – at nearby federal Class I areas (40 CFR 52.21(p));

- public participation in the PSD permitting process (40 CFR 52.21(q));

- comply with certain source obligations (40 CFR 51.21(r)); and

- cooperate in the review by the EPA of a PSD permit application in parallel with the NEPA review that may be required of other federal agencies (40 CFR 52.21(s)).

For GHG pollutants, only the BACT analysis, public participation, and cooperation in separate NEPA analyses are required (EPA, 2011a). The applicable requirements are described in more detail below.

BACT Analysis

BACT is an emissions limitation that is based on the maximum degree of reduction for each NSR-regulated pollutant that would be emitted in significant amounts from the Project, which the EPA – on a case-by-case basis – determines is achievable, while taking into account energy, environmental, and economic impacts and other costs. BACT can be add-on control equipment or modification of the production processes or methods. This includes fuel cleaning or treatment and innovative fuel combustion techniques. BACT may be a design, equipment, work practice, or operational standard if imposition of an emissions standard is infeasible.

The BACT analysis for the Terminal site would use the voluntary "top-down" approach developed by the EPA for determining the best type of control technology for such facilities. The approach includes five basic steps:

1. identification of all available control options for the emission unit in question;

2. evaluation of the technical feasibility of the control options identified in step one;

3. ranking of remaining control technologies from step two based on control effectiveness for the pollutant under review;

4. consideration of the energy, environmental, and economic impacts of available and technically feasible control technology options; and

5. selection of the most effective control alternative not eliminated in step four and establishment of a corresponding emission limit.

A BACT analysis was completed for the Project to identify the maximum degree of emissions reduction for NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, VOC, and CO_2e taking into account technical feasibility, energy, environmental, and economic impacts. The results of the BACT analysis, showing the selected emission control technologies and practices, are listed in appendix I.

Source Impact Analysis

In accordance with 40 CFR 52.21, a source must demonstrate that significant net emissions increases of an NSR regulated pollutant from a project would not cause or contribute to the violation of a NAAQS. In addition, a source must demonstrate that significant net emissions increases of a NSR regulated pollutant will not cause or contribute to an increase in ambient concentrations in excess of the relevant PSD increment for any criteria pollutant in any attainment or unclassifiable area. Venture Global conducted an air quality dispersion modeling analysis for each PSD pollutant emitted from the Project in excess of its significant Emission Rate (see table 4.11.1.3-1) and an O_3 photochemical grid modeling analysis to demonstrate compliance with the NAAQS. The modeling results are summarized in section 4.11.1.6, *Impacts on Ambient Pollutant Concentrations*.

Additional Impact Analyses (Class I Areas; Soil, Vegetation, and Wildlife, and Growth Impact)

Venture Global followed the Federal Land Managers' Air Quality Related Values Work Group's *Phase I Report – Revised* (2010) to determine the lack of Class I impacts from the Project. Federal Class I areas are areas of special national or regional natural, scenic, recreational, or historic value for which the PSD regulations provide special protection. There are 156 mandatory Class I areas in the United States. If a new source or major modification of an existing source is subject to the PSD program requirements 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 ratio of emissions of SO_2, $PM_{2.5}$, NO_x, or sulfuric acid to the distance in kilometers is greater than 10 (this ratio is known as Q/D), the facility is required to notify the appropriate federal officials and assess the impacts of the proposed Project on the Class I area. There are no Class I areas within 62 miles (100 kilometers) of the Project, and the Q/D for each relevant pollutant is less than 10; therefore, no federal land manager notification is necessary.

For most types of soils and vegetation, ambient concentrations of criteria pollutants below the secondary NAAQS will not result in harmful effects (EPA, 1990). Venture Global used the NAAQS compliance modeling analysis to evaluate the effects of the Project emissions on soil, vegetation, and wildlife. Venture Global's compliance modeling analysis also included a growth analysis. The growth analysis includes a projection of the associated industrial, commercial, and residential growth that could occur in the area of impact from the proposed Project, including the potential impact on ambient air resulting from this growth. The modeling results are summarized in section 4.11.1.6, *Impacts on Ambient Pollutant Concentrations*.

Public Participation and NEPA Coordination

LDEQ has detailed public participation requirements that satisfy the requirements of the federal PSD rules. Venture Global has followed these requirements in order to obtain a preconstruction air quality permit.

New Source Performance Standards (NSPS)

NSPS regulations (40 CFR Part 60) establish pollutant emission limits and monitoring, reporting, and recordkeeping requirements for various emission sources based on source type and size. These regulations apply to new, modified, or reconstructed sources. The sections below discuss the NSPS requirements that apply to the Project.

Subpart A – General Provisions

The general provisions listed in Subpart A include broader definitions of applicability and various methods for maintaining compliance with requirements listed in subsequent subparts of 40 CFR 60. Subpart A also specifies the state agencies to which the EPA has delegated authority to implement and enforce standards of performance. The LDEQ has been delegated authority for all 40 CFR 60 standards promulgated by the EPA, except for Subpart AAA – Standards of Performances for New Residential Wood Heaters, which is not applicable to the Project (40 CFR 60.4(e)(2)). Equipment proposed at Project facilities subject to any of the NSPS subparts listed below would also be subject to Subpart A.

40 CFR 60.18(b) sets forth specific requirements for flares and reflects specific design and operating requirements for every flare. All flares are to be designed for and operated with no visible emissions, except for periods not to exceed a total of 5 minutes during any 2 consecutive hours, and flares shall be operated with a flame present at all times. Other requirements are specific to the type of flare (steam assisted, air assisted, or non-assisted). The Project would have four flares – the cold flare, the warm flare, the low pressure vent flare, and the marine flare for the LNG loading operations.

Subpart Dd – Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units

40 CFR 60, Subpart Dd establishes emission standards and compliance requirements for steam generating units constructed, modified, or reconstructed after June 19, 1984, with a heat input capacity greater than 100 million British thermal units per hour (MMBtu/hr). The six hot oil heaters at the Terminal site are subject to the recordkeeping and reporting requirements of Subpart Dd. However, due to the nature of the fuel burned in each hot oil heater, the units are not subject to any of the emission requirements of this subpart.

Subpart Kb – Standards of Performance for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984

This subpart regulates emissions of VOCs from various forms of volatile organic liquid storage tanks with a capacity greater than or equal to 19,800 gallons (75 m^3) for which construction, reconstruction, or modification is commenced after July 23, 1984. In addition to standards for reducing emissions of VOCs, this subpart also requires testing of emission control devices as well as monitoring, recordkeeping, and reporting requirements.

The iso-pentane storage tank is the only storage tank at the Terminal site that is subject to NSPS Subpart Kb, as the tank meets the applicability requirements of having a capacity greater than 19,800 gallons (75 m^3) and does not meet the exemptions specified in 40 CFR 60.110b(b) or (d). As a result, the iso-pentane storage tank would be required to implement a closed vent system designed to collect all VOC vapors and gases per 40 CFR 60.112b(b). Notification of the date of construction for the iso-pentane storage tank must be issued, along with an operating plan that demonstrates that the emission control device would achieve the required control efficiency during maximum loading conditions and specify monitoring parameters. The iso-pentane storage tank must comply with the recordkeeping and reporting requirements outlined in 40 CFR 60.115b and 60.116b.

Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

Subpart IIII applies to owners and operators of stationary compression ignition internal combustion engines (CI ICE) that commence construction after July 11, 2005 where the stationary CI ICEs: (1) are manufactured after April 1, 2006 and are not firewater pump engines, or (2) are manufactured as certified NFPA firewater pump engines after July 1, 2006.

Subpart IIII specifies emission standards, fuel requirements, compliance requirements, and testing requirements for CI ICEs, some of which vary by model year, engine power, and displacement, and also specifies notification, reporting, and recordkeeping requirements for owners and operators of CI ICEs subject to this subpart. The twelve proposed diesel-fired emergency generators, two proposed diesel-fired emergency fire pumps, and three diesel generators for the concrete batch plant proposed at the Terminal site are subject to Subpart IIII.

In accordance with 40 CFR 60.4205(b), Venture Global would comply with the emission limitation requirements by installing firewater pump CI ICEs and emergency generators that are certified by the engine manufacturer to meet the required emission limits. In addition, Venture Global would maintain and operate the firewater pump CI ICEs and emergency generators in accordance with the engine manufacturer's specifications. Emergency engines would not be operated in excess of 100 hours per calendar year for any combination of purposes or in excess of 50 hours per year in non-emergency situations, except situations when a time limit is not applicable. In order to ensure compliance with hours of operation limits, Venture Global would install a non-resettable hour meter prior to startup of each of the engines.

Subpart KKKK – Standards of Performance for Stationary Combustion Turbines

Subpart KKKK applies to owners and operators of stationary combustion turbines with a heat input at peak load equal to or greater than 10.7 gigajoules (10 MMBtu) per hour for which construction, reconstruction, or modification commences after February 18, 2005. Each proposed combustion turbine has a nameplate capacity of 1,166 MMBtu/hr. Subpart KKKK regulates emissions of NO_x and SO_2. Subject turbines must meet the applicable emission limits and operational requirements as well as recordkeeping and reporting requirements of this subpart.

All of the turbines at the power generating facility, including associated heat recovery steam generators and duct burners (peak load equal to or greater than 10 MMBtu/hour based on the higher heating value of the fuel), would be subject to NSPS Subpart KKKK. The turbines would meet the less than 42 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 in excess of 850 MMBtu/hr firing fuels. Venture Global would perform annual NO_x testing to demonstrate compliance with the NO_x emission limit in accordance with 40 CFR 60.4340(a).

Additionally, Venture Global proposes an interim operating mode for greater than or equal to 50 percent natural gas. If the total heat input of the fuel gas is greater than or equal to 50 percent natural gas, the turbines would comply with requirements to meet the NO_x emission limitations for a natural gas-fired turbine with a heat input at peak load of greater than 850 MMBtu/hr.

National Emission Standards for Hazardous Air Pollutants (NESHAP)

The NESHAP codified in 40 CFR 61 and 63 regulated HAP emissions. Part 61 was promulgated prior to the 1990 Clean Air Act Amendments (CAAA) and regulates specific HAPs such as asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride.

The 1990 CAAA established a list of 189 HAPs while directing EPA to publish categories of major sources and area sources of these HAPs for which emission standards were to be promulgated according to a schedule outlined in the CAAA. These standards, also known as the Maximum Achievable Control Technology standards, were promulgated under Part 63. The 1990 CAAA defines a major source of HAPs as any source that has a PTE of 10 tpy for any single HAP or 25 tpy for all HAPs in aggregate. Area sources are stationary sources that do not exceed the thresholds for major source designation. The Project would not emit more than 6.79 tpy of any single HAP and would not emit more than 12.83 tpy of all HAPs combined. Therefore, the Project would not be a major source for HAPs and only those NESHAPs for relevant area sources at the Project would be applicable. NESHAPs that are applicable to the Terminal site are listed below.

Subpart A – General Provisions

The general provisions listed in Subpart A include broader definitions of applicability and various methods for maintaining compliance with requirements listed in subsequent subparts of 40 CFR 63. This subpart also addresses the delegation of NESHAP authority to the states. Though not all NESHAPs have been delegated to the State of Louisiana, the specific NESHAPs that are applicable to the Project have been delegated and are implemented by the LDEQ.

Subpart ZZZZ – NESHAP for Stationary Reciprocating Internal Combustion Engines

40 CFR 63 Subpart ZZZZ provides HAP emission limitations and operating limitations for stationary reciprocating internal combustion engines (RICE) including emergency engines at facilities that are major or area sources of HAP emissions. Venture Global proposes to install twelve diesel-fired generators, two diesel-fired emergency firewater pumps, and three concrete batch plant diesel generators.

Per 40 CFR 63.6590(c)(1), new stationary RICE located at an area HAP source must meet the requirements of Subpart ZZZZ by meeting the requirements for 40 CFR Part 60 Subpart IIII. No other requirements of 40 CFR 63 Subpart ZZZZ apply to the emergency RICE.

Title V Operating Permits

Title V of the CAA requires states to establish an air quality operating permit program. The requirements of Title V are outlined in the federal regulations in 40 CFR 70 and in LAC 33:III.507. The operating permits required by these regulations are often referred to as Title V or Part 70 permits.

Major sources (i.e., sources with a PTE greater than a major source threshold level) are required to obtain a Title V operating permit. Title V major source threshold levels are 100 tpy for CO, NO_x, PM_{10}, $PM_{2.5}$, or SO_2, 10 tpy for an individual HAP, or 25 tpy for any combination of HAPs. The recent Title V GHG Tailoring Rule also requires facilities that have the potential to emit GHGs at a threshold level of 100,000 tpy CO_2e be subject to Title V permitting requirement.

The Project would be subject to Title V permitting requirements based on the emission of more than 100 tpy of CO, NO_x, $PM_{2.5}$, and SO_2. Venture Global Calcasieu Pass submitted a Title V permit application to LDEQ initially on August 31, 2015 and a Title V and PSD permit addendum on February 15, 2017. This is currently in review by the LDEQ.

General Conformity

A conformity analysis must be conducted by the lead federal agency if a federal action would result in the generation of emissions that would exceed

The entire Project area is classified as being in attainment or unclassified for all criteria pollutant standards; therefore, General Conformity requirements do not apply.

Greenhouse Gas Reporting Rule

Subpart W under 40 CFR 98, the Mandatory Greenhouse Gas Reporting Rule, requires petroleum and natural gas systems that emit 25,000 metric tons or more of CO_2e per year to report annual emissions of GHG to the EPA. "LNG storage" and "LNG import and export equipment" are industry segments specially included in the source category definition of petroleum and natural gas systems. Equipment subject to reporting includes storage of LNG, regasification of LNG, and liquefaction of natural gas.

The Project GHG emissions are estimated to exceed the 25,000-metric-ton threshold for CO_2e emissions. Therefore, the Project would be required to comply with all applicable requirements of the rule.

Chemical Accident Prevention Provisions

The Chemical Accident Prevention Provisions, codified in 40 CFR 68, are federal regulations designed to prevent the release of hazardous materials in the event of an accident and minimize potential impacts if a release does occur. The regulations contain a list of substances (including CH_4, propane, and ethylene) and threshold quantities for determining applicability to stationary sources. If a stationary source stores, handles, or processes one or more substances on this list in a quantity equal to or greater than specified in the regulation, the facility must prepare and submit a Risk Management Plan. A Risk Management Plan is not required to be submitted to the EPA until the chemicals are stored on site at the facility.

If a facility does not have a listed substance onsite, or the quantity of a substance is below the applicability threshold, the facility does not have to prepare a Risk Management Plan. However, if there is any regulated substance or other extremely hazardous substance onsite, the facility still must comply with the requirements of the General Duty Clause in section 112(r)(1) of the 1990 CAAA. The General Duty Clause is as follows:

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

Stationary sources are defined in 40 CFR 68 as any buildings, structures, equipment, installations, or substance-emitting stationary activities that belong to the same industrial group, are on one or more contiguous properties, are under control as the same person (or persons under common control), and are from which an accidental release may occur. However, the definition also states that the term stationary source does not apply to transportation, including storage incidental to transportation, of any regulated substance or any other extremely hazardous substance. The term transportation includes transportation subject to oversight or regulation under 49 CFR 192, 193, or 195. Based on these definitions, the Terminal, which is subject to 40 CFR 193, would not be required to prepare a Risk Management Plan.

Applicable State Air Quality Regulations

In addition to the federal regulations identified above, the LDEQ has its own air quality regulations and is the lead air permitting authority for the Project. The LDEQ's air quality regulations are codified in LAC Title 33, Part III, Chapters 1 through 59. The regulations incorporate the federal program requirements listed in 40 CFR 50 through 99 and establish permit review procedures for all facilities that can emit pollutants to the ambient air. Louisiana also requires applicants for an air quality permit to prepare an environmental assessment statement pursuant to state-only requirements set forth in Louisiana Revised Statute 30:2018.A. New facilities are required to obtain an air quality permit prior to initiating construction. LAC Title 33, Part III, Chapters 1 through 59 set forth the air quality regulations for emission sources in Louisiana. In addition, LAC Title 33, Part III, Chapter 1 delegates authority to the LDEQ to maintain air quality resources in Louisiana and enforce LDEQ air quality regulations. The following regulations are applicable 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; and
- Chapter 56: Prevention of Air Pollution Emergency Episodes.

4.11.1.4 Construction Emissions and Mitigation

Construction of the Terminal site and Pipeline would result in short-term increases in emissions of some 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. More specifically, the construction activities that would generate air emissions include:

- site preparation (vegetation clearing, trenching, land contouring, foundation preparation, etc.);
- installation of Terminal site equipment;
- installation of Pipeline and pipeline interconnect equipment;
- operation of off-road vehicles and trucks during construction;
- operation of on-road trucks delivering materials;

- operation of marine vessels (e.g., equipment barges) during construction;
- offshore dredging; and
- workers' vehicles used for commuting to and from the construction site (i.e., on-road vehicles).

The total period of construction for the Terminal site is estimated to be 35 months. The total period of construction for the Pipeline is estimated to be 10 months. These activities would take place concurrently. The emission increases associated with the Project construction activities would have short-term, localized impacts on air quality. These emissions are not subject to the air quality permitting requirements that apply to emissions from operation of stationary sources at the Terminal site. Nevertheless, the construction-related emission rates are discussed in this section as a means of identifying potential air quality concerns associated with the construction phase of the Project and to assist in developing mitigation.

Construction activities can result in emissions of fugitive[23] PM or "fugitive dust" from earthmoving and exposed earth surfaces. The amount of fugitive dust for an area under construction would depend on numerous factors including: degree of vehicular traffic; size of area disturbed, amount of exposed soil, soil properties (silt and moisture content); and wind speed. Construction of the Project would also result in fuel combustion emissions from a variety of sources, including off-road sources (e.g., bulldozers, cranes, front-end loaders, pile drivers), on-road sources (e.g., construction worker vehicles), and marine vessels (e.g., tugs, barges).

Site preparation activities for the Terminal site would include grading, cutting of drainage ditches, placement of gravel surfaces (e.g., lay-down areas), and construction of access roads within the Project site boundaries. Site preparation activities would generate fugitive dust from earthmoving and movement of construction equipment over unpaved surfaces and tailpipe emissions from construction equipment and vehicle engines. The construction equipment and vehicles would be powered by internal combustion engines that would generate CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2, VOC, and GHG emissions. Site preparation equipment would include bulldozers, front-end loaders, backhoes, compactors, scrapers, dump trucks, and other mobile construction equipment.

The Terminal site construction equipment would include cranes, forklifts, pile drivers, welders, concrete pump trucks, and generators (for various duties such as pumping, lighting, etc.), which would result in fuel combustion and fugitive dust emissions.

The Project would include off-shore dredging of the LNG carrier berthing area at the Terminal site. The emissions generated by these activities would be predominantly combustion emissions from the construction equipment and marine vessel engines. The construction equipment would include a dredge, tugboats, survey/workboats, crew boats, inspection vessels, and trucks.

Air emissions would also be generated during construction of the Pipeline. 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 that would be used for the Pipeline construction activities would include various earthmoving equipment (bulldozers,

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[23] Fugitive means emissions that are not emitted from a stack, vent, or other specific device that controls the discharge. For example, windblown dust is fugitive PM.

backhoes, trenchers, graders, and compactors), cranes, forklifts, compressors, pumps, trenchers, stringing trucks, welding rigs, generators, and miscellaneous trucks.

Site truck traffic (e.g., supply trucks) and worker commuter vehicles would generate fugitive dust from travel on paved and unpaved surfaces as well as tailpipe emissions. Most of the commuter vehicles would likely burn gasoline, although supply trucks and some worker pickup trucks would burn ultra-low-sulfur diesel fuel.

Anticipated construction emissions are summarized in table 4.11.1.4-1. The air emissions potentially resulting from construction of the Project, as presented in this EIS, represent worst-case scenarios based on currently available technology, equipment, and schedule.

TABLE 4.11.1.4-1

CONSTRUCTION EMISSIONS [a] (TONS PER YEAR)

Construction Activity	NO_x	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	HAPs	CO_2e
YEAR 1								
Terminal Site [b]								
Off-Road Construction Equipment	158.6	51.5	14.6	9.5	9.2	0.2	1.9	36,848
On-Road Vehicles	50.0	364.4	8.0	1.3	1.1	0.3	2.1	49,136
Marine Vessels	1,179.5	101.1	43.7	37.5	35.4	0.4	N/A	46,311
Construction Activity Fugitive Dust	N/A	N/A	N/A	6.0	0.9	N/A	N/A	N/A
Roadway Fugitive Dust	N/A	N/A	N/A	48.8	4.9	N/A	N/A	N/A
Concrete Batch Plants	0.1	0.5	0.0	0.5	0.4	0.1	0.0	48
Total YEAR 1	**1,388.2**	**517.5**	**66.3**	**103.6**	**51.9**	**1.0**	**4.0**	**132,343**
YEAR 2								
Terminal Site								
Off-Road Construction Equipment	221.2	71.6	20.4	12.4	12.1	0.3	2.7	80,918
On-Road Vehicles	99.6	726.5	16.0	2.5	2.2	0.7	4.3	97,923
Marine Vessels	1,925.9	165.2	71.4	61.3	57.8	0.6	N/A	75,712
Construction Activity Fugitive Dust	N/A	N/A	N/A	12.0	1.8	N/A	N/A	N/A
Roadway Fugitive Dust	N/A	N/A	N/A	97.8	9.8	N/A	N/A	N/A
Concrete Batch Plants	0.1	1.2	0.1	1.3	1.0	0.2	0.0	119
Subtotal Terminal Site	2,246.8	964.5	107.9	187.3	84.7	1.8	7.0	254,672
Pipeline [c]								
Off-Road Construction Equipment	6.2	10.6	0.9	0.4	0.4	0.0	0.1	1,019
On-Road Vehicles	2.0	16.9	0.4	0.0	0.0	0.0	0.1	2,186
Construction Activity Fugitive Dust	N/A	N/A	N/A	11.9	1.2	N/A	N/A	N/A
Roadway Fugitive Dust	N/A	N/A	N/A	2.1	0.2	N/A	N/A	N/A
Subtotal Pipeline	8.2	27.5	1.3	14.4	1.8	0.0	0.2	3,205
Total YEAR 2	**2,255.0**	**992.0**	**109.2**	**201.7**	**86.5**	**1.8**	**7.2**	**257,877**
YEAR 3								
Terminal Site								
Off-Road Construction Equipment	144.4	55.7	14.1	8.7	8.4	0.2	1.9	34,407
On-Road Vehicles	99.2	726.2	16.0	2.2	2.2	0.7	4.3	97,780
Marine Vessels	469.7	40.6	17.6	14.6	14.6	0.1	N/A	18,860
Construction Activity Fugitive Dust	N/A b	N/A	N/A	12.0	1.8	N/A	N/A	N/A
Roadway Fugitive Dust	N/A	N/A	N/A	97.6	9.8	N/A	N/A	N/A
Concrete Batch Plants	0.0	0.4	0.0	0.4	0.3	0.1	0.0	35
Subtotal Terminal Site	713.3	822.9	47.7	135.5	37.1	1.1	6.2	151,082
Pipeline								
Off-Road Construction Equipment	15.4	26.5	2.1	0.9	0.9	0.0	0.3	2,547

TABLE 4.11.1.4-1 CONSTRUCTION EMISSIONS [a] (TONS PER YEAR)								
Construction Activity	NO_x	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	HAPs	CO_2e
On-Road Vehicles	4.9	42.3	0.9	0.1	0.1	0.0	0.2	5,465
Construction Activity Fugitive Dust	N/A	N/A	N/A	31.9	3.4	N/A	N/A	N/A
Roadway Fugitive Dust	N/A	N/A	N/A	5.2	0.5	N/A	N/A	N/A
Subtotal Pipeline	20.3	68.8	3.0	38.1	4.9	0.0	0.5	8,012
Total YEAR 3	**733.6**	**891.7**	**50.7**	**173.6**	**42.0**	**1.1**	**6.7**	**159,094**
YEAR 4								
Terminal Site								
Off-Road Construction Equipment	60.1	22.4	5.6	3.4	3.3	0.1	0.7	13,678
On-Road Vehicles	41.2	301.6	6.7	1.0	0.9	0.3	1.8	40,619
Marine Vessels	46.7	4.2	1.8	1.8	1.7	0.0	N/A	2,039
Construction Activity Fugitive Dust	N/A	N/A	N/A	5.0	0.8	N/A	N/A	N/A
Roadway Fugitive Dust	N/A	N/A	N/A	40.5	4.1	N/A	N/A	N/A
Total YEAR 4	**148.0**	**328.2**	**14.1**	**51.7**	**10.8**	**0.4**	**2.5**	**56,336**
Total Construction Period Emissions	**4,524.8**	**2,729.4**	**240.3**	**530.6**	**191.2**	**4.3**	**20.4**	**605,650**

[a] Emissions less than 0.05 tons per year are rounded to zero.

[b] Construction duration is 38 months. Note that Chapter 2 indicates that the construction schedule for the terminal is estimated to last 35 months. A longer schedule of 38 months was used in the air analysis to represent a worst-case analysis with emissions extending into a fourth year.

[c] Construction duration is 6 months. Note that Chapter 2 indicates that the construction schedule for the pipeline is estimated to last 10 months. The air analysis assumed a shorter span of 6 months which would not result in any substantive change to the emissions results.

Emissions from construction equipment would depend on the duration and type of construction activity, together with the 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, PM_{10}, $PM_{2.5}$, VOCs, GHGs, and minimal amounts of HAPs.

Emissions from equipment associated with the Pipeline would be short-term and localized in the area of construction as equipment and activities move sequentially along the route, and depending on the equipment being operated at any given time. Construction equipment would be operated on an as-needed basis. Emissions from diesel- and gasoline-fired construction equipment would be minimized by maintaining the equipment in accordance with the manufacturer's recommendations and, to the extent practicable, by minimizing the idling time of engines. Additionally, fugitive dust emissions during construction would be controlled in accordance with LAC Title 33, Part III, Chapter 13. Specific reasonable precautions for the prevention of PM becoming airborne include, but are not limited to the following practices listed in LAC Title 33, Part III, Chapter 13:

1. use of water or suitable chemicals for control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads, or the clearing of land;

2. application of asphalt, oil, water, or suitable chemicals on dirt roads, materials, stockpiles, and other surfaces that can give rise to airborne dust;

3. installation and use of dust collectors to enclose and vent the handling of dusty materials;

4. use of adequate containment methods during sandblasting or similar operations;

5. covering of open-bodied trucks in the process of transporting materials likely to give rise to airborne dust;

6. paving of roadways and maintenance of roadways in a clean condition; and

7. for paved streets, prompt removal of earth or other material originating from trucks or earth-moving equipment, sedimentation from erosion of surrounding land, or other sources.

Venture Global has not provided a commitment to implementing the practices or any information about accountability or individuals with authority regarding fugitive dust mitigation for the duration of construction at the proposed LNG terminal. Specifically, more information regarding other mitigation measures for dust abatement in addition to spraying of water (e.g., reducing vehicle speeds where appropriate for travel on unpaved roads, using dust suppressants in high erosion areas to control dust in residential areas and near road crossings, and training of Project personnel) is necessary. Therefore, **we recommend that:**

- **<u>Prior to construction of the Terminal</u>, Venture Global Calcasieu Pass should file with the Secretary, for review and written approval by the Director of OEP, a Fugitive Dust Control Plan that specifies the precautions that Venture Global Calcasieu Pass will take to minimize fugitive dust emissions from construction activities, including additional mitigation measures recommended by the EPA to control PM_{10} and $PM_{2.5}$. The plan should clearly explain how Venture Global Calcasieu Pass will implement such measures as:**

  a. watering the construction workspace and access roads;

  b. providing measures to limit track-out onto the roads;

  c. identifying the speed limit that Venture Global Calcasieu Pass would enforce on unsurfaced roads;

  d. covering open-bodied haul trucks, as appropriate;

  e. clarifying that the EI has the authority to determine if/when water or an alternative dust suppressant needs to be used for dust control; and

  f. clarifying the individuals with the authority to stop work if the contractor does not comply with dust control measures.

Emissions over the 35-month construction period would increase pollutant concentrations in the vicinity of the Project; however, their effect on ambient air quality would vary with time due to the construction schedule, the mobility of the sources, and the variety of emission sources. Construction emissions associated with the Pipeline are considered temporary and would cease at completion of construction. Based on the analysis above and with implementation of our recommendation we conclude the Project's construction-related impacts on local or regional air quality would not be significant.

4.11.1.5 Operating Emissions and Mitigation

Operation of the Project would result in long-term air emissions from the following stationary equipment.

Terminal Site

Power Plant Facility

- five combined-cycle combustion turbines;
- five simple-cycle combustion turbines;
- five heat recovery steam generators with duct burners that feed two steam turbines;
- diesel emergency/black start engines; and
- fugitive emissions from various components.

Liquefaction Facility

- nine liquefaction blocks;
- two LNG storage tanks;
- condensate, LNG, and refrigerant storage tanks;
- four total flares: a low pressure flare, a warm flare, a cold flare, and a marine loading flare;
- emergency backup diesel generators;
- firewater pump engines;
- gas heaters;
- six hot oil furnaces;
- three gas treatment systems (each containing equipment for dehydration [molecular sieve] and heavy hydrocarbon removal) served by a single acid gas thermal oxidizer;
- concrete batch plant; and
- fugitive emissions from various components.

LNG Carrier Loading Facility

- LNG carrier loading emissions (emission units located onshore); and
- fugitive emissions from various onshore components.

Emissions Common to All Facilities

- Vehicle travel emissions.

Pipeline

- Pig launcher/receivers;
- meter station;
- block valves; and
- fugitive emissions from various components.

Marine Vessels

- LNG carriers at berth (hoteling emissions);
- escort tug boats;
- LNG carriers within the exclusionary zone (1,640-foot [500-meter] radius from the dock); and
- security vessels.

Operational emissions are presented in table 4.11.1.5-1 below. Table 4.11.1.5-1 includes combustion and non-combustion emissions as listed above. Combustion sources primarily include engines, turbines, heaters/furnaces, and flares. Non-combustion sources primarily 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 station, as well as from one annually scheduled pipeline pigging event.

TABLE 4.11.1.5-1

OPERATIONAL EMISSIONS

	Criteria Pollutants (tpy)							GHG (tpy)
Source Facility	NO_x	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	HAPs	CO_2e
Terminal Site [a]	677.67	1,203.58	74.10	241.85	241.85	94.77	15.11	3,906,336
Pipeline [b,c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Marine Vessels	176.8	16.1	6.9	4.8	4.6	2.8	0.0	9,178
Facility Totals	**854.47**	**1204.68**	**81.00**	**246.65**	**246.45**	**97.57**	**15.11**	**3,915,514**

[a] Totals for each pollutant represent the higher of the Terminal Power Plant Facility final turbine combined cycle operating mode or the interim turbine simple cycle mode.

[b] Pipeline emissions are considered to be negligible: values less than 0.1 are rounded to zero.

[c] Values shown do not include methane emissions from one annually scheduled pipeline pigging event, which is considered an authorized discharge under Louisiana Administrative Code 33:III.537(XVII). Emissions from pipeline pigging are about 0.07 tpy CO_2e.

CO = carbon monoxide; CO_2e = carbon dioxide equivalent; GHG = greenhouse gas; HAP = Hazardous Air Pollutant; NO_x = nitrogen oxides; PM_{10} = particulate matter less than 10 microns in diameter; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compounds

In order to identify leaking equipment such as valves, flanges, and seals, Venture Global Calcasieu Pass and TransCameron Pipeline would use a site-specific program utilizing a combination of design and Auditory/Visual/Olfactory leak detection methods. Auditory/Visual/Olfactory leak detection will 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. Venture Global Calcasieu Pass and TransCameron Pipeline would also facilitate proper piping design and installation and conduct direct and control room monitoring to identify that system facilities remain in proper working order once operational. Proper design and installation practices can include the following:

- Ensuring proper bracing;
- Manually verifying that all joints are tight;
- Visually confirming that all pipes are properly assembled;
- Designing piping for adequate/desired pressure;
- Ensuring proper seal design/selection;
- Ensuring proper installation of valve packing or O rings; and
- Manually inspecting the installation of the disk gaskets on pressure relief devices.

Venture Global Calcasieu Pass and TransCameron Pipeline operations would comply with all applicable PHMSA codes and advisories regarding leak detection and repair, and LDEQ air quality regulations.

Sections 4.11.1.6 and 4.11.1.7 demonstrate through dispersion modeling that the ambient pollutant concentrations that would result from these emissions would not lead to violation of any ambient air quality standard or exceedance of any other air quality impact criterion.

4.11.1.6 Impacts on Ambient Pollutant Concentrations – PSD Pollutants

Venture Global conducted an air quality dispersion modeling analysis to estimate ambient pollutant concentrations in the vicinity of the Project. The analysis used the EPA's American Meteorological Society/EPA Regulatory Model (AERMOD) to predict maximum short-term and annual concentrations. The analysis is summarized below.

Preliminary Modeling Analysis

Initially, Venture Global conducted a preliminary modeling analysis for those pollutants that are subject to PSD (CO, NO_2, PM_{10}, $PM_{2.5}$, and SO_2). In a preliminary impact analysis, the net emissions increases of PSD pollutants from the Project are evaluated to determine whether they have the potential to have significant impacts on air quality in the area surrounding the facility. Modeled concentrations are compared to the respective EPA Significant Impact Levels (SILs), PSD Increments, and Significant Monitoring Concentrations (SMCs). If the modeled level is less than the SIL then the impact is considered to be less than significant with respect to the NAAQS for that pollutant and further analysis is not required. If the modeled level is greater than the SIL, or if the SIL plus a relevant background concentration exceeds the corresponding NAAQS, then a full impact analysis is required. Venture Global determined relevant background concentrations from nearby LDEQ monitoring stations in consultation with LDEQ. Similarly, if the modeled impact of any pollutant indicates a potential violation of the corresponding PSD increment or NAAQS, then a full impact analysis is required.

The modeled impact also is compared to the 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. However, discussions between Venture Global with LDEQ indicated that preconstruction air quality monitoring would not be necessary, and the use of representative background concentrations from LDEQ monitoring stations would be adequate.

Table 4.11.1.6-1 lists the applicable air quality standards and criteria, including the NAAQS, SILs, PSD Class II Increments (Class II areas are all areas that are not Class I areas, defined previously), and SMCs. These standards and criteria were compared to the preliminary modeling results in order to determine the Project's impact on the surrounding air quality. The preliminary modeling results demonstrated that the Project would not cause or contribute to a violation of the NAAQS or PSD Increments. However as shown in table 4.11.1.6-1, modeled impacts for the following pollutants and averaging periods exceeded the corresponding SILs for 1-hour CO, 1-hour NO_2, Annual NO_2, 24-hour $PM_{2.5}$, Annual $PM_{2.5}$, and 3-hour SO_2. Therefore, Venture Global conducted a full impact analysis for these pollutants and averaging periods.

TABLE 4.11.1.6-1

APPLICABLE AIR QUALITY STANDARDS AND CRITERIA

Pollutant	Averaging Period	SIL (µg/m^3)	SMC (µg/m^3)	PSD Class II Increment (µg/m^3)	NAAQS (µg/m^3)	Preliminary Modeled Concentration[l] (µg/m^3)
CO	1-hour	2,000	Not Established	Not Established	40,000 [d]	2,734.1
	8-hour	500	575	Not Established	10,000 [d]	190.8
NO_2	1-hour	7.5 [a]	Not Established	Not Established	188.7 [b]	20.8
	Annual	1	14	25 [c]	100	1.4
PM_{10}	24-hour	5	10	30 [c]	150 [h]	3.2
	Annual	1	Not Established	17 [i]	Revoked	0.5
$PM_{2.5}$	24-hour	1.2	4 [j]	9 [c]	35	2.8
	Annual	0.3 [i,k]	Not Established	4 [c]	12	0.4
SO_2	1-hour	7.8 [e]	Not Established	Not Established	196 [f]	56.0
	3-hour	25	Not Established	512 [d]	1300 [d]	63.5
	24-hour	5	13	91 [d]	365 [g]	2.4
	Annual	1	Not Established	20	80 [g]	0.3

[a] EPA interim SIL, based on SIL of 4 ppb, recommended in EPA 2010a.

[b] Based on the 1-hour NO_2 NAAQS of 100 ppb. 98th percentile of the maximum daily 1-hour concentration per year, averaged over 3 years.

[c] Highest of each year's second high over 5 years of meteorological data.

[d] Not to be exceeded more than once per year.

[e] Based on SIL of 3 ppb, recommended in EPA 2010b.

[f] Based on the 1-hour SO_2 NAAQS of 75 ppb. 99th percentile of the maximum daily 1-hour concentration per year, averaged over 3 years.

[g] EPA has revoked the 24-hour and annual SO_2 standards. These former SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual, equivalent to 365 µg/m^3 and 80 µg/m^3, respectively) will remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR § 50.4(3)).

[h] Not to be exceeded more than once per year on average over 3 years.

[i] Highest of each year's first high over 5 years of meteorological data.

[j] $PM_{2.5}$ SMC was vacated and remanded on January 22, 2013 by the D.C. Circuit Court.

[k] EPA (2016c) guidance provides that a state is authorized to use the annual $PM_{2.5}$ SIL of 0.3 µg/m^3 from 40 CFR § 51.165(b) rather than the non-binding EPA guidance-based SIL of 0.2 µg/m^3.

[l] Value shown is the higher of the results for the turbine interim and final operating modes.

µg/m^3 = micrograms per cubic meter; CFR = Code of Federal Regulations; CO = carbon monoxide; EPA = U.S. Environmental Protection Agency; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; PM_{10} = particulate matter of 10 microns in diameter or less; $PM_{2.5}$ = particulate matter of 2.5 microns in diameter or less; ppb = parts per billion; ppm = parts per million; PSD = Prevention of Significant Deterioration; SIL = Significant Impact Level; SIP = State Implementation Plan; SMC = Significant Monitoring Concentration; SO_2 = sulfur dioxide

Full Modeling Analysis

<u>Dispersion Model</u>

The dispersion modeling was conducted using version 15181 of EPA's AERMOD model. AERMOD is recommended by EPA's 2016 Appendix W Guidance (EPA, 2016d) for determining near-field impacts (impacts within a 31-mile [50-kilometer] radius of the facility) and is approved for regulatory determinations.

All model assessments were performed using the regulatory default options. AERMOD calculates concentrations at each receptor[24] for each hour of meteorological data. Pollutant concentrations were averaged over short-term (1-hour, 3-hour, 8-hour, or 24-hour) or annual averaging periods as required by the applicable NAAQS averaging period for each modeled pollutant.

<u>Emission Sources</u>

Modeled emission rates included two operating scenarios that address the two operating stages of the turbines:

1. The turbine interim operating mode which consists of three simple cycle heavy-duty frame combustion turbines and one aeroderivative combustion turbine with selective catalytic reduction (a NO_x control technology).

2. The turbine final operating mode which consists of five combined cycle heavy-duty frame combustion turbines and one aeroderivative combustion turbine with selective catalytic reduction.

Both of these scenarios include all other emissions facility-wide, which are consistent between the two scenarios. For short-term (1-hour, 3-hour, 8-hour, and 24-hour) averaging periods, emissions were based on hourly maximum emission rates. Long-term (annual) averaging period emission rates were based on an average annual PTE.

All stack or vent emissions with vertical momentum were modeled as point sources. For point sources, stack heights and other stack exit parameters were used to define the characteristics of the exhaust flow from each emission unit. The stack and building locations and dimensions were input to AERMOD to assess potential downwash effects. Wind direction-specific building profiles were prepared by using the EPA's currently approved version of the Building Profile Input Program – Plume Rise Model Enhancements software (version 04274).

Sources at a facility that are operated on a periodic or emergency basis are known as intermittent sources. The Project includes the following intermittent sources:

- three simple cycle heavy-duty frame combustion turbines – during maintenance, startup, and shutdown (MSS) (27 hours/year/turbine);

- five combined cycle heavy-duty frame combustion turbines – MSS (27 hours/year/turbine);

- one ACT – MSS (27 hours/year);

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[24] A receptor is any location at which the model calculates pollutant concentrations.

- five emergency generators (100 hours/year/engine);
- two firewater pumps (50 hours/year/pump);
- one cold flare – MSS (60 hours/year);
- one warm flare – MSS (60 hours/year);
- one low-pressure flare – MSS (60 hours/year); and
- one marine loading flare (18 hours/year).

The schedule for operation of these units cannot be predicted precisely. Emission rates were estimated based on likely operating characteristics over each averaging period, in accordance with EPA guidance (EPA, 2011b).

The full impact analysis includes not only the Project in the modeling, but also other large emission sources in the region (collectively known as inventory sources). Emission sources within a distance defined by the Radius of Impact (the maximum distance from the Project at which the impact exceeds the SIL) plus 12.4 miles (20 kilometers) were included in the modeling, based on LDEQ guidance. Emissions data (as PTE) for these sources was obtained from LDEQ's Emissions Reporting and Inventory Center (ERIC). These major sources were defined as facilities with emissions greater than 250 tpy for each modeled pollutant. The LDEQ's Electronic Document Management System was used to validate missing stack parameters. Source parameters missing from the LDEQ ERIC data and not listed in the LDEQ Electronic Document Management System search were filled in with parameter values from similarly sized pieces of equipment, if available, or LDEQ default values.

<u>Land Use and Terrain</u>

The Project is located in a mainly rural area with limited industrial and commercial land uses in the vicinity. Given the setting of the Project on the Louisiana Coastal Plain, the local topography is characteristically low and relatively flat. The USGS topographic mapping for the Terminal site indicates elevations of less than 5 feet above National Geodetic Vertical Datum of 1929 across most of the site.

The terrain elevation for each modeled building, source, and receptor were interpolated from National Elevation Dataset data obtained from the USGS. The National Elevation Database data consists of arrays of regularly spaced elevations and corresponds to the 1:24,000 scale USGS topographic quadrangle map series. The array elevations are at 30-meter (1 arc-second) intervals. Terrain elevations were assigned to each receptor, and a hill scale calculated with the AERMAP (version 11103) terrain processor. The AERMAP terrain processor searches for the terrain height and location that has the greatest influence on dispersion for each individual receptor. The output from AERMAP is incorporated into AERMOD which uses the data to select the correct algorithm to predict the dispersion of each part of the plume at each receptor.

<u>Receptor Grid</u>

Based on LDEQ 2016 Modeling Guidance, five nested receptor grids were used to analyze the ground-level concentrations of each pollutant. These receptor grids cover a region extending 31 miles (50 kilometers) from all edges of the Terminal site fence line. Receptor grids near the modeled facility require closer spacing to ensure that the highest concentration is captured. For the dispersion modeling analyses, the receptor grids were defined as follows:

- The “fence line grid” consists of a discrete receptor grid with the receptors spaced at 328-foot (100-meter) linear intervals along the fence line (orange line in figure 1-2 of Supplemental Response to September 20, 2016 Environmental Information Request [Latham & Watkins, 2017]).

- The “fine grid” contains receptors spaced 328 feet (100 meters apart) extending 0.62 mile (1 kilometer) from the fence line exclusive of the receptors within the property line.

- The “inner coarse grid” contains 1,640-foot (500-meter) spaced receptors extending from 0.62 mile (1 kilometer) to 3.1 miles (5 kilometers) from the fence line.

- The “middle coarse grid” contains 328-foot (1,000-meter) spaced receptors extending from 3.1 miles (5 kilometers) to 6.2 miles (10 kilometers) from the fence line.

- The “outer coarse grid” contains 3.1-mile (5-kilometer) spaced receptors extending from 6.2 miles (10 kilometers) to 31 miles (50 kilometers) from the fence line.

Meteorological Data

Meteorological data was obtained from the National Weather Service station at Lake Charles Regional Airport, National Weather Service (station 03937). This station was selected because the data is most representative of the conditions at the Project site. Weather data was obtained for the period of January 1, 2011 through December 31, 2015. Meteorological data processing included running AERSURFACE to determine the land surface characteristics surrounding the Project site for input to the meteorological data processor AERMET. AERSURFACE uses a 0.62-mile (1-kilometer)-radius area surrounding the site to determine surface roughness values for each direction sector, and a 6.2-mile-by-6.2-mile (10-kilometer-by-10-kilometer) area to determine the midday albedo (the proportion of the incidental sunlight that is reflected by a surface) and daytime Bowen Ratio (the ratio of sensible heat to latent heat). AERMET was then used to prepare meteorological data for use in AERMOD.

NO_x to NO_2 Conversion

NO_x emitted from a source react with oxygen in the atmosphere to form the pollutant NO_2. The rate at which NO_x converts to NO_2 affects the modeled NO_2 concentration. The AERMOD default option for calculating the conversion rate is the Tier 2 Ambient Ratio Method, and this option was used in the modeling. In addition, a set of NO_2 background values that vary by season and hour of the day was used, in accordance with EPA guidance (EPA, 2011b).

Modeling Results

NAAQS Assessment

Table 4.11.1.6-2 shows the modeling results for the NAAQS assessment. The table shows that all predicted concentrations were less than the NAAQS except for 1-hour NO_2. To address the 1-hour NO_2 exceedance a “culpability analysis” was performed. A culpability analysis looks not only at the maximum values shown in table 4.11.1.6-2 but 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 contributions to modeled NAAQS exceedances are greater than the SIL for 1-hour NO_2. 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 4.11.1.6-2

NATIONAL AMBIENT AIR QUALITY STANDARDS ASSESSMENT RESULTS

Pollutant	Averaging Period	Model Predicted Concentration [a] ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
CO	1-hour	2,695	839	3,534	40,000
NO_2	1-hour	[b]	[b]	3,367	188.7
	Annual	3.1	11.9	15.0	100
$PM_{2.5}$	24-hour	2.1	16.3	18.4	35
	Annual	0.4	7.6	8.0	12
SO_2	3-hour	58.1	84.9	143	1300

[a] Value shown is the highest of the results for the turbine interim and final operating modes, or the terminal emissions including the marine vessel mobile emissions. See the discussion in the Emission Sources section above for descriptions of the turbine interim and final operating modes.

[b] Modeled and background concentrations are not shown separately because background values varied seasonally and hourly.

$\mu g/m^3$ = micrograms per cubic meter; CO = carbon monoxide; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; SO_2 = sulfur dioxide

The NAAQS Assessment in table 4.11.1-8 shows the higher of the predicted model concentration for the Terminal (turbine interim or final operating modes), or the Terminal plus LNG carrier and supporting vessel mobile emissions. The mobile sources associated with the LNG carriers along with the support vessels were modeled for maneuvering activities within the moored safety (security) zone and hoteling at the terminal, 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. This modeling analysis was not carried through to include nearby inventory sources for the pollutant concentrations that exceeded the SIL for a complete evaluation of the Project air quality impacts; therefore, **we recommend that:**

- **<u>Prior to the end of the draft EIS comment period</u>, Venture Global Calcasieu Pass should file with the Secretary a refined air modeling analysis for the Terminal and the associated mobile emissions, during LNG vessel hoteling and maneuvering activities, that includes the nearby inventory sources for the pollutants that exceeded the significant impact levels and for comparison to the NAAQS. Venture Global Calcasieu Pass should perform the modeling analysis using the same protocol used for the PSD permitting modeling analysis with justification for the basis of any assumptions.**

<u>PSD Increment Assessment</u>

The PSD increment assessment was performed in the same way as the NAAQS assessment. The assessment was performed for annual NO_2, 24-hour and annual $PM_{2.5}$, and 3-hour SO_2, which are the pollutants for which modeled concentrations exceeded their respective SILs and for which both NAAQS and PSD increments have been established. Table 4.11.1.6-3 shows the modeling results for the PSD increment assessment and indicates that all predicted concentrations are less than the corresponding PSD increment. Therefore, the Project would not cause or contribute to any PSD increment violations.

TABLE 4.11.1.6-3			
PREVENTION OF SIGNIFICANT DETERIORATION INCREMENT ASSESSMENT RESULTS			
Pollutant	Averaging Period	Model Predicted Concentration [a] ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
NO_2	Annual	3	25
$PM_{2.5}$	24-hour	3.2	9
	Annual	0.5	4
SO_2	3-hour	57.5	512

[a] Value shown is the higher of the results for the turbine interim and final operating modes.

$\mu g/m^3$ = micrograms per cubic meter; NO_2 = nitrogen dioxide; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PSD = Prevention of Significant Deterioration; SO_2 = sulfur dioxide

Secondary Formation of $PM_{2.5}$

EPA (2014b) guidance for PM modeling calls for PSD permit applications to address the potential for secondary formation of $PM_{2.5}$ in the atmosphere due to emissions of the $PM_{2.5}$ precursors NO_X (which forms nitrates) and SO_2 (which forms sulfates). Venture Global performed an assessment of the potential formation of secondary $PM_{2.5}$ from Project sources in accordance with this guidance.

The maximum modeled direct $PM_{2.5}$ concentrations are unlikely to occur where maximum secondary $PM_{2.5}$ impacts occur because the emissions of NO_x and SO_2 from the Project would require time in the atmosphere to form particulate nitrates and sulfates, during which time they would be transported downwind. 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. Therefore, this analysis does not consider further the direct $PM_{2.5}$ concentration, but focuses on the role that nitrates and sulfates play in the total formation of $PM_{2.5}$ in the region and how regional emissions of NO_x and SO_2 have historically coincided with locally monitored values of $PM_{2.5}$. These historical values were used to derive a maximum expected secondary $PM_{2.5}$ concentration that could be attributable to the Project's NO_x and SO_2 emissions.

Venture Global compiled emissions and their trends over time from the LDEQ's ERIC database for the region within 31 miles (50 kilometers) of the Project. The Project's NO_x emissions would be less than 1 percent of the total regional NO_x emissions, and the Project's emissions of SO_x would be less than 1 percent of the total regional SO_x emissions. Venture Global also compiled LDEQ measured data on $PM_{2.5}$ for the region and the proportions of $PM_{2.5}$ that consisted of nitrates and sulfates. From these data, Venture Global estimated the ratio between the change in regional emissions over time to the changes in nitrate and sulfate concentrations. By applying this ratio to the Project emissions an estimate was derived of the Project's contribution to nitrate and sulfate concentrations. The combined nitrate and sulfate contribution from the Project is 0.12 microgram per cubic meter ($\mu g/m^3$) for the higher of the two turbine operating scenarios. This is less than the annual $PM_{2.5}$ SIL of 0.3 $\mu g/m^3$. Consequently, the emissions of NO_x and SO_2 associated with the Project would not be expected to cause significant formation of secondary $PM_{2.5}$ in the region.

Additional Impact Analyses

Venture Global performed additional assessments of potential impacts from air emissions on Class I areas; soil, vegetation, and wildlife; and effects on development growth. The additional assessments were based on the results of the NAAQS analysis and are summarized below.

Class I Areas

The nearest Class I area is the Breton Wilderness Area which is located 260 miles (420 kilometers) from the Project site. This distance is greater than the PSD threshold of 62 miles (100 kilometers). In addition, the Q/D analysis for this Class I area demonstrates that the threshold value of 10 is not exceeded for either turbine operating scenario; therefore the Project is shown not to have a significant impact on pollutant concentrations or visibility impairment in any Class I area.

Soil, Vegetation, and Wildlife

The secondary NAAQS are set at levels designed to protect soil, vegetation, and wildlife in Class I Areas. The NAAQS assessment demonstrates that the Project would be in compliance 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 and associated emissions 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 due to the shipping and export facilities. Raw materials, other supplies, and services to be used by the Project are currently available to serve existing oil and gas facilities. Venture Global anticipates that existing suppliers would serve the Project as well, and does not anticipate that the Project would induce new suppliers, support facilities, or other industry to locate in the Project area that were not already drawn to this coastal region.

The area surrounding the Project site contains a viable road network and available workforce. Venture Global anticipates that the majority of the permanent workforce at the Project would be local hires. As the majority of jobs would be staffed locally, 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.

Consequently, the Project's contribution to inducing growth would not be large enough to result in a substantial increase in emissions, and no additional analysis was required to assess impacts due to growth.

4.11.1.7 Impacts on Ambient Pollutant Concentrations – Ozone

The Project is located in Cameron Parish which is currently designated as an attainment area for the 2008 O_3 NAAQS.[25] However, there are three areas of potential air quality concern in the larger region beyond Cameron Parish:

- parishes in the Baton Rouge Metropolitan Statistical Area that were only recently designated as attainment for the 2008 O_3 NAAQS (about 110 miles northeast of the project site);

[25] EPA has not issued area designations for the 2015 ozone NAAQS. LDEQ has recommended to EPA that Cameron Parish be designated as unclassifiable or attainment with the 2015 ozone NAAQS.

- the Houston/Galveston/Brazoria 2008 O_3 NAAQS nonattainment area (about 60 miles west of the Project site); and

- the Beaumont/Port Arthur 2008 O_3 NAAQS attainment area, a former nonattainment area in which O_3 remains a concern and which is relatively nearby (about 30 miles northwest of the Project site).

Due to the quantity of O_3 precursor emissions (VOC and NO_x) from the Project and the proximity of the Project to these three areas, Venture Global performed a modeling analysis to quantify the potential impact of the Project on O_3 concentrations in the surrounding area. The analysis was performed in accordance with current EPA and LDEQ air quality modeling guidelines.

Photochemical Grid Model

The potential 8-hour O_3 impact of the 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 O_3 episode that occurred in the Baton Rouge region from August 17 through October 31, 2010. LDEQ had prepared the O_3 episode data as part of its submittal to EPA requesting redesignation of the Baton Rouge O_3 nonattainment area to attainment for the 1997 8-hour O_3 standard.

The LDEQ CAMx model was prepared for the 2008 8-Hour O_3 NAAQS Modeling Project and is 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.[26] Consistent with the analysis by 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 (2016e) guidance for a "Refined or Second Tier" application. Consistent with the guidance, the metric used to assess the Project impact was the episode maximum daily 8-hour average concentration at receptors (as grid cells) on days where the O_3 is estimated to be over 60 ppb on more than 5 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 PSD modeling analysis described previously.

<u>Preliminary Modeling Analysis</u>

Initially, Venture Global conducted a preliminary modeling analysis for O_3. In a preliminary impact analysis, the peak increases in O_3 concentrations from the Project, as modeled with CAMx, are evaluated to determine whether they have the potential to have significant impact on air quality in the area surrounding the facility. Modeled concentrations are compared to the EPA SIL for O_3. 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 further analysis is not required. The SIL for O_3 as identified in the EPA (2016e) guidance is 1.0 ppb.[27] The modeled peak impact from the project is 1.31 ppb (the higher of the results for the turbine interim and final operating modes), which exceeds the draft O_3 SIL of 1.0 ppb. Because the project impact from the preliminary analysis exceeds the SIL, Venture Global performed a full modeling analysis for O_3 impacts.

[26] In a photochemical grid modeling analysis, grid cells correspond to receptors.

[27] This SIL is a draft SIL but is used in this analysis because EPA has not established a final SIL for ozone.

Full Modeling Analysis

The full modeling analysis was performed using CAMx as described above, but with the addition of background concentrations in the region. In accordance with the EPA (2016e) guidance, monitored design values[28] were used for the background values. The modeling used data consistent with that used in the PSD analysis discussed previously.

Modeling Results

The 2016 Modeling Guidance specifies that the highest daily 8-hour maximum O_3 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 Lake Charles area for 2013–2015 was used to conservatively represent the monitored design value at all receptors. The design values used in the analysis were 68 ppb at the LDEQ Carlyss air quality monitoring station (EPA AIRS ID: 22019002) and 66 ppb at the LDEQ Vinton air quality monitoring station (EPA AIRS ID: 22019009).

The addition of the modeled Project impact (1.31 ppb) to these monitored design concentration levels would not exceed either the 75 ppb 2008 O_3 NAAQS or the 70 ppb 2015 O_3 NAAQS. Therefore, the Project would not cause or contribute to a violation of the O_3 NAAQS.

Based on the analysis of the air quality impacts from construction and operations of the Project and with implementation of our recommendations, we conclude the Project's impacts on local and regional air quality would not be significant.

4.11.2 Noise

Noise would affect the local environment during both construction and operation of the Project facilities. At any location, both the magnitude and frequency of environmental noise may vary considerably over the course of the day and throughout the week. This variation is caused in part by changing weather conditions, the effects of seasonal vegetative cover, and man-made activities.

Two measures used by federal agencies to relate the time-varying quality of environmental noise to its known effect on people are the equivalent sound level (L_{eq}) and the day-night average sound level (L_{dn}). The L_{eq} is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a 24-hour period. The L_{dn} is the L_{eq} with 10 decibels on the A-weighted scale (dBA) added to nighttime sound levels between the hours of 10:00 p.m. and 7:00 a.m. to account for people's greater sensitivity to sound during nighttime hours. The A-weighted scale is used because human hearing is less sensitive to low and high frequencies than mid-range frequencies. A person's threshold of perception for a perceivable change in loudness on the A-weighted sound level is on average 3 dBA, whereas a 5 dBA change is clearly noticeable and a 10 dBA change is perceived as twice or half as loud.

Table 4.11.2-1 demonstrates the relative sound levels of common sounds measured in the environment and industry.

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[28] The design value is a statistic that describes the air quality status of a given location relative to the level of the NAAQS for a specific pollutant. It is calculated using the same statistical formulation that is used to define the NAAQS for that pollutant.

TABLE 4.11.2-1

SOUND LEVELS AND RELATIVE LOUDNESS

Description of Sound	Sound Level (dBA)	Relative Loudness (dBA)
Threshold of pain	140	256
Jet taking off (200-foot distance)	130	128
Operating heavy equipment	120	64
Night club with music	110	32
Construction site	100	16
Boiler room	90	8
Freight train (100-foot distance)	80	4
Classroom chatter	70	2
Conversation (3-foot distance)	60	1
Urban residence	50	1/2
Soft whisper (5-foot distance)	40	1/4
North rim of Grand Canyon	30	1/8
Silent study room	20	1/16
Threshold of hearing (1,000 hertz)	0	1/64

Note: Adapted from U.S. Department of Labor (2016) Occupational Health and Safety Administration Technical Manual https://www.osha.gov/dts/osta/otm/new_noise/index.html
dBA = decibels on the A-weighted scale

4.11.2.1 Regulatory Requirements

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 use it to evaluate the potential noise impacts from the Project at noise-sensitive areas (NSAs) such as residences, schools, or hospitals. Due to the 10 dBA nighttime penalty added prior to calculation of the L_{dn}, for a facility to meet the L_{dn} of 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.

Neither the State of Louisiana nor Cameron Parish has adopted noise regulations applicable to construction and operation of the Project. Cameron Parish does not have a numerical noise ordinance; however, the Cameron Parish Code of Ordinances, Chapter 15, section 15-28 has a general prohibition on excessive noise, which states, "No person shall make, continue, or cause to be made or continued any loud, unnecessary or excessive noise which unreasonably interferes with the comfort and repose of others within the parish."

4.11.2.2 Existing Noise Levels

The Terminal site is located in a mixed industrial and rural area with no residences within 0.5 mile of the site. The noise sources in the area include wind, birds, insects, nearby industrial facilities, marine traffic, and vehicular traffic on local roads. The Pipeline is also located in an area of mixed use, with noise levels along the pipeline route influenced by rural backgrounds sources, with some mixed industrial activities. There are several residential areas within 0.5 mile of the Pipeline.

A preconstruction ambient noise survey for the Terminal site was conducted on May 14, 2015. Four potential noise receptors (PNRs)[29] were identified and noise monitoring locations were also determined based on these PNRs. PNR 1 is a residence or seasonal structure about 3,000 feet southwest of the center of the noise producing equipment at the Terminal, or Terminal noise center; PNR 2 is a group of residences about 8,900 feet northeast of the Terminal noise center; PNR 3 is a group of temporary residences for ship pilots on the southern tip of Monkey Island across Calcasieu Pass, located about 3,400 feet from the Terminal noise center; and PNR 4 is a group of temporary residences about 9,080 feet from the Terminal noise center.

An updated ambient noise survey was completed in December 29, 2016, with an updated Terminal noise center and refined PNRs. Figure 4.11.2.2-1 is a map of the refined NSAs, PNRs, and the associated noise monitoring locations. Monitoring location 1 (ML 1) was located within the boundary of the Terminal site, adjacent to the southwestern boundary of the site. ML 2 was located outside the boundary of the Terminal site, approximately 3,450 feet to the east in an open field previously used for agriculture operations. ML 3 was located within the Terminal site boundary, approximately 900 feet east of the site boundary and the Calcasieu River Shipping Channel. ML 4 was located within the boundary of the proposed construction support facility, approximately 425 feet north of the Terminal site boundary. Results of the ambient noise survey for the noise monitoring locations are listed in table 4.11.2.2-1.

[29] Venture Global's noise survey used the term 'potential noise receptor'; however, FERC staff uses the standard term 'noise sensitive area'. In this case, potential noise receptor and noise sensitive area have the same meaning.

Figure 4.11.2.2-1 Refined Noise-Sensitive Areas, Potential Noise Receptors Noise Monitoring Locations

TABLE 4.11.2.2-1			
AMBIENT NOISE SURVEY RESULTS [a]			
Monitoring Location	Distance and Direction From Terminal site	Measured Daytime Noise Level, L_d [b] (dBA)	Calculated Day-Night Noise Level, L_{dn} [c] (dBA)
ML 1	Within and adjacent to the southwest edge of Terminal site	51.4	57.8
ML 2	Approximately 3,450 feet east of Terminal site boundary	48.1	54.5
ML 3	Within Terminal site boundary, approximately 900 feet from western edge of boundary	58.4	64.8
ML 4	Within construction support facility area, approximately 425 feet north of Terminal site boundary	56.4	62.8

[a] The data summarized in this table is a logarithmic average of the 1 minute L_{eq} data logged by the Larson Davis 824 for each monitoring location.

[b] L_d is the daytime L_{eq}, as recorded with the sound level meter.

[c] L_{dn} is the calculated day-night average sound level, where $L_{dn} = 10\log_{10}((15/24)10^{Ld/10} + (9/24)10^{(Ln+10)/10})$. L_n is the nighttime L_{eq}.

Note: Ambient noise surveys were not conducted during nighttime hours (10:00 p.m. to 7:00 a.m.), therefore, 10 decibels on the A-weighted scale (dBA) was logarithmically added to the survey results to account for increased noise sensitivity at night. This is considered a conservative assumption, since noise levels are typically lower at night.

An ambient noise survey was not conducted along the Pipeline route. An L_{dn} of 54.5 dBA was the lowest recorded ambient noise survey result near the Terminal; Venture Global assumed an L_{dn} of 54.5 dBA as the ambient noise level for each NSA along the Pipeline. An L_{dn} of 54.5 dBA is also consistent with ambient sound levels associated with a small town or quiet suburban setting. (Cowan, 1994)

4.11.2.3 Noise-Sensitive Areas

Five PNRs were observed within 7,000 feet from the Terminal noise center. Although PNR 2 and 4 are greater than a mile away from the Terminal, and would be less likely to experience an increase in ambient noise levels, these two noise receptors are still included in the LNG Terminal noise analysis below. The focus of the LNG Terminal noise analysis will be PNR 1 and 3, which are the closest noise receptors to the LNG Terminal, and we define as NSA 1 and 3. An additional NSA was included in the updated noise analysis and is defined as NSA 5. NSA 5 is the Cameron Jetty Pier Facility, located about 4,000 feet southwest of the Terminal noise center. The Cameron Jetty Pier Facility is a public recreational area that includes parking for visitors and also accommodates overnight RV parking. Given its proximity to Project construction activities at the Terminal site, the road to the Cameron Jetty Pier Facility may be closed for a period of time during construction for safety reasons. During Terminal operations, it is anticipated that day use of the facility would continue; however, the public would not have vehicular access and, as such, overnight stays in RVs would not occur. (Refer to Section 4.8.1.3 for conditions specific to the Cameron Jetty Pier Facility.)

There are multiple residences within 0.5 mile of seven HDD sites along the proposed pipeline route. Some of the NSAs represent one residence, while other NSAs represent a cluster of residences. Thirteen NSAs are presented in table 4.11.2.3-1 below. Appendix J includes maps showing the relation of the NSAs to each HDD. TransCameron Pipeline did not conduct ambient noise surveys along the pipeline route. TransCameron Pipeline assumed that the noise levels along the pipeline would be similar to those recorded during the ambient noise survey for the Terminal site. An L_{dn} of 54.5 dBA was the lowest ambient noise survey result for the Terminal site; therefore, this noise level was used for each NSAs along the pipeline route.

TABLE 4.11.2.3-1 TRANSCAMERON PIPELINE PROJECT NOISE-SENSITIVE AREAS				
Resource Crossing	NSA	HDD Location	Distance (feet) and Direction of Nearest NSA	Ambient Noise Levels, L_{dn}
Mermentau River Road	1	HDD Exit at MP 0.1	2,772 South	54.5
Mermentau River Road/Kings Bayou[a]	1	HDD Entry at MP 0.5	2,904 Southeast	54.5
Kings Bayou	1	HDD Exit at MP 1.0	4,282 Southeast	54.5
East Creole Highway	4	HDD Exit at MP 7.9	1,456 Northeast	54.5
East Creole Highway	5	HDD Entry at MP 8.3	1,601 West	54.5
West Creole Highway	5	HDD Exit at MP 8.5	742 Southwest	54.5
West Creole Highway/Raymond Richard Road[a]	6	HDD Entry at MP 9.4	989 South	54.5
Raymond Richard Road	7	HDD Exit at MP 10.1	1,779 South	54.5
Amoco Road	8	HDD Exit at MP 18.9	8,991 South	54.5
Amoco Road	9	HDD Entry at MP 19.1	8,842 Southwest	54.5
Marshall Street-Hwy 27	10	HDD Exit at MP 21.3	502 Southeast	54.5
Marshall Street-Hwy 27	11	HDD Entry at MP 21.6	973 Southeast	54.5
Pipeline to Terminal	12	HDD Entry at MP 22.9	5,470 East	54.5
Pipeline to Terminal	13	HDD Exit at MP 23.2	7,278 East	54.5

[a] HDD entry site used for two separate HDDs to different HDD exit sites.
HDD = horizontal direction drill; Hwy = highway; L_{dn} = day-night average sound level; MP = milepost; NSA = noise-sensitive area

4.11.2.4 Noise Impacts and Mitigation

Construction Noise

Construction noise would be generated over an extended period at the Terminal Site and for a short-term period along the Pipeline and HDD work areas. Noise generated during construction of the Project has the potential to impact terrestrial and aquatic wildlife species. Specifically, pile driving during construction would result in increased underwater noise levels within the Calcasieu River Ship Channel and nearshore environment. The underwater noise impacts on wildlife are discussed in section 4.6.2, Aquatic Resources.

Terminal Site

The most prevalent noise-generating activity and equipment during construction at the Terminal site is anticipated to be pile driving, dredging, and the internal combustion engines associated with construction equipment. The noise levels experienced in the general vicinity would depend on the type of equipment used, the mode of operation of the equipment, the length of time the equipment is in use, the amount of equipment used simultaneously, and the distance between the sound generation source and the receptor. Pile driving could produce peak sound levels that could be perceptible above the background sound levels at NSAs 1 and 3 during construction (NSA 5 would be closed during construction). Offshore dredging would be carried out using one barge-mounted 30-inch hydraulic cutterhead dredge. These operations would be carried out on a 24-hour per day basis for an estimated 270 days. Primary noise sources would include diesel engines with associated pumps, as well as a tugboat used to position the dredge. For purposes of this analysis, it is assumed that dredging noise levels would be 80 dBA at a distance of 50 feet. This estimated noise level would be consistent with dredging noise associated with periodic dredging maintenance of Calcasieu Pass and adjacent berthing areas. Venture Global Calcasieu Pass has not provided a noise survey to estimate the potential noise impacts of the pile driving and dredging activities.

Because these activities would be carried out on a 24-hour per day basis, and would potentially result in an increase in nighttime noise at NSAs 1 and 3, **we recommend that:**

- **<u>Prior to the end of the draft EIS comment period</u>, Venture Global Calcasieu Pass should file with the Secretary a pile driving and dredging noise analysis identifying the existing and projected noise levels at NSAs 1 and 3. If noise attributable to the pile driving and dredging activities are projected to exceed an Ldn of 55 dBA at either NSA, Venture Global Calcasieu Pass should file the noise analysis and a mitigation plan to reduce the projected noise levels.**

Noise levels during construction activities would vary over time and would be dependent primarily on the number of noise-generating sources operating simultaneously. With the exception of dredging, pile driving, and HDD pipeline "pullback" activities, construction activities for the Project would generally occur between the hours of 7:00 a.m. and 7:00 p.m., varying with the season and light availability. It is anticipated that the Project would require nighttime construction during the initial 6 to 12 months at the Terminal site. The level of construction-related noise would also vary over the course of the approximately 35-month construction period depending on the construction phase in progress. During the initial phase of the Project, a berm would be constructed on the west side of the Terminal site and a floodwall would be constructed on the north, east, and south sides of the Terminal site. These elevated barriers would assist with minimizing construction noise disturbance in the surrounding area.

<u>Pipeline</u>

During construction of the Pipeline, noise would be generated primarily by construction equipment, including HDD equipment used to install pipeline sections at several locations. While individuals in the immediate vicinity of the construction activities would experience an increase in noise, this effect would be temporary and local at any given location because of the assembly-line method of pipeline installation. The changing number and type of construction equipment present at these sites would result in varying levels of noise. The Project would utilize conventional construction techniques and equipment, including excavators, bulldozers, heavy trucks (water and dump trucks), and similar heavy construction equipment. Construction equipment would be operated on an as-needed basis. With the potential exception of the HDD locations, construction activities would be limited to daytime hours; therefore, most construction noise would not have nighttime impacts on residents near the Pipeline.

TransCameron Pipeline proposes to conduct eight HDD crossings along the pipeline route. 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.

Noise levels associated with activities at the HDDs for the Project are detailed in table 4.11.2.4-1.

TABLE 4.11.2.4-1

NOISE LEVELS ASSOCIATED WITH HORIZONTAL DIRECTIONAL DRILL OPERATIONS

Equipment	Noise Level at 50 Feet (dBA)
HDD Entry	
Drill Machine	90
Mud/Slurry Recycler	82
Forklift	80
Drill Console Generator	82
Generator (Gas)	82
Generator (Diesel)	80
Combined HDD Entry Noise Level [a]	92.4
HDD Exit	
Crane	85
Welding Engine	73
Excavator	85
Forklift	80
Generator	82
Combined HDD Exit Noise Level [a]	89.6

[a] Assumes all equipment is operating simultaneously.
dBA = decibels on the A-weighted scale; HDD = horizontal directional drill

TransCameron Pipeline conducted an acoustical assessment for the proposed HDDs as part of its July 2016 Project layout and design update; however, TransCameron Pipeline updated once again the HDD sites and NSAs subsequent to the July 2016 update. The updated NSAs are shown in table 4.11.2.3-1, but an updated acoustical assessment was not conducted for the new HDD sites. According to the July 2016 acoustical assessment, the noise levels from HDD operations could exceed the FERC's criteria of 55 dBA L_{dn} at some or all of the NSAs.

In anticipation of HDD noise exceedances, TransCameron Pipeline has committed to reduce noise impacts as necessary to comply with FERC's noise criteria by implementing appropriate mitigation measures, which may include one or more of the following: reconfiguration of equipment locations to take advantage of natural and artificial noise barriers; use of temporary acoustical barriers; use of engine mufflers; use of noise blanket and/or other mechanical noise dampening blankets; and use of acoustical tents. Prior to implementing noise mitigation measures, TransCameron Pipeline committed for an EI to visit the HDD entry and exit sites to conduct sound tests that would quantify the noise levels generated by the actual HDD operations/equipment. For entry or exit sites at which noise level thresholds could be exceeded, the results of the preconstruction sound tests would determine the extent of the temporary noise mitigation measures that would be installed at the site. If the survey results indicate that noise attributable to HDD activities at a particular site exceeds applicable threshold levels at residential NSAs in the locality, TransCameron Pipeline committed for a further assessment and mitigation measures to be taken.

TransCameron Pipeline provided an anticipated noise mitigation plan for the impacts on the nearest NSAs to the HDD sites; however, an acoustical assessment was not completed for the NSAs. To minimize the impact of noise attributable to the HDD activities on the NSAs identified in table 4.11.2.3-1, **we recommend that:**

- **Prior to construction of the HDDs identified in table 4.11.2.3-1 of the EIS, TransCameron Pipeline should file with the Secretary an HDD noise analysis identifying the existing and projected noise levels at each NSA identified within 0.5 mile of each HDD entry and exit site. If noise attributable to the HDD is projected to exceed an L_{dn} of 55 dBA at any NSA, TransCameron Pipeline should file with the noise analysis a mitigation plan to reduce the projected noise levels for the review and written approval by the Director of OEP. During drilling operations, TransCameron 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 NSAs.**

Construction activities associated with the LNG Terminal Project would be localized to the Terminal site, the construction activities of the Pipeline would result in short-term, temporary increases in ambient noise levels. With the majority of the Pipeline and Terminal construction limited to daytime hours, Venture Global Calcasieu Pass and TransCameron Pipeline's proposed mitigation measures, and our recommendations, we believe that nearby NSAs would not be significantly affected by construction-related noise associated with the Project.

Operational Noise

Terminal Site

Operation of the Terminal site would produce noise on a continuous basis. The primary noise-generating sources would be:

- fan-driven air-cooled heat exchangers;
- LNG refrigerant compressor electric motor drive units;
- MR and Boil-Off Gas compressor units;
- power plant electric generation units;
- inlet and discharge piping;
- expander units; and
- packaged items.

Many of the dominant noise sources (compressor piping and air coolers) would be at elevations of more than 20 feet above grade and, as such, may have a greater influence on NSAs than if ground based. Some of the piping and exhaust ducts would have direct line of sight from the source to the NSAs, with no benefit of screening from plant infrastructure or the Terminal's perimeter berm/wall. The air coolers, together with their connecting compressor piping, would be dominant noise source groupings at these elevated locations.

Implementation of the following noise mitigation measures was determined in the noise analysis to result in noise at NSAs that meet our criteria of an L_{dn} of 55 dBA at the nearest NSAs:

- liquefaction air coolers are reduced to a sound power level of 88 dBA per fan;
- elastomeric foam and metal jacketing Class D piping insulation;
- compressor blankets (SPL = 85 dBA @ 1 meter); and
- steam turbine duct insulation D.

Table 4.11.2.4-2 summarizes the predicted noise levels from Terminal operation with these mitigation measures in place.

TABLE 4.11.2.4-2

CALCASIEU PASS TERMINAL PROJECT ESTIMATED NOISE IMPACTS AT NEARBY NOISE-SENSITIVE AREAS

Noise Monitoring Location	PNR/NSA	Baseline L_{dn} (dBA)	Estimated L_{dn} Attributable to Terminal Operations (dBA)	Combined Baseline L_{dn} and Estimated Terminal Operations L_{dn} (dBA)	Potential Increase Above Ambient Noise Level (decibel)
ML 1	NSA 1	57.8	50.7	58.8	+1.0
ML 2	PNR 2	54.5	52.7	56.5	+2.0
ML 3	NSA 3	64.8	54.9	64.8	0
ML 4	PNR 4	62.8	52.7	62.8	0
ML 5	NSA 5	57.8	50.8	58.7	+0.9

dBA = decibels on the A-weighted scale; L_{dn} = day-night average sound level; NSA = noise-sensitive area; PNR = potential noise receptor

Venture Global Calcasieu Pass has not committed to employ the mitigation measures included in the noise analysis to meet our criteria of an L_{dn} of 55 dBA at the nearest NSAs. Therefore, to ensure that the nearest NSAs are not significantly affected by noise during operation of the Terminal, **we recommend that:**

- **Venture Global Calcasieu Pass should file with the Secretary a full power load noise survey for the Terminal <u>no later than 60 days</u> after each phase of liquefaction blocks are placed into service. If the noise attributable to operation of the equipment at the Terminal exceeds an L_{dn} of 55 dBA at the nearest NSA, Venture Global Calcasieu Pass should reduce operation of the liquefaction facilities or install additional noise controls until a noise level below an L_{dn} of 55 dBA at the NSA is achieved. Venture Global Calcasieu Pass should confirm compliance with the above requirement by filing a second noise survey with the Secretary <u>no later than 60 day</u>s after it installs the additional noise controls.**
- **Venture Global Calcasieu Pass should file a noise survey with the Secretary <u>no later than 60 days</u> after placing the entire Terminal into service. If a full load condition noise survey is not possible, Venture Global Calcasieu Pass should provide an interim survey at the maximum possible horsepower load <u>within 60 days</u> of placing the Terminal into service and provide the full load survey <u>within 6 months</u>. If the noise attributable to operation of the equipment at the Terminal exceeds an L_{dn} of 55 dBA at the nearest NSA under interim or full horsepower load conditions, Venture Global Calcasieu Pass should file a report on what changes are needed and should install the additional noise controls to meet**

the level <u>within 1 year</u> of the in-service date. Venture Global Calcasieu Pass should confirm compliance with the above requirement by filing an additional noise survey with the Secretary <u>no later than 60 days</u> after it installs the additional noise controls.

In compliance with the condition above, Venture Global Calcasieu Pass would need to complete several noise surveys to ensure that the cumulative noise levels of the phased-in liquefaction blocks are below 55 dBA L_{dn} at the nearest NSAs. If the noise levels reported in any of the noise surveys are over 55 dBA L_{dn}, Venture Global Calcasieu Pass would need to implement the required mitigation to reduce the noise impacts on the nearest NSAs within the time specified in the condition.

<u>Pipeline</u>

Normal operations of the proposed Pipeline would not result in permanent noise impacts on nearby noise receptors. Pipeline blowdown events, however, could also generate noise impacts on MLV sites. Planned pipeline blowdown events can happen during inspections or maintenance and are conducted on the segment of pipeline between MLV sites, requiring a segment of pipeline to be evacuated of natural gas. The duration of a blowdown depends on factors such as the extent of the maintenance activity and the gas pressure, and could generally last between 20 minutes and 2 hours. Planned events could allow for slower gas release and be scheduled for daytime hours, thus reducing the noise impacts. Unplanned pipeline blowdowns occur only in emergency situations. Unplanned events could occur at any time, but are typically infrequent and of short duration.

Based on the analyses conducted and our recommendation, we conclude that operation of the Terminal and TransCameron Pipeline would not result in significant noise impacts on the NSAs.

4.12 RELIABILITY AND SAFETY

4.12.1 Regulatory Oversight

Multiple federal agencies share regulatory authority over the siting, design, construction, and operation of LNG facilities. The safety, security, and reliability of the Venture Global Calcasieu Pass Terminal would be regulated by the FERC, the DOT, and the USCG.

The FERC authorizes the siting and construction of LNG facilities under the NGA and delegated authority from the DOE. The 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 safety-related siting requirements of 49 CFR Part 193, Subpart B. The level of detail necessary for this submittal requires the project sponsor to perform substantial front-end engineering of the complete project.[30] The design information is required to be site-specific and developed to the extent that further detailed design would not result in changes to the siting considerations, basis of design, operating conditions, major equipment selections, equipment design conditions, or safety system designs that we considered during our review process. As part of the review required for a FERC authorization, we use this information from the applicant to assess whether the proposed facilities would have a public safety impact.

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[30] Additional guidance on information to be submitted regarding the safety, reliability, and engineering design can be found in our Guidance Manual for Environmental Report Preparation for Applications Filed Under the Natural Gas Act, Volume II, Liquefied Natural Gas Project Resource Reports 11 & 13 Supplemental Guidance, February 2017.

The DOT establishes and has the authority to enforce the federal safety standards for the siting, construction, operation, and maintenance of onshore LNG facilities, as well as for the siting of marine cargo transfer systems at waterfront LNG facilities, under the Natural Gas Pipeline Safety Act (49 USC. 1671 et seq.). The DOT's LNG safety regulations are codified in 49 CFR Part 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 USC 60101 et seq.), and 49 CFR Part 192. In 1985, the FERC and the DOT entered into a memorandum of understanding (MOU) regarding the execution of each agency's respective statutory responsibilities to ensure the safe siting, design, construction, operation, and maintenance of LNG facilities. In addition to the FERC's existing ability to impose requirements to ensure or enhance the operational reliability of LNG facilities, the MOU specified that the FERC may, with appropriate consultation with the DOT, impose more stringent safety requirements than those in Part 193. As a cooperating agency, the DOT assists the FERC staff in evaluating whether an applicant's proposed project siting meets the DOT requirements. If the project is constructed and becomes operational, the facilities would be subject to the DOT's inspection program. Final determination of whether the facilities are in compliance with the requirements of 49 CFR Part 193 would be made by the DOT staff.

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 entire LNG terminal and LNG marine traffic. The USCG regulations over LNG facilities are codified in 33 CFR Parts 105 and 127. As a cooperating agency, the USCG assists the FERC staff in evaluating whether an applicant's proposed waterway would be suitable for LNG marine traffic and whether the terminal facilities would be in accordance with 33 CFR Parts 105 and 127. If the facilities are constructed and become operational, the facilities would be subject to the USCG inspection program. Final determination of whether the facilities are in compliance with the requirements of 33 CFR Parts 105 and 127 would be made by the USCG.

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 marine carrier 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 respective regulations covering LNG facility siting, design, construction, and operation. All three agencies have some oversight and responsibility for inspection and compliance during the LNG facility's operation.

Federal regulations issued by the Occupational Safety and Health Administration (OSHA) under 29 CFR §1910.119 (*Process Safety Management of Highly Hazardous Chemicals; Explosives and Blasting Agents* (PSM)), and the EPA under 40 CFR Part 68 (*Chemical Accident Prevention Provisions*) cover hazardous substances, such as methane, propane and ethylene at many industrial plants in the United States. However, on October 30, 1992, shortly after the promulgation of the OSHA Process Safety Management regulations, OSHA issued a letter of interpretation that precluded the enforcement of PSM regulations over gas transmission and distribution facilities. In a subsequent letter on December 9, 1998, OSHA further clarified that this letter of interpretation applies to LNG distribution and transmission facilities.

In addition, EPA's preamble to its final rule in the Federal Register, Volume 63, Number 3, 639-645, clarified that exemption from the requirements in 40 CFR Part 68 for regulated substances in transportation, including storage incident to transportation, is not limited to pipelines. The preamble further clarified that the transportation exemption applies to LNG facilities subject to oversight or regulation under 49 CFR Part 193, including facilities used to liquefy natural gas or used to transfer, store, or vaporize LNG in conjunction with pipeline transportation. Therefore, the above OSHA and EPA regulations are not applicable to facilities regulated under 49 CFR Part 193.

4.12.2 Hazards

Before liquefaction, Venture Global Calcasieu Pass would pre-treat the natural gas feed stream to remove components that would be incompatible with the liquefaction process or equipment, including hydrogen sulfide (H_2S), CO_2, water, and heavy hydrocarbons. In general, H_2S gas can be flammable and is also toxic upon inhalation, while CO_2 gas can cause respiratory irritation or asphyxiation. The heavier hydrocarbons would contain toxic components and would be flammable. 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. Mercury induced embrittlement and corrosion resulted in a catastrophic failure of a heat exchanger at a LNG liquefaction plant at Skikda.[31,32,33,34] While the Project is not expecting mercury in the feed gas and mercury concentrations have been generally low in natural gas found in the United States, mercury concentrations in the U.S. can still exceed typical specified mercury concentration limits for liquefaction facilities and no specific tests for mercury have been carried out by Venture Global Calcasieu Pass to support that mercury does not currently exist in their proposed feed gas sources. In addition, Venture Global Calcasieu Pass has not provided any other assurances (e.g., pipeline tariffs) that would prohibit mercury from being present in the proposed feed gas sources in the future. Therefore, we have included recommendations in section 4.12.5 for Venture Global Calcasieu Pass to provide a means to remove mercury 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 provisions for a mercury removal package. In general, mercury can result in toxic effects if contacted, ingested, or inhaled.

The CO_2 and H_2S would be removed from the feed gas by contact with an amine-based solvent solution in an absorber column. The proposed pre-treatment system would be capable of handling a natural gas feed stream with less than 5 parts per million by volume (ppmv) of H_2S, and 2 mole percent CO_2. After CO_2 and H_2S has accumulated in the amine solution, an amine regenerator would release the CO_2 and H_2S from that solution into an acid gas stream. The concentrations of H_2S and CO_2 in the acid gas stream could reach 277 ppmv and 91.4 mole percent, respectively, during this process. Most of the H_2S in the acid gas stream would be removed in the non-regenerable H_2S removal beds. The adsorbent in the H_2S removal beds would be periodically removed and disposed from the site in accordance with applicable regulations by a qualified third party commercial disposal contractor.

The gas leaving the H_2S removal beds would be sent to an incineration package and an elevated vent, where any remaining traces of H_2S and hydrocarbons would be incinerated. Due to the relatively low rates of CO_2 to be processed and the high concentrations of CO_2 needed to cause asphyxiation, safety hazards associated with CO_2 would be localized at the incineration package vent stack or release location. Therefore, CO_2 would not be expected to pose a significant safety hazard to the public, which would have no access to onsite areas. The hazards associated with a release from acid gas stream containing H_2S, before it reaches the H_2S removal beds, are described further in the following subsections and in section 4.12.7.4.

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[31] Kinney, G, Skikda LNG Plant Solving Troubles, Oil & Gas Journal, 1975.

[32] Kehnat, B., Hasni, T., The first Yeats of Operation of the Skikda LNG plant with a Discussion of Mercury Corrosion of Aluminum Cryogenic Exchangers, LNG Conference, 1977.

[33] Leeper, J.E., "Mercury LNG's Problem", *Hydrocarbon Processing*, 237- 40, 1980.

[34] Carnell, P., Row, V., A re-think of the mercury removal problem for LNG plants, 2007.

The amine solution used for the removal of acid gases can be flammable or irritating to the skin, eyes, and lungs upon short-term contact or inhalation. Extremely high vapor concentrations of the amine solution could cause lung damage. However, the equipment containing the amine solution would be provided with impoundment for potential releases, and the amine solution would be handled at temperatures below the point at which they could produce enough vapors to form a flammable mixture. Therefore, the amine solution would not pose a significant hazard to the public, which would have no access to onsite areas. The containment provided for the amine solution is discussed further in section 4.12.7.1.

Water would be removed from the feed gas by a dehydration unit using regenerative molecular sieve beds. The water would be recovered and sent to a waste-water treatment unit. This water would not pose a significant safety hazard to the public.

Heavy hydrocarbon removal would be integrated into the liquefaction process. In the initial brazed aluminum heat exchanger (BAHX) pass, the 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 flash drum where both the condensate vapors and liquid would be directed into the fuel gas system. The LNG would leave the BAHX with a temperature of approximately -251 °F and would flow to the LNG storage tanks as a sub-cooled liquid. A loss of containment from the hydrocarbon condensate facilities would result in a release of both toxic components and flammable components, with the ability to produce damaging overpressures. The primary toxic components in the hydrocarbon condensate stream would include benzene, toluene, xylenes, hexanes, and methyl mercaptan. Analysis of these hazards are discussed in section 4.12.7.

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, butane, and pentane. After cooling the natural gas into its liquid form, this LNG would be stored in one of two full-containment LNG storage tanks. The principal hazards associated with a release of LNG or refrigerants would be the potential for flammable vapor dispersion, radiant heat from a fire, and the ability to produce damaging overpressures. Propane is also associated with toxic dispersion. All of these hazards are further described in the following subsections and analyzed for the Project in section 4.12.7.

In addition, Venture Global Calcasieu Pass proposed to use hot oil as a heat transfer fluid, diesel as a fuel, liquid nitrogen as an inerting medium, and 19 percent aqueous ammonia solution as part of the emission control system at the power plant associated with the Terminal. The potential hazard from these substances are also addressed in section 4.12.7.

4.12.3 Hazardous Releases

A release of hazardous fluid from piping or equipment is the initial event that could result in all other potential hazards. This initial loss of containment can produce a liquid and/or gaseous release with the formation of vapor at the release location as well as at the location of any liquid that may have pooled. The released fluid may present low or high temperature hazards and may result in the formation of toxic and/or flammable vapors. The extent of the hazards depends on the material released, the storage and process conditions, and the volumes released.

LNG is typically stored near its boiling point, at approximately -260 °F and liquid nitrogen is typically stored at or above its boiling point from -320 °F to -250 °F. Ethylene is typically stored at temperatures below -20 °F and at pressures above 100 pounds per square inch (psi) gauge. Propane is typically stored at close to ambient temperature and at pressures above 100 psig. Butane and iso-pentane are typically stored at close to ambient temperatures and at pressures above 15 psig. Heavier condensates, diesel, and hot oil are typically stored at close to ambient temperature and pressures or are handled at elevated pressures to blend with fuel gas. In order for the natural gas to be cooled into LNG, the refrigerants also typically need to reach temperatures approaching -260 °F. System pressures in the liquefaction area of an LNG plant can typically reach hundreds of psi, and in some cases exceed 1,000 psig. However, in this Project, maximum pressures in the liquefaction process are less than 1,000 psig.

Loss of containment of these liquids could lead to the release of both liquid and vapor into the immediate area. Exposure to either cold liquid or vapor could cause freeze burns and, depending on the length of exposure, more serious injury or death. However, spills would be contained to onsite areas, and the extent of the cold vapor state from these releases would be greatly limited due to the continuous mixing with the warmer air. The cold temperatures from the release would not present a hazard to the public, which would not have access to onsite areas.

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

A rapid phase transition (RPT) can occur when a cryogenic liquid is spilled onto water and changes from liquid to gas, virtually instantaneously. Unlike an explosion that releases energy and combustion products from a chemical reaction, an RPT is the result of heat transferred to the liquid, inducing a change to the vapor state. RPTs have been observed during LNG test spills onto water. In some test cases, the overpressures generated were strong enough to damage test equipment in the immediate vicinity of the LNG release point. The sizes of the overpressure events have been generally small and did not cause significant damage. The average overpressures recorded at the source of the RPTs during the Coyote tests have ranged from 0.2 to 11 psi.[35] These events are typically limited to the area within the spill and are not expected to cause damage outside of the area engulfed by the LNG pool. However, an RPT may affect the rate of pool spreading and the rate of vaporization for a spill on water. In addition, 49 CFR §193.2051 requires all LNG facilities to be provided with siting requirements in accordance with NFPA 59A (2001). The March 2010 Letter of Interpretation[36] provides indication that the siting requirements in NFPA 59A (2001) for "transfer areas" would apply to a transfer system, including permanent plant piping. Therefore, the siting requirement in NFPA 59A (2001) section 2.2.1.2, which specifies that transfer areas be graded, drained or provided with impoundment in a manner that minimizes the possibility that accidental spills could reach a waterway, would be applicable to the dock and trestle areas for this Terminal. The proposed Venture Global Calcasieu Pass marine transfer arms would also have powered emergency release coupling (PERC) valves to quickly disconnect from the ship and shut off LNG flow during a potential emergency.

[35] The Lawrence Livermore National Laboratory conducted seven tests (the Coyote series) on vapor cloud dispersion, vapor cloud ignition, and RPTs at the Naval Weapons Center in China Lake, California in 1981.

[36] U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Application of the Siting Requirements in Subpart B of 49 C.F.R. Part 193 to the Mount Hope Bay Liquefied Natural Gas Transfer System, March 2010 Letter of Interpretation https://www.phmsa.dot.gov/regulations/title49/interp/PI-10-0020, March 25, 2010.

However, to ensure Venture Global Calcasieu Pass demonstrates that liquid releases of any size from facilities on the dock and trestle would be captured and directed to an impoundment, we included a recommendation in section 4.12.5 for Venture Global Calcasieu Pass to provide information on the final design of this collection system for review and approval. In addition, impoundment areas required by 49 CFR §193.2173 must be constructed so that all areas drain completely to prevent water collection.

Vapor Dispersion

In the event of a release, the LNG, refrigerants, or condensate would produce vapor. Depending on the size of the release, these liquids may also form a liquid pool that would continue to vaporize because of exposure to ambient heat sources, such as water or soil. The dispersion of the vapor cloud will depend on the physical properties of the cloud, the ambient conditions, and the surrounding terrain and structures. Generally, a denser-than-air vapor cloud would sink to the ground due to the relative density of the vapor to the air and would travel with the prevailing wind, while a lighter-than-air vapor cloud would rise and travel with the prevailing wind. The density depends on the material released and the temperature of the material. For example, an LNG release would initially form a denser-than-air vapor cloud and transition to a lighter-than-air vapor cloud as the vapor disperses downwind and mixes with the warm surrounding air. However, experimental observations and vapor dispersion modeling indicate that an LNG vapor cloud would not typically be warm, or buoyant, enough to lift off from the ground before the LNG vapor cloud disperses below its lower flammable limit (LFL). A liquid ethylene, ethane, or nitrogen release would form a denser-than-air vapor cloud and transition to a neutrally buoyant vapor cloud as it mixes with the warm surrounding air; and a propane, pentane, diesel, hot oil, or condensate release would form a denser-than-air vapor cloud that would remain denser than the surrounding air, even after warming to ambient temperatures.

The Terminal assessment also included analyzing the hazards associated with toxic vapor cloud dispersion. The vapor cloud would continue to be hazardous until it dispersed below toxic levels and/or flammable limits. Toxicity is primarily dependent on the concentration of the vapor cloud in the air and the exposure duration, while flammability of the vapor cloud primarily depends only on the concentration of the vapor when mixed with the surrounding air. In general, higher concentrations within the vapor cloud would exist near the spill, and lower concentrations would exist near the edge of the cloud as it disperses downwind.

Toxicity is defined by a number of different agencies for different purposes. Acute Exposure Guideline Levels (AEGL) and Emergency Response Planning Guidelines (ERPG) are recommended for use by federal, state, and local agencies as well as the private sector for emergency planning, prevention, and response activities related to the accidental release of hazardous substances.[37] Other federal agencies, such as the DOE, EPA, and NOAA, use AEGLs and ERPGs as the primary measure of toxicity.[38,39,40]

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[37] U.S. Environmental Protection Agency, *Dose-Response Assessment for Assessing Health Risks Associated with Exposure to Hazardous Air Pollutants*, http://www2.epa.gov/fera/dose-response-assessment-assessing-health-risks-associated-exposure-hazardous-air-pollutants, July 3, 2014.

[38] U.S. Department of Energy, *Temporary Emergency Exposure Limits for Chemicals: Methods and Practice*, DOE Handbook, DOE-HDBK-1046-2008, August 2008.

[39] U.S. Environmental Protection Agency, 40 CFR Part 68 Final Rule: Accidental Release Prevention Requirements: Risk Management Programs Under Clean Air Act Section 112(r)(7), 61 Federal Register 31667-31732, Vol. 61, No. 120, Thursday, June 20, 1996.

[40] U.S. National Oceanic and Atmospheric Administration, *Public Exposure Guidelines*, http://response.restoration.noaa.gov/oil-and-chemical-spills/chemical-spills/resources/public-exposure-guidelines.html, December 3, 2013.

There are three AEGLs and three ERPGs that are distinguished by varying degrees of severity of toxic effects, with AEGL-1 and ERPG-1 (Level 1) being the least severe to AEGL-3 and ERPG-3 (Level 3) being the most severe.

- AEGL-1 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, these effects are not disabling and are transient and reversible upon cessation of the exposure.

- AEGL-2 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

- AEGL-3 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

The EPA directs the development of AEGLs in a collaborative effort consisting of committee members from public and private sectors across the world. The FERC staff uses AEGLs preferentially as they are more inclusive and provide toxicity levels at various exposure times (10 minutes, 30 minutes, 1 hour, 4 hours, and 8 hours). The use of AEGLs is also preferred by the DOE and NOAA and DOT Federal Aviation Administration (FAA). The AEGL toxic concentrations for the primary toxic components that would be stored and processed onsite are presented in table 4.12.3-1.

TABLE 4.12.3-1

TOXICITY LEVELS (IN PPM) FOR VARIOUS EXPOSURE TIMES [a,b]

Material Components[41]	AEGL Level	10 min	30 min	60 min	4 hr	8 hr
Ammonia	AEGL 1	30	30	30	30	30
	AEGL 2	220	220	160	110	110
	AEGL 3	2,700	1,600	1,100	550	390
Benzene	AEGL 1	130	73	52	18	9
	AEGL 2	2,000	1,100	800	400	200
	AEGL 3	9,700	5,600	4,000	2,000	990
Butane	AEGL 1	10,000	6,900	5,500	5,500	5,500
	AEGL 2	24,000[c]	17,000	17,000	17,000	17,000
	AEGL 3	77,000[c]	53,000[c]	53,000[c]	53,000[c]	53,000[c]
Hydrogen sulfide	AEGL 1	0.75	0.60	0.51	0.36	0.33
	AEGL 2	41	32	27	20	17
	AEGL 3	76	59	50	37	31
Propane	AEGL 1	10,000	6,900	5,500	5,500	5,500
	AEGL 2	17,000	17,000	17,000	17,000	17,000
	AEGL 3	33,000[c]	33,000[c]	33,000[c]	33,000[c]	33,000[c]

[41] List is not comprehensive and only covers the primary components of the primary hazards. The process fluids present at the Venture Global Calcasieu Pass facility would contain mixtures of various components. Many of these mixtures contain some amount of these toxic constituents. The exact composition varies due to process and ambient weather conditions. For toxic hazard modelling, the process streams that would result in the farthest toxic dispersion for each respective stream was chosen to provide the most conservative results for siting the facility.

TABLE 4.12.3-1

TOXICITY LEVELS (IN PPM) FOR VARIOUS EXPOSURE TIMES [a,b]

Material Components[41]	AEGL Level	10 min	30 min	60 min	4 hr	8 hr
Hexane	AEGL-1	NR	NR	NR	NR	NR
	AEGL-2	4,000	2,900	2,900	2,900	2,900
	AEGL-3	12,000	8,600	8,600	8,600	8,600
Mercaptan	AEGL-1	NR	NR	NR	NR	NR
	AEGL-2	40	29	23	14	7.3
	AEGL-3	120	86	68	43	22
Toluene	AEGL 1	67	67	67	67	67
	AEGL 2	1,400	760	560	310	250
	AEGL 3	10,000	5,200	3,700	1,800	1,400
Xylenes	AEGL 1	130	130	130	130	130
	AEGL 2	2,500	1,300	920	500	400
	AEGL 3	7,200	3,600	2,500	1,300	1,000

[a] EPA, 2013d
[b] American Industrial Hygiene Association, 2013
[c] ≥100 percent LFL
NR Not Recommended due to insufficient data

In addition, methane (the primary component of LNG), nitrogen, and other non-toxic fluids that displace air are classified as simple asphyxiants and may pose extreme health hazards, including death, if inhaled in significant quantities within a limited time. As discussed under "Hazardous Releases," very cold LNG and refrigerant vapors may also cause freeze burns. However, the locations where high vapor concentrations could cause these cold temperatures and oxygen-deprivation effects would be greatly limited due to the vapor continuously mixing with the warmer air surrounding the spill site. For that reason, exposure and asphyxiation injuries from releases of LNG and refrigerants normally represent negligible risks to the public. Exposure to a potential release of liquid nitrogen is discussed in section 4.12.7.4.

Flammable vapor can develop when the temperature of a flammable substance is above its flash point. This vapor can be ignited wherever its concentration in air is between the LFL and upper flammable limit (UFL). Vapor concentrations above the UFL or below the LFL would not ignite. The flammable properties for the various materials stored and processed onsite are tabulated in table 4.12.3-2.

TABLE 4.12.3-2 FLAMMABLE PROPERTIES [a]			
Material Components[42]	Flash Point	LFL (% vol)	UFL (% vol)
Methane	-283°F	5.0	15.0
Ethylene	-250°F	2.7	36
Ethane	-211°F	3.0	12.5
Propane	-155°F	2.1	9.5
n-Butane	-76°F	1.8	8.5
i-Butane	-105°F	1.8	8.4
n-Pentane	-56°F	1.4	7.8
i-Pentane	-60°F	1.4	7.6
n-Hexane	-7.6°F	1.2	7.5
n-Heptane	30°F	1.05	7.0
Benzene	11°F	1.4	7.1
Toluene	45°F	1.2	7.1
m-Xylene	77°F	1.1	7.0
o-Xylene	75°F	1.1	6.0
p-Xylene	77°F	1.1	7.0
Hydrogen sulfide	-116°F	4.0	44
Diesel	82-166°F	0.6	7.5
Hot oil	338°F[b]	0.8[c]	5.0[c]

[a] Society of Fire Protection Engineers (2008) unless otherwise noted.
[b] Therminol Heat Transfer Fluids by Eastman (https://www.therminol.com/).
[c] Niesson, Walter. *Combustion and Incineration Processes*. Boca Raton: CRC Press, 2010. Print.

For flammable vapors, the extent of the affected area and the severity of the impacts on objects within a vapor cloud primarily depend on the material, quantity, and duration of the initial release; the surrounding terrain; and the environmental conditions present during the dispersion of the cloud. Although H_2S is a flammable material, it would be present at this plant only in small quantities and in mixtures with other materials, and always at concentrations less than its LFL. Therefore, toxicity would be the governing hazard for a hydrogen sulfide release. In addition, while ammonia is a flammable material, it would be mixed with water to form an aqueous solution and the toxicity hazards would be the governing hazard. Toxic and flammable vapor dispersion distances for the proposed Terminal are evaluated in section 4.12.7.4.

Flammable Vapor Ignition

If the flammable portion of a vapor cloud encounters an ignition source, the vapor cloud will ignite. Once a vapor cloud is ignited, the flame front may propagate back to the spill site if the vapor concentration along this path is sufficiently high to support the combustion process. In most circumstances, the flame would be driven by the heat it generates. This process is known as a "deflagration," or a flash fire, because of its relatively short duration. However, exposure to a deflagration can cause severe burns and death, and

[42] List is not comprehensive and only covers the primary components of the primary hazards. The process fluids present at the Calcasieu Pass facilities often contain mixtures of various components. Many of these mixtures contain some amount of these toxic constituents. The exact composition varies due to process and ambient weather conditions. For toxic hazard modelling, the process streams that would result in the furthest toxic dispersion for each respective stream was chosen to provide the most conservative results for siting the facility.

can ignite combustible materials within the cloud. Flammable vapor dispersion distances for the proposed Terminal are evaluated in section 4.12.7.3.

If the deflagration in a flammable vapor cloud accelerates to a sufficiently high rate of speed, damaging pressure waves would be generated. As a deflagration accelerates to super-sonic speeds, the large shock waves produced, rather than the heat, would begin to drive the flame, resulting in a detonation. High-speed deflagrations or detonations are generally characterized as explosions, as the rapid movement of the flame and pressure waves associated with them cause additional damage beyond that from the heat. The amount of damage an explosion causes depends on the amount that the produced pressure wave is above atmospheric pressure (i.e., an overpressure) and its duration (i.e., pulse). For example, a 1 psi overpressure, often cited as a safety limit in U.S. regulations, is associated with glass shattering and the glass pieces traveling with velocities high enough to lacerate skin and sufficient to collapse wooden framed structures. The flame speeds primarily depend on the reactivity of the fuel, the ignition strength and location, the degree of congestion and confinement of the area occupied by the vapor cloud, and the flame travel distance. Overpressure hazards for the proposed Terminal are addressed in section 4.12.7.5.

When the flame reaches vapor concentrations above the UFL, the deflagration could transition to a fireball and result in a pool or jet fire at the source. A fireball would occur near the source of the release and would be of a relatively short duration compared to an ensuing jet or pool fire. The extent of the affected area and the severity of the impacts in the vicinity of a fire would primarily depend on the material, quantity, and duration of the fire; the surrounding terrain; and the environmental conditions present during the fire. Radiant heat hazards for the proposed Terminal are addressed in section 4.12.7.6.

The heat from a fire may also cause failures of nearby storage tanks, piping, equipment, and structures if not properly mitigated. A failure of a pressurized vessel could cause fragments of material to fly through the air at high velocities. These fragments can pose damage to surrounding areas and a hazard for operating staff, emergency personnel, or other individuals in proximity to the event. In addition, failure of a pressurized vessel when the liquid is at a temperature significantly above its normal boiling point could result in a boiling-liquid-expanding-vapor explosion (BLEVE). BLEVEs can produce overpressures when the superheated liquid rapidly changes from a liquid to a vapor upon the release from the vessel. BLEVEs of flammable fluids may also ignite upon its release and cause a subsequent fireball. The potential for these hazards are further discussed in section 4.12.7.6.

4.12.4 Past Incidents at LNG Plants

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.[43] The failure of the LNG storage tank was due to the use of materials inadequately suited for cryogenic temperatures. LNG migrating through streets and into underground sewers due to the lack of adequate spill impoundments at the site was also a contributing factor. Current regulatory requirements ensure that proper materials suited for cryogenic temperatures are used and that spill impoundments are designed and constructed properly to contain a spill at the site. To ensure that this potential hazard would be addressed for the Terminal, we evaluated the preliminary specifications for suitable materials of construction and made a recommendation in section 4.12.5 for Venture Global Calcasieu Pass to provide for our approval the final design details. In addition, we evaluated their preliminary impoundment sizing calculations and made a recommendation in section 4.12.5 for Venture

[43] 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.

Global Calcasieu Pass to provide for our approval the details of the spill impoundment 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 seal failure resulted in gas vapors entering an electrical conduit and settling in a confined space. When a worker switched off a circuit breaker, the gas ignited, causing heavy damage to the building and a worker fatality. With the participation of the FERC, lessons learned from the 1979 Cove Point accident resulted in changing the national fire codes to better ensure that the situation would not occur again. To ensure that this potential hazard would be addressed for the Terminal, we evaluated the preliminary pump seal design to prevent migration of flammable vapors and we made recommendations in section 4.12.5 for Venture Global Calcasieu Pass to provide for our approval the details of the seal design at the interface between flammable fluids and the electrical conduit or wiring system and the details of a physical 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 to the high-pressure steam boiler by the combustion air fan. An explosion developed inside the boiler firebox, which subsequently triggered a larger explosion of the hydrocarbon vapors in the immediate vicinity. The resulting fire damaged the adjacent liquefaction process and liquid petroleum gas 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 Terminal, we evaluated the preliminary design for mitigation of flammable vapor dispersion and ignition in buildings and combustion equipment to ensure they were 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 made a recommendation in section 4.12.5 for Venture Global Calcasieu Pass to provide the final design details for our approval.

On March 31, 2014, a detonation occurred within a gas heater at Northwest Pipeline Corporation's LNG peak-shaving plant in Plymouth, Washington.[44] 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 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 for the proposed Terminal, we included a recommendation in section 4.12.5 for Venture Global Calcasieu Pass to provide a plan for purging that 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. We also included a recommendation in section 4.12.5 for Venture Global Calcasieu Pass to provide, for review and approval, its operating and maintenance plans, including safety procedures. In order to prevent other sources of projectiles from affecting occupied buildings and storage tanks, we also included a recommendation in

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[44] 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.

section 4.12.5 for an analysis of thermal mitigation to prevent a pressure vessel burst or BLEVE from occurring. As part of the analysis, the potential damage from projectiles is evaluated for cascading effects.

4.12.5 Technical Review of the Preliminary Engineering Designs

Operation of the proposed facilities poses a potential hazard that could affect the public safety if strict design and operational measures to control potential accidents are not applied. The primary concerns are those events that could lead to a hazardous release of sufficient magnitude to create an offsite hazard, as discussed in section 4.12.3. However, it is important to recognize the stringent requirements in place for the design, construction, operation, and maintenance of the facilities, as well as the extensive safety systems proposed to detect and control potential hazards.

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 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; operating and design limits for process piping, process vessels, and storage tanks; adequate design for wind, flood, seismic, and other outside hazards;

- control systems, including monitoring systems and process alarms, remotely-operated control and isolation valves, and operating procedures to ensure 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.

We believe 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. In addition, siting of the proposed facilities with regard to potential offsite consequences can further minimize impacts on public safety. The DOT's regulations in 49 CFR Part 193, Subpart B also requires an additional mitigative safeguard by excluding the public from certain hazards as determined by a siting analysis performed by Venture Global Calcasieu Pass as discussed in section 4.12.7.

As part of its application, Venture Global Calcasieu Pass provided a front-end-engineering-design (FEED) for the Terminal facility. FERC staff used this information to assess the safety of the Project. The objectives of our FEED review focused on the engineering design and safety concepts of the various protection layers, as well as the projected operational reliability of the proposed facilities.

Process Design Review

Per previous discussion, Venture Global Calcasieu Pass would have various pretreatment, liquefaction, storage, marine transfer, and other associated facilities with this Terminal facility. The failure of that equipment could pose potential harm if not properly safeguarded through the use of appropriate controls and operation.

Venture Global Calcasieu Pass 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. Operators would have the capability to take action from the control room to mitigate an upset. Venture Global Calcasieu Pass would develop facility operation procedures after completion of the final design; this timing is fully consistent with accepted industry practice. Venture Global Calcasieu Pass would design their control systems and human machine interfaces (HMI) to the International Society for Automation (ISA) Standards 5.3, 5.5, 60.1, 60.3, 60.4, 60.5, and 60.6, and other standards and recommended practices. We have made recommendations for Venture Global Calcasieu Pass to provide more information on the operating and maintenance procedures as they are developed, including but not limited to safety procedures, hot work procedures and permits, abnormal operating conditions procedures, and personnel training. In addition, we have recommended measures such as labeling of instrumentation and valves, piping, and equipment and car-seals/locks to address human factor considerations and improve facility safety.

Emergency shutdown valves and instrumentation would be installed to monitor, alarm, shut down, and isolate equipment and piping during process upsets or emergency conditions. The plant would have plant-wide emergency shutdown and individual process unit shutdown capabilities. Safety-instrumented systems would comply with ISA Standard 84.01 and other recommended and generally accepted good engineering practices. We also made recommendations 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, Venture Global Calcasieu Pass conducted a Hazard Identification Report (HAZID) of the preliminary design to identify potential risk scenarios. The HAZID identified potential hazards for the process area, operating area, and adjacent spaces and considered the consequences of these hazards. The study also identified the safeguards that would be in place to prevent or mitigate the hazard and proposed recommendations as needed to eliminate, prevent, control, or mitigate the hazards. A more detailed and thorough hazard and operability review (HAZOP) analysis would be performed by Venture Global Calcasieu Pass during the final design phase to identify the major hazards that may be encountered during the operation of facilities. The HAZOP study would identify potential process upsets and what-if scenarios that could cause hazards or operability issues, provide a qualitative evaluation of a range of possible safety, health, and environmental effects that may result from the hazard or operability issue, and identify whether there are adequate engineering and administrative controls to prevent or mitigate the risk from such events. Where insufficient engineering and administrative controls are identified, recommendations to further prevent or minimize these hazards would be generated from the results of the HAZOP review. We have included a recommendation that Venture Global Calcasieu Pass should file the HAZOP study on the completed final design. Resolutions of the recommendations generated by the HAZOP review would be monitored by the FERC staff. Once the design has been subjected to a HAZOP review, the design development team tracks changes in the facility design, operations, documentation, and personnel. Venture Global Calcasieu Pass would evaluate these changes to ensure that the safety, health, and environmental risks arising from these changes are addressed and controlled based on their change management procedures. We have included a recommendation for Venture Global Calcasieu Pass to file all changes to their FEED, regardless of origination, for review and approval by FERC staff. However, major modifications could require an amendment or new proceeding.

Mechanical Design Review

Venture Global Calcasieu Pass provided design specifications for piping and equipment, including design codes and standards for which the facility would meet. The design specifies materials of construction and ratings suited to the pressure and temperature conditions of the process design. Piping would be designed, fabricated, assembled, erected, inspected, examined, and tested in accordance with the American Society of Mechanical Engineers (ASME) Standards B31.1, B31.3, B31.5, B36.10, and B36.19. Pressure vessels would be designed, fabricated, inspected, examined, and tested in accordance with ASME Boiler and Pressure Vessel Code (BPVC) Section VIII per 49 CFR Part 193 and the NFPA 59A (2001 edition). Low-pressure storage tanks such as the amine and condensate storage tanks, would be designed, inspected and maintained in accordance with the API Standards 620, 625, and 650. Concrete LNG storage tanks would also be designed in accordance with ACI 376. 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 for an inherently safer design. Heat exchangers would be designed to ASME BPVC Section VIII standards; API Standards 660, 661, and 662; and the Tubular Exchanger Manufacturers Association (TEMA) standards. Rotating equipment would be designed to standards and recommended practices, such as API Standards 610, 613, 614, 616, 617, 618, 619, 670, 671, 672, 675, 676, 682, and 686; and ASME Standards B73.1 and B73.2. Valves would be designed to standards and recommended practices such as API Standards 594, 598, 600, 602, 607, and 609; ASME Standards B16.5, B16.10, B16.20, B16.25, and B16.34; and ISA Standards S75.03, S75.04, S75.05, and S75.16.

Pressure and vacuum safety relief valves and flares would be installed to protect the storage tanks, process equipment, and piping. The safety relief valves would be designed to handle process upsets and thermal expansion within piping when isolated or exposed to a fire, per NFPA 59A (2001 edition) and ASME Section VIII; and would be designed in accordance with API Standards 520, 521, 526 and 527 (2000 requirements); ASME Standards B31.3 and B31.5; and other recommended and generally accepted good engineering practices. In addition, we made recommendations to further ensure the final design and installation of pressure and vacuum relief devices are adequate.

Hazard Mitigation Design Review

If operational control of the facilities were lost and operators and emergency shutdown systems failed to maintain the Terminal facility within the design limits of the piping, containers, and safety relief valves, a release could potentially occur. However, as required by 49 CFR Part 193 through NFPA 59A (2001 edition) section 9.1.2, fire protection must be provided for all LNG 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.

To satisfy these requirements, Venture Global Calcasieu Pass 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 have made recommendations for Venture Global Calcasieu Pass to provide a final fire protection evaluation and 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 as Venture Global Calcasieu Pass further develops this information during the final design phase.

Spill Containment, Spacing and Ignition Controls

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. The spacing of vessels and equipment between each other, from ignition sources, and to the property line would meet the requirements of 49 CFR §193.2401, which incorporates NFPA 59A (2001 edition). NFPA 59A further references NFPA Standards 30, NFPA 58, and NFPA 59. As further discussed in section 4.12.7, FERC staff evaluated the adequacy of the spill containment conveyance system flows and total volume to handle a full spectrum of releases based on the FEED. In addition, we have recommended additional information on final design of these systems where details are yet to be determined and final design could change as a result of these details or other changes in the final design of the Terminal.

Terminal areas would be designated with a hazardous electrical classification and process seals in accordance with NFPA 59A, 70, 497, and API RP 500. Depending on the risk level, these areas would either be classified as non-classified, Class 1 Division 1, or Class 1 Division 2. In addition, equipment 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 have included a recommendation for Venture Global Calcasieu Pass to provide for our approval the final design of the electrical area classification for the Terminal facilities.

Hazard Detection, Emergency Shutdown and Depressurization Systems

Venture Global Calcasieu Pass 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 other appropriate procedures, and would meet NFPA Standard 72, ISA Standard 12.13, and other recommended and generally accepted good engineering practices. FERC staff evaluated the adequacy of the general hazard detection type and coverage to detect cryogenic spills, flammable and toxic vapors, and fires as well as the related cause and effect matrices that would initiate an alarm, shutdown, depressurization, or other action based on the FEED. The hazard detection drawings did not indicate low oxygen detectors near the liquid nitrogen, but Venture Global Calcasieu Pass committed to installing low oxygen detectors in response to a data request. We have made a recommendation to provide additional information on final design of all hazard detection systems where details are yet to be determined (e.g., manufacturer and model, elevations, etc.) and where the final design could change as a result of these details or other changes in the final design of the Terminal.

Hazard Control

If ignition of flammable vapors occurred, hazard control devices would be installed to extinguish or control incipient fires and releases, and would meet NFPA 59A; NFPA 10, 11, 12, 15, 17, and 2001; API 2218 and 2510A; as well as other recommended and generally accepted good engineering practices. FERC staff verified the adequacy of the number and availability of handheld, wheeled, and fixed fire extinguishing devices throughout the site based on the FEED. FERC staff recommends clean agent systems be installed in all electrical switchgear and instrumentation buildings and the spacing of the fire extinguishers be confirmed to meet NFPA 10. In addition, we have recommended additional information on final design of these systems where details are yet to be determined (e.g., travel, distances, 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 Terminal.

Structural Fire Protection

If a fire could not be separated, controlled, or extinguished to limit fire exposures to insignificant levels, structural fire protection would be provided to prevent failure of structural supports of equipment and pipe racks. The structural fire protection would comply with NFPA 59A (2001 edition) and other recommended and generally accepted good engineering practices. Based on the FEED, FERC staff recommended all pressure vessels and structural supports to facilities within 4,000 Btu/ft^2-hr radiant heat zone from pool fires with durations that could result in failures[45] and that they be specified in accordance with recommended and generally accepted good engineering practices with a fire protection rating of a commensurate fire exposure and duration. In addition, we have recommended additional information on final design of these systems where details are yet to be determined (e.g., calculation of structural fire protection materials, thicknesses, etc.) and where the final design could change as a result of these details or other changes in the final design of the Terminal.

Firewater Systems

Venture Global Calcasieu Pass would also provide firewater systems, including fire hydrants and monitors for use during an emergency to better disperse or control flammable or toxic vapors and to cool the surface of storage vessels, piping, and equipment exposed to heat from a fire, and would meet NFPA 59A, 11, 13, 14, 15, 17, 20, 22, 24, 25, 30, 37, and 1961 requirements. Based on the FEED, FERC staff evaluated the adequacy of the general firewater system coverage from hydrants, hose wheels, fixed and automatic monitors, fixed deluge systems, foam systems, and sprinklers, and verified the appropriateness of the associated demands of those devices and worst-case fire scenarios to size the firewater pumps and judge whether the firewater source or onsite storage volume was appropriate. FERC staff also made some recommendations on the final design to ensure there would be firewater coverage of the LNG storage tanks and to clarify use of high expansion foam or foam glass blocks, to provide consideration for other foam systems or automatic firewater systems, and to include certain design features to aid in the testing and maintenance of firewater systems and to provide acceptance test verifying the adequacy of the coverage. We have recommended an updated fire protection evaluation be carried out with some of these considerations and to provide additional information on final design of these systems where details are yet to be determined (e.g., manufacturer and model, nozzle types, etc.) and where the final design could change as a result of these details or other changes in the final design of the Terminal.

Onsite and Offsite Emergency Response Plans

Venture Global Calcasieu Pass would also have emergency procedures in accordance with 49 CFR Part 193 and 33 CFR Part 127. 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 Terminal facilities. Venture Global Calcasieu Pass would also be required to provide an Emergency Response Plan in accordance with the EPAct 2005, as discussed further in section 4.12.9. FERC staff evaluated a draft of the emergency response procedures to assure that it would be incorporated to cover the new hazards associated with the Terminal appropriately. In addition, we have recommended additional information on development and final updated emergency response plans.

[45] 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.

Geotechnical and Structural Design Review

FERC staff evaluated Venture Global Calcasieu Pass' geotechnical and structural design information to ensure the site preparation and foundation designs are appropriate for the underlying soil characteristics and to ensure the structural design of the Terminal facilities would be in accordance with federal regulations, standards, and recommended and generally accepted good engineering practices to be resilient 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, and volcanic activity.

Geotechnical Evaluation

As required by NFPA 59A (2001 edition) section 2.1.4, Venture Global Calcasieu Pass contracted Fugro to conduct geotechnical investigations that evaluated existing soil site conditions and proposed foundation designs for the Terminal. Fugro conducted 78 soil borings to depths ranging from 30 feet to 300 feet below existing, grade, 69 cone penetration tests (CPTs) to depths ranging from 100 feet to 200 feet (or to refusal) below existing grade, 19 seismic cone penetration tests (SCPTs) to depths ranging from 150 feet to 200 feet below existing grade, 5 temporary piezometers to measure groundwater levels, and over 15 different tests on more than 2,800 recovered soil samples, including classification tests (water content, Atterberg liquid and plastic limits, sieve tests), compression tests, consolidation tests, shear tests, organic content tests, corrosion potential tests (pH, sulfate, chloride, electrical resistivity) in general accordance with pertinent ASTM standards. FERC staff reviewed the adequacy in the number, coverage, and results 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.

The existing site elevation is approximately +2.5 feet, but varies across the site. The site would be cleared, grubbed, and prepared using standard earthmoving and compaction equipment. Site preparation would result in a final grade elevation being raised from +2.5 feet to +5 to +6 feet (North American Vertical Datum 1988 [NAVD88]) with approximately 2 feet 6 inches of fill that would be added across the site. On the western boundary, the berm crest elevation would be +26 feet (NAVD88) and on the eastern, southern, and northern boundaries, the floodwall crest elevation would be +31.5 feet (NAVD88) to protect the facilities from storm surge as discussed in more detail later in this section.

Based on the test borings conducted, the site is composed of approximately 0 to 5 feet of surficial soil consisting of very soft to very stiff cohesive clay underlain by granular materials from 5 to 30 feet below the ground surface; natural cohesive soils are generally firm to stiff from 30 to about 80 feet below ground surface; another granular layer is generally present at depths ranging from 80 to 100 feet and consists primarily of silts, silty sands, clayey silts and silty clays; slightly over-consolidated soils from 100 feet to about 160 feet ; generally over-consolidated soils below from 160 to 200 feet below ground surface; and silty sand or sand layer from 200 feet to approximately 300 feet below ground surface. Corrosion tests indicate there is a very high potential for corrosion of steel based on electrical resistivity results (chloride ion concentration generally indicated high and pH generally indicated mild corrosion potential), and a mild to moderate deterioration of concrete based on sulfate ion concentrations. Based on these results, Venture Global Calcasieu Pass considered potential for corrosion and concrete degradation in the design.

Based on the subsurface conditions, shallow foundations would be suitable for some lightly loaded structures, and are recommended to be placed at a depth of 6 to 10 feet below final grade. As is common for heavier structures in areas with these types of soil conditions, the LNG storage tanks, liquefaction blocks, and heavier structures would require deep foundations. Therefore, Venture Global Calcasieu Pass is proposing to drive either precast square concrete piles, auger cast in place piles, DeWaal Piles, or steel pipe piles depending on the equipment being supported, and subsurface conditions. The final type, size, and spacing of the piles would be determined during final design. The piles are proposed to be embedded between 60 and 150 feet, depending on the equipment being supported, pile spacing, pile type. Downdrag forces on the piles would be accounted by applying coatings to reduce the negative skin friction of the piles. We reviewed the preliminary design and have made a recommendation for Venture Global Calcasieu Pass to submit the final design information on the foundations.

Dredging would also need to occur for the LNG ships to traverse to the terminal. The existing shoreline of the Calcasieu Ship Channel would be excavated, dredged, and sloped during construction. The post-construction shoreline would be approximately 500 feet east of the current location. To prevent slumping of the dredged slope, maintain the berthing line position, and provide structural integrity support to the landside facilities, the excavated shoreline would be reinforced with rip-rap armoring. Additional consideration for shoreline erosion is the increase in large ship traffic within the Calcasieu Ship Channel. Venture Global has been consulting with the USCG on its Follow-on Waterway Suitability Assessment to address impacts from passing ships. The proposed rip-rap armoring would minimize the potential for erosion where the shoreline would be excavated.

<u>Structural Evaluation</u>

The Terminal facilities would be constructed to satisfy the design requirements of 49 CFR Part 193, NFPA 59A-2001, NFPA 59A-2006 for LNG storage tanks, 2009 International Building Code and ASCE 7-05. These regulations and 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 from extreme events, such as earthquakes, tsunamis, seiche, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea level rise, landslides, wildfires, and volcanic activity. FERC staff evaluated the design basis for the environmental loads as described more fully for various natural hazards below. In addition, FERC staff recommends that the final quality assurance and control procedures, engineering, and maintenance information are completed as follows:

- **<u>Prior to initial site preparation</u>, Venture Global Calcasieu Pass should file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in Louisiana:**
  - **a. quality assurance and quality control procedures to be used for civil/structural design and construction;**
  - **b. site preparation drawing and specifications; and**
  - **c. seismic specifications for procured equipment prior to the issuing of requests for quotations.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in Louisiana:**
  - **a. pile installation drawings and specifications;**
  - **b. LNG storage tank and foundation design drawings and calculations;**
  - **c. LNG facility structures and foundation design drawings and calculations (including prefabricated and field-constructed structures as applicable); and**
  - **d. perimeter berm and floodwall design drawings and calculations based upon the design recommendations provided in the Project Levee and Floodwall Overtopping**

Analysis report (Moffat and Nichol, 2016) and the Project Geotechnical Study report (Fugro, 2015).

- **Prior to commencement of service, Venture Global Calcasieu Pass should file with the Secretary a surface maintenance plan, stamped and sealed by the professional engineer-of-record registered in Louisiana, for the perimeter berm 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.**

Earthquakes, Tsunamis, and Seiche

Earthquakes and tsunamis have the potential to cause damage from the 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 as a result of ground motions are 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 Calcasieu Pass 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).[46] Louisiana is located 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 thicken toward the south, with salt domes and relatively shallow listric growth faults that run parallel to the Gulf of Mexico Coastline and extend outside of Louisiana. Movement within the fault system has 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).

Venture Global Calcasieu Pass conducted a site-specific seismic risk analysis for the Project, involving field investigations and subsequent data evaluation. Venture Global Calcasieu Pass' *Seismic Hazard Assessment* report includes 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 being 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. A detailed investigation is being conducted by Venture Global Calcasieu Pass as part of a separate study to characterize any potential for surface deformation from growth fault activity. And while the presence of faults can require special consideration, the presence or lack of 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, via incorporation by reference of NFPA 59A-2001, require LNG facilities be designed to continue to safely operate 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), and to safely shutdown and withstand earthquake ground motions at the ground surface at the site that have a 2 percent

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[46] USGS, Earthquake Hazards Program, Quaternary Fault and Fold Database of the United States, https://earthquake.usgs.gov/hazards/qfaults/, 2018.

probability of being exceeded in 50 years (2,475 year mean return interval), termed the safe shutdown earthquake (SSE). The facility would also be designed to withstand aftershock level earthquakes (ALE), which is assumed as ½ SSE in accordance with NFPA 59A (2013 and 2016 editions).

The Project area is located in a very low seismic risk region (USGS, 2014a). According to the USGS, there is only a 2 to 4 percent probability that the peak ground acceleration (PGA) will exceed 0.04 percent the acceleration of gravity (g) in 50 years. These accelerations are for a soft rock site and can be amplified by a factor of 2 or more for soft soil sites such as those found at the site, but even when amplified these values represent a relatively low level of shaking.

Fugro performed a site-specific seismic hazard study for the site. The study concluded that the site would have an OBE peak ground acceleration (pga) of 0.039 g, a SSE peak ground acceleration of 0.117 g. (Fugro, 2015), a 0.2-second spectral acceleration value of 0.140 g, and a 1.0-second spectral acceleration at the site of 0.104 g. Based on the design ground motions for the site and the importance of the facilities, the facility seismic design is assigned Seismic Design Category B or C for Occupancy Category III and IV, respectively, in accordance with the 2009 IBC and ASCE 7-05. These ground motions are relatively low compared to other locations in the United States.

The geotechnical investigations of the existing site performed by Fugro indicate the site is classified as Site Class E[47] in accordance with ASCE 7-05, which is incorporated into 49 CFR Part 193 and in accordance with IBC (2009) based on a site time-averaged shear wave velocity (Vs) in approximately the upper 100 feet that ranged between 387 to 728 feet per second (Fugro, 2015). Sites with soil conditions of this type would 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.

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 seismic study conducted for the Project documented a silty sand strata within the top 35 feet that could be liquefiable; however, the potential for a large enough seismic event near enough to cause soil liquefaction in the Project area is low. Also, LNG facilities at the site would be constructed on deep foundations, which would mitigate any potential impacts of soil liquefaction. Should soil improvement be required to counteract soil liquefaction, Venture Global Calcasieu Pass would utilize ground improvement techniques (e.g., densification, cementitious strengthening) or removal and replacement of existing soils with non-liquefiable material.

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. The Terminal site'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 tsunamis did occur in the Gulf of Mexico in the early 20th century and had wave heights of

[47] 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).

3 feet or less (USGS, 2014c), which is not significantly higher than the average breaking wave height of 1.5 feet (Owen, 2008). Hydrodynamic modeling conducted off the coast of south Texas in 2004 indicated that the maximum tsunami run-up could be as high as 12 feet above mean sea level. No earthquake generating faults have been identified that are likely to produce tsunamis or seiches, despite recorded seismic activity in the 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 only 17 tsunamigenic submarine landslides over the past 20,000 years, which equates to a mean recurrence interval of 1,176 years, in the Gulf of Mexico. Based on simulation, the median wave height is approximately 13 feet (4 meters). However, there is significant uncertainty in these estimates because potential for tsunamis associated with submarine landslides remains a focus of government research (USGS, 2009). While research plans are currently being developed, available information indicates that tsunami-related hazards would be relatively low for the Project area and maximum tsunami run-up elevations are less than the hurricane design storm surge elevations discussed below.

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, Venture Global Calcasieu Pass evaluated such events historically. The severity of these events is 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.

Historically, flooding caused by hurricanes and associated storm surges has been encountered in Cameron Parish. Several hurricanes were particularly damaging to Cameron Parish. Prior to 1957, two unnamed storms in 1915 and 1940 produced water levels of 10.3 feet and 4.8 feet. In 1957 Hurricane Audrey, a Category 4 hurricane, reached wind speeds of 145 mph and a storm surge of 10 to 15 feet. In 1961 and 1971 Hurricanes Carla and Edith produced tides of 6.6 feet and from 5 to 8 feet, respectively. In 2005 Hurricane Rita, a Category 3 hurricane, reached wind speeds of 120 mph and storm surge values were 12 to 18 feet across most of Cameron Parish (NOAA, 2010). Hurricane Ike in 2008 produced surge with a high water mark of 9 feet. Based on the data from previous hurricanes that affected Cameron Parish and projections from NOAA data, it is possible that storm surges could reach as high as 20 feet (NOAA, 2014). According to a storm surge map for Cameron Parish (NOAA, 2008) the Project area is located in an area that would be affected by a storm surge of at least 4 to 5 feet. This level of storm surge is consistent with a Category 1 hurricane. The area has been affected by a tropical storm or hurricane, on average, every 3.02 years. Hurricane reanalysis data from AOML suggests an 83 percent chance that a storm reaching major hurricane status (Saffir-Simpson Category 3 or greater) will pass near the Site within a 30 year period. Observations of historic flooding near the Site show that water levels have exceeded an elevation of 10 feet four times in in the past century, with high water marks exceeding 15 feet during Hurricane Audrey in 1957 and Hurricane Rita in 2005.

Potential flood levels may also be informed from 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 Hazard Layer, portions of the Project would be located in the 100-year and 500-year flood plain with base flood elevations. In addition, according to FEMA flood hazard maps (2016), the 100-year still water elevation level (SWEL) at the Site is +14.1 feet (NAVD88) and the 500-year SWEL is +17.6

feet (NAVD 88) with 15 to 19 feet base flood elevations across the site, which includes SWEL and wave height.

Venture Global Calcasieu Pass also conducted a storm surge analysis that identified the surge elevation for the 1-year, 5-year, 20-year, 100-year, and 500-year events. Wave run-up calculations were carried out for the proposed berm and floodwall using the Technical Advisory Committee for Water Retaining structures (TAW) methodology, as applied by FEMA. These calculations determined that at the 100-year and 500-year return periods, the maximum wave run-up elevations are approximately 22.5 feet and 28.25 feet.

FERC staff also evaluated these projected site elevations and flood values against the FEMA maps and Sea, Lake and Overland Surges from Hurricanes (SLOSH) Maximum Envelope of High Water (MEOW) maps and found that the facilities would be precluded from approximately a 25 feet storm surge from a Category 5 Hurricane hitting at high tide, which should also protect it against a 500-year event and should exceed the 100-year event requirement in federal regulations based on consultation with DOT staff.

In addition to storm surge, long-term sea level rise could increase flooding of the Terminal site. In the vicinity of the Terminal site, it is estimated that the sea level could rise between 1.13 and 2.44 feet over the Terminal facility lifespan of 30 years. These estimates were based on USACE estimates of sea level rise in the Lake Charles area (USACE, 2013a). Typically, global warming and the melting of polar ice is attributed as the cause of sea level rise, but changes in coastal geology contribute to localized sea level rise. Local subsidence and accretion would influence the sea level rise in coastal regions. Based on this information, Venture Global Calcasieu Pass has estimated that sea level rise at the Terminal site during the expected life of the liquefaction facility (30 years) would be approximately 1.5 feet. FERC staff compared this with NOAA 2017 projections from 2020 to 2050, which indicated an intermediate value of 1.21 feet.

Subsidence may also affect flood elevations over time, but is unlikely to present a significant hazard to the Terminal site other than the need to consider it in the height of the storm-surge perimeter berm. 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. Subsidence in southern Louisiana is typically caused through sub-surface water extraction for agriculture, flood protection, or development. Subsidence has also been recorded occurring naturally through fault movements and compaction/consolidation of Holocene deposits. The natural subsidence rate for the area where the Terminal site and associated facilities is located is considered low at 0 to 1.0 foot of subsidence every 100 years (USACE, 2013a). Venture Global has indicated that it would conduct maintenance of the perimeter berm to address berm settlement including short- and long-term elevation changes.

As a result of these analyses, Venture Global Calcasieu Pass has proposed to construct an earthen berm on the west side of the site, and a steel pile floodwall on the east, north, and south sides of the site to minimize impacts associated with potential storm surge. The floodwall and berm would be designed with a 26-foot crest elevation. The berm would have stone armor on the non-protected side. In addition, the Storm Surge analysis report recommends that the crest and protected side of the berm be maintained with healthy grass cover over a protective clay soil, unless otherwise sufficiently armored. The floodwall on the east, north, and south sides of the site would be a combination wall with steel pipe king piles and intermediate steel sheet piling to provide the structural capacity for protection of the enclosed plant infrastructure. The floodwall crest elevation would be +31.5 feet (NAVD88). The floodwall would include a precast concrete-slab apron along the outer base, providing scour protection against the impacts of wave action. A 15-foot-wide splash pad (compacted gravel bed) would be constructed along the floodwall's inner base to mitigate against potential scour due to overtopping waves. The Northeast Access Road would cross into the enclosed site by an earthen ramp of lower elevations than previously described; a sliding flood gate over the ramp would bring the overall ramp/wall height at this location to the required +31.5 feet (NAVD88). The height of the berm would be above the Hurricane 5 SLOSH MEOW and have approximately 3.5 feet of freeboard above the 22.5 feet maximum wave run-up elevation for a 100-year event, but would be less than the 28.25 feet maximum wave run-up elevation for a 500-year event. However, Venture Global analyzed this potential of wave overtopping to determine the effect of the proposed barrier design. The analyses found a maximum mean overtopping of 0.039 cubic feet per second per foot, which is less than what is expected to cause flooding or failure due to erosion of the protected side of a levee with healthy grass cover offer protective clay soil.

Increased storm activities, shortage of sediment supply, and sea level rise have made shoreline erosion a major concern in southern Louisiana. The average shoreline erosion rate in Cameron Parish was 15 feet per year between 1998 and 2009 (Shepis et al., 2010). In the vicinity of the Terminal Site, shoreline erosion claimed from 30 to 106 feet of shoreline along the Calcasieu Ship Channel, and 14 to 309 feet along the Gulf Shoreline, south of the Terminal Site between 1998 and 2013. Much of this shoreline loss can be attributed to Hurricane Rita and Hurricane Ike, which occurred in 2005 and 2008, respectively. In an unlikely scenario of continuing net erosional shoreline loss at the same magnitude, it would take 45 years for shoreline erosion to reach the proposed perimeter berm on the Gulf Coast side, and the berm would be armored to protect it from further erosion. Additionally, the current shoreline has been the focus of government-sponsored restoration initiatives that include the deposition of material to restore and widen local beaches. These initiatives would offset natural erosional losses that may occur in the area.

With uncertainties in respect to water levels, wave conditions, and future sea level and subsidence changes, the Storm Surge Analysis report commissioned by Venture Global Calcasieu Pass recommends that relative sea level change be calculated periodically in the future, we agree. Venture Global has not filed a berm maintenance plan, but we have recommended they provide one prior to commencement of service.

Due to the Terminal site location, the Terminal site would also be subject to hurricane force winds during the life of the Terminal facility. Federal regulations require Venture Global Calcasieu Pass to meet 49 CFR §193.2067 for wind load requirements. Venture Global Calcasieu Pass states that all Project LNG facilities would be designed to withstand a sustained wind speed of 150 mph and that shop fabricated containers of LNG or other hazardous fluids with a capacity of not more than 70,000 gallons would be in accordance with ASCE 7-05. A 150-mph sustained wind speed would correspond to a 183-mph 3-second gust using the Durst Curve in American Society of Civil Engineers (ASCE) 7-05 and a 185-mph 3-second gust using a 1.23 gust factor for onshore winds at a coast line recommended in World Meteorological Organization, *Guidelines for Converting between Various Wind Averaging Periods in Tropical Cyclone Conditions*. FERC staff also evaluated this wind speed against the 10,000 year and 1,700 year hurricane wind speeds derived from the 50-year wind speed from the Applied Technology Council website[48] and a log fit of various mean return intervals in ASCE 7-05, ASCE 7-10, and ASCE 7-16 for hurricane prone regions. Using this methodology, the 10,000 year wind speed would be approximately a 168-174 mph 3-second gust and the 1,700 year wind speed would be approximately a 146-159 mph 3-second gust.

In addition to hurricane force winds, the Terminal site may be subjected to tornado wind forces. Therefore, FERC staff evaluated the potential wind speeds from tornadoes using ICC 500, ASCE 7-05, and NRC's NUREG/CR-4461. ICC 500 would predict potentially higher wind speeds of 200 mph 3-second gusts for 10,000 year tornado events for the region. However, ICC 500 does not account for subregional scales or the likelihood of a specific tornado impacting a specific site and therefore is actually considered more conservative than the 1 in 10,000 year event it is claimed to represent and closer to 1,000,000 to 10,000,000 year event when considering strike probability at a specific site. Therefore, FERC staff

[48] Applied Technology Council, https://hazards.atcouncil.org/, accessed May 2018.

evaluated tornadoic wind speeds using a more refined approach described in NRC's NUREG/CR-4461 that evaluates tornadic wind speeds based on strike probabilities using tornado impact widths, lengths, and areas, and wind speed variations for specific tornado categories at the specific project site. This site specific approach is allowable per ASCE 7-05, and NUREG/CR-4461. 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.

In conclusion, the site specific analyses indicate the 150 mph sustained (183 mph 3-second gust) wind speed being used in the design should be in compliance with 49 CFR 193.2067(b)(2) and would be above a 10,000 year maximum hurricane wind speed specified and 100,000 year maximum tornadic wind speed. In addition, Venture Global Calcasieu Pass states the LNG storage tanks would be designed to withstand, without loss of structural or functional integrity, the direct effect of wind forces, impact forces, and potential penetrations by wind-borne projectiles as required by 49 CFR 193.2067(a)(3). These analyses would typically be conducted in final design. Therefore, we have included a recommendation to provide these analyses prior to construction of the final design.

Landslides and other Natural Hazards

Due to the low relief across the Terminal site, there is little likelihood that landslides or slope movement at the Terminal site would be a realistic hazard. Landslides involve the downslope movement of earth materials under force of gravity due to natural or human causes. The Terminal site has low relief which reduces the possibility of landslides, and for the earthen berm, slope stability and other engineering analyses were conducted to ensure they would be designed to prevent such failure.

Other natural hazards, such as wildfires and volcanic activity, were also dismissed as unlikely events that could impact the site. Wildfires are primarily in the West and Northeast and would not be expected to occur near the project site as there is not significant vegetation surrounding the site that would support wildfires. Volcanic activity is primarily a concern along plate boundaries on the West Coast and Alaska and also Hawaii. Based on FERC staff review of maps from USGS[49] and DHS[50] 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 approximately several hundred miles of the site with the closest being approximately 700 miles away across the Gulf of Mexico in Los Atlixcos, Mexico.

External Impact Evaluation

Transportation and other land uses and activities within, adjacent, and nearby the site may have the potential to cause damage or failure of facilities through external impacts with the Terminal facilities. To assess the potential impact to and from these external events, Venture Global Calcasieu Pass evaluated transportation routes and land use and activities within and surrounding their site and the safeguards in place to mitigate such events as described below. FERC staff worked in coordination with other federal agencies to assess these impacts.

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[49] United States Geological Survey, U.S. Volcanoes and Current Activity Alerts, https://volcanoes.usgs.gov/index.html, accessed May 2018.

[50] Department of Homeland Security, Homeland Infrastructure, Foundation-Level data (HIFLD), Natural Hazards, hifld-geoplatform.opendata.arcgis.com, accessed May 2018

Air

The closest airport to the Terminal site is the Southland Field airport, which is approximately 24 miles away. There is also a privately-owned airstrip to the northwest of the proposed facility along Gulf Beach Highway (LA-82). The end of the runway appears to be just under one mile away from the edge of the closest LNG storage tank. Given that the LNG storage tank is close to or possibly less than 1 mile from the end of the airstrip and 49 CFR 193.2155(b) requires that a LNG storage tank must not be located within a horizontal distance of one mile from the ends, or 1/4 mile from the nearest point of a runway, whichever is longer, we recommend:

> **<u>Prior to the end of the draft EIS comment period</u>, Venture Global should demonstrate how they comply with 49 CFR 193.2155(b).**

In addition, 49 CFR 193.2155(b) also requires the height of LNG structures must comply with DOT FAA regulations. The proposed facilities include equipment taller than 200 feet. Therefore, the regulations in 14 CFR Part 77 apply to that equipment and require Venture Global Calcasieu Pass to provide notice to the FAA of its proposed construction. Venture Global Calcasieu Pass initiated an aeronautical obstruction study under 14 CFR Part 77 for each of the facilities that would be over 200 feet in height. On February 1, 2017, Venture Global Calcasieu Pass received a Determination of No Hazard to Air Navigation from the FAA. Therefore, these February 1, 2017 documents satisfy the regulations in 14 CFR Part 77 and should also meet 49 CFR 193.2155(b). These Determinations of No Hazards to Air Navigation documents are set to expire on August 8, 2018. Venture Global Calcasieu Pass would need to file with the FAA for an extension of these determinations at least 15 days prior to the expiration date above.

DOD

In accordance with the 2007 Memorandum of Understanding between the FERC and the United States Department of Defense (DOD) (http://www.ferc.gov/legal/mou/mou-dod.pdf), the FERC sent a letter to the DOD on January 23, 2015 requesting their comments on whether the proposed Project could potentially have an impact on the test, training, or operational activities of any active military installation. On March 19, 2015 the FERC received a response letter from the DOD Siting Clearinghouse stating that the proposed Calcasieu Pass terminal would have a minimal impact on military training and operations conducted in the Cameron Parish, LA area.

Security Design Review

The security requirements for the proposed Terminal are governed by 33 CFR Part 105, 33 CFR Part 127, and 49 CFR Part 193. Title 33 CFR Part 105, as authorized by the Marine Transportation Security Act, requires all terminal owners and operators to submit a Facility Security Assessment and a Facility Security Plan to the USCG for review and approval. 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, vessel and facility operations, conditions, security measures, emergency preparedness, response, and contingency plans, who would be responsible for implementing the Facility Security Assessment and Facility Security Plan and performing an annual audit for the life of the Project;
- conducting a Facility Security Assessment to identify site vulnerabilities, possible security threats and consequences of an attack, and facility protective measures; developing a Facility Security Plan based on the Facility Security Assessment, with procedures for: responding to transportation security incidents; notification and coordination with 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, vessel stores and bunkers, and monitoring; ensuring that the Transportation Worker Identification Credential program is properly implemented;
- ensuring coordination of shore leave for vessel personnel or crew change out as well as access through the facility for visitors to the vessel;
- conducting drills and exercises to test the proficiency of security and facility personnel on a quarterly and annual basis;
- reporting all breaches of security and transportation security incidents to the National Response Center; and
- reporting all suspicious activity to the USCG per 33 CFR §101.305.

Under 33 CFR Part 105, Venture Global Calcasieu Pass would be required to submit a Facility Security Plan to the USCG for review and approval before commencement of operations of the proposed Terminal facilities. Venture Global Calcasieu Pass 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 Title 33 CFR Part 105. Title 33 CFR Part 127 also has requirements for access controls, lighting, security systems, security personnel, protective enclosures, communications, and emergency power.

Title 49 CFR Part 193 Subpart J also specifies security requirements for the onshore component of LNG terminals, 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.

Venture Global Calcasieu Pass must comply with all of the requirements specified in the USCG and the DOT regulations and has proposed to provide additional qualified security personnel, access control systems, lighting, security cameras, intrusion detection systems, communication systems, and emergency power.

FERC staff evaluated preliminary design information regarding security measures, including protective enclosures, access controls, lighting, security monitoring, intrusion detection systems, communication systems, and emergency power and found the preliminary designs to be lacking in some areas. The lighting drawings show lighting only along egress paths and did not show general lighting throughout the plant. The site layout drawings show the security fence, but access/egress locations are not clear, and some revisions are recommended. Also, closed-circuit television (CCTV) drawings do not show cameras throughout the facility. Therefore, FERC staff included a recommendation in section 4.12.5 for Venture Global Calcasieu Pass to provide final drawings of the lighting, fencing, and CCTV at the facility that show both operating and security lighting and cameras.

Final Design Review

As a result of the technical review of the information provided by Venture Global Calcasieu Pass in the submittal documents, we issued an information request on March 3, 2016, relating to the civil/structural aspects, reliability, operability, and safety of the proposed design. Venture Global Calcasieu Pass provided written responses on March 23, 2016 and indicated that the design would be revised in subsequent Project filings. On July 14, 2016, Venture Global Calcasieu Pass filed a revised design to improve process efficiency and reduce the overall operational footprint for the Terminal facility. As a result of the technical review of the revised design, information request letters were issued on January 5, and March 20, 2017, relating to the civil/structural aspects, reliability, operability, and safety of the proposed design. Venture Global Calcasieu Pass provided written responses to these information requests on February 3 and March 15, 2017, respectively. Additional data requests were issued on April 4, October 11, November 13, and December 19, 2017 and January 30, 2018 with Venture Global Calcasieu Pass filing responses on April 19, October 13, and December 1, 2017 and January 19, and February 2, 2018.

Furthermore, on September 28, 2017, Venture Global Calcasieu Pass indicated that it would revise its LNG storage tank design. Additional information was filed on October 13, October 16, October 23, and October 30, 2017 that provided details of a full containment tank design. We identified a number of clarifications and concerns with the full containment storage tank design in an information request letter issued on December 1, 2017. Venture Global Calcasieu Pass provided written responses to the information request on December 13, 2017. Some of the responses filed on February 3, 2017 and the December 13, 2017 indicated that Venture Global Calcasieu Pass would correct or modify its design in order to address issues raised in the information requests. As a result, we included two recommendations for each information request in this section for Venture Global Calcasieu Pass to file final design information on those items. In addition, we added a recommendation for design details on the system to prevent frost heave under the LNG storage tanks, which they indicated would be determined in final design.

The FEED and specifications submitted for the proposed facilities to date are preliminary but would serve as the basis for any detailed design to follow. If authorization is granted by the Commission, the next phase of the proposed Terminal would include development of the final design, including final selection of equipment manufacturers, process conditions, and resolution of some safety-related issues. We do not expect that the detailed design information to be developed would result in changes to the basis of design, operating conditions, major equipment selections, equipment design conditions, or safety system designs that were presented as part of the FEED.

Information regarding the development of the final design, as detailed below, would need to be filed with the Secretary for review and written approval by the Director of OEP, or the Director's designee, before equipment construction at the site would be authorized. To ensure that the concerns we've identified relating to the reliability, operability, and safety of the proposed design are addressed by Venture Global Calcasieu Pass, and to ensure that the Terminal facilities are subject to the Commission's construction and operational inspection program, **we recommend that the following measures should apply to this Project. 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. Specific engineering, vulnerability, or detailed design information meeting the criteria specified in Order No. 833 (Docket No. RM16-15-000), including security information, should 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 should be filed <u>a minimum of 30 days</u> before approval to proceed is requested.

- **<u>Prior to initial site preparation</u>, Venture Global Calcasieu Pass should file an overall Terminal schedule, which includes the proposed stages of the commissioning plan.**
- **<u>Prior to initial site preparation</u>, Venture Global Calcasieu Pass should file quality assurance and quality control procedures for construction activities.**
- **<u>Prior to initial site preparation</u>, Venture Global Calcasieu Pass should file procedures for controlling access during construction.**
- **<u>Prior to initial site preparation</u>, Venture Global Calcasieu Pass should develop an Emergency Response Plan (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 including, but not limited to, the calculated AEGL dispersion zones;**

  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 carrier to activate sirens and other warning devices.**

  Venture Global Calcasieu Pass should notify FERC staff of all planning meetings in advance and should report progress on the development of its Emergency Response Plan <u>at 3-month intervals</u>.

- **<u>Prior to initial site preparation</u>, Venture Global Calcasieu Pass 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. Venture Global Calcasieu Pass should notify FERC staff of all planning meetings in advance and should report progress on the development of its Cost Sharing Plan <u>at 3-month intervals</u>.**
- **<u>Prior to initial site preparation</u>, Venture Global Calcasieu Pass should file a complete specification of the proposed LNG tank design and installation.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file information/revisions pertaining to Venture Global Calcasieu Pass's response numbers 64, 68, 69, 73, 74, 77, 80, 83, and 88 of its February 3, 2017 filing, which indicated features to be included or considered in the final design.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file information/revisions pertaining to the response numbers 1, 3, 4, 5, 8, 10, 11, 12, 13, and**

14 of its December 13, 2017 filing, which indicated features to be included or considered in the final design.

- **Prior to construction of the final design, Venture Global Calcasieu Pass should file information/revisions pertaining to the response numbers 1(a), 3(b), 6(b), 7, 9(a) leakage source table changes, 13, and 15 of its March 7 and 13, 2018 filings, which indicated features to be included or considered in the final design.**
- **Prior to construction of the final design, Venture Global Calcasieu Pass should provide details of its foundation heating system of the LNG storage tanks or details of an alternative system that demonstrates cold temperatures would be prevented from causing frost heave underneath the tank. If an elevated pile cap design is selected, Venture Global Calcasieu Pass should consider preventing the migration and ignition of vapor clouds underneath the LNG storage tank or demonstrating the tank would be able to withstand such a scenario.**
- **Prior to construction of the final design, Venture Global Calcasieu Pass should file change logs that list and explain any changes made from the FEED provided in its application and filings. A list of all changes with an explanation for the design alteration should be filed and all changes should be clearly indicated on all diagrams and drawings.**
- **Prior to construction of the final design, Venture Global Calcasieu Pass should file a plot plan of the final design showing all major equipment, structures, buildings, and impoundment systems.**
- **Prior to construction of the final design, Venture Global Calcasieu Pass should file an up-to-date complete equipment list, process and mechanical data sheets, and specifications.**
- **Prior to construction of the final design, Venture Global Calcasieu Pass should file three-dimensional plant drawings to confirm plant layout for maintenance, access, egress, and congestion.**
- **Prior to construction of the final design, Venture Global Calcasieu Pass should file up-to-date Process Flow Diagrams with heat and material balances and a complete set of Piping and Instrumentation Diagrams (P&IDs), which include the following information:**
  a. **equipment tag number, name, size, duty, capacity, and design conditions;**
  b. **equipment insulation type and thickness;**
  c. **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 the final design, Venture Global Calcasieu Pass should revise P&IDs to be consistent and include the full tag numbering system for valves and instrumentation to prevent operator errors.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file a car seal philosophy and a list of all car-sealed and locked valves consistent with the P&IDs.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file a hazard and operability review of the completed design prior to issuing the P&IDs for construction. The review should include a list of recommendations and actions taken on the recommendations.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should provide 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.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should include provisions in the facility plot plan for the possible future installment of a mercury removal system.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should include space for possible future installment of LNG drain pumps for the BOG Compressor Drain Drum (110-V0003).**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should include an antisurge and control system on the recycling gas compressor (103-K1001).**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should include a vent valve on the drain line 3"-BO-126-040002-1K0A1-PH from the Warm Flare Knockout Drum (126-V0001).**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should include a flow meter on the discharge of the LNG Loading Pumps to verify the pump's performance.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should include an antisurge and control system on the molecular sieve dehydration system.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should include double isolation valves on the Cold Flare Scrubber (00A-V-1110).**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file the cause-and-effect matrices for the process instrumentation and emergency shutdown system. The cause-and-effect matrices should include alarms and shutdown functions, details of the voting and shutdown logic, and set points.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should specify that all emergency shutdown valves are to be equipped with open and closed position switches connected to the Distributed Control System/Safety Instrumented System.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file the procedures for pressure/leak tests which address the requirements of ASME VIII and ASME B31.3, as required by 49 CFR Part 193.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass 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 required by 49 CFR Part 193, and should provide justification if not using an inert or non-flammable gas for clean-out, dry-out, purging, and tightness testing.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass 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.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should specify that piping specifications for stainless steel piping capable of operating at cryogenic temperatures should require the inner and outer ring of spiral wound gaskets to be stainless steel.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should include dual relief valves on the ethylene, propane, and pentane storage drums.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass 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.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file an updated fire protection evaluation of the proposed facilities carried out in accordance with the requirements of NFPA 59A (2001 edition), Chapter 9.1.2 as required by 49 CFR Part 193. The evaluation should include a list of recommendations and supporting justifications, and actions taken on the recommendations. Clarification should be provided on the use of high expansion foam or foam glass blocks for LNG spill impoundments and specific consideration should be given to the use of other foam systems or automatic fire protection measures in the hazardous fluid storage areas, including the diesel storage area.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file spill containment system drawings with dimensions and slopes of curbing, trenches, impoundments, and capacity calculations for trenches and impoundments considering any foundations and equipment within impoundments, the sizing and design of the down-comer that would transfer LNG tank top spills to the ground-level impoundment system, and demonstration that the piping spill trays at the base of the LNG tanks would withstand the force and shock of a sudden cryogenic release.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file revised dimensions for Discharge Holding Basins 127-M0011, 127-M0021, and 127-M0041 to contain the liquid volume associated with the high liquid level in the hot oil surge drum or should demonstrate that sizing liquid volumes greater than those already considered could not occur.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file detailed calculations to confirm that the final fire water volumes would be vaporized or accounted for when evaluating the capacity of the impoundment system during a spill and fire scenario.**
- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file documentation of the process hazard analysis software tool (PHAST) model suitability for predicting the rainout from a catastrophic failure of the liquid nitrogen storage tank, including any validation against experimental data for similar scenarios. Alternatively, Venture Global Calcasieu Pass should revise the liquid nitrogen containment design to take into account for the non-flashing portion of the vessel liquid volume in the PHAST**

modeling results or to account for the liquid fraction indicated by experimental data for similar scenarios of a similar scale.

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should provide containment for the liquid from a failure of a feed gas booster compressor knock out drum, as well as any other significant liquid vessels outside of containment areas, or should provide a detailed explanation of how this liquid would be safely collected, including calculations for the liquid volume considered.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should provide a detailed analysis to demonstrate that liquid from an LNG storage tank failure would not be expected to reach the metal storm surge wall and gate or should demonstrate that the storm surge wall, up to a necessary height, would be designed or protected to withstand the potential spill conditions, including sudden cryogenic temperatures.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass 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).**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass 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.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file electrical area classification drawings.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass 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. The list should include the instrument tag number, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file a technical review of its proposed facility design that:**

  a. identifies all combustion/ventilation air intake for equipment and buildings and the distances to any possible hazardous fluid release (LNG, flammable refrigerants, flammable liquids and flammable gases); 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 ventilation equipment whose continued operation could add to or sustain an emergency.

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas when determining the lower flammability limit set points for methane, propane, and ethylene, pentane, and condensate.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file a list of alarm and shutdown set points for all hazard detectors that account for the calibration**

gas when determining the toxic concentration set points for condensates, ammonia, and hydrogen sulfide.

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass 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 which would be accessible during an emergency.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file the cause-and-effect matrices for the fire and gas detection system and emergency shutdown system. The cause-and-effect matrices should include alarms and shutdown functions, details of the voting and shutdown logic, and set points.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file complete plan drawings and a list of the fixed and wheeled, dry-chemical, and hand-held fire extinguishers, and other hazard control equipment. Drawings should clearly show the location by tag number of all fixed, wheeled, and hand-held extinguishers. The list should include the equipment tag number, type, capacity, equipment covered, discharge rate, and automatic and manual remote signals initiating discharge of the units. The spacing of portable fire extinguishers should be demonstrated to meet NFPA 10 spacing requirements.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should include clean agent systems in the electrical switchgear and instrumentation buildings.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file facility plans and drawings that show the location of the firewater and foam systems. Drawings should clearly show: firewater and foam piping; post indicator valves; and the location, and area covered by, each monitor, hydrant, deluge system, foam system, water-mist system, and sprinkler. The drawings should also include piping and instrumentation diagrams of the firewater and foam system.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should install firewater hydrants or monitors that cover the LNG storage tanks for exposure cooling.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should specify that the firewater flow test meter is 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. The firewater main header pressure transmitter should also be connected to the DCS and recorded.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file the structural analysis of the LNG storage tank and outer containment demonstrating they are designed to withstand all loads and combinations. The analysis should include thermal loads on the outer containment of the full containment storage tanks when exposed to a roof tank top fire or adjacent tank top fire and overpressure and projectile loads from wind borne projectiles and ignition of design spills.**

- **<u>Prior to construction of final design</u>, Venture Global Calcasieu Pass should include 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.**

- **<u>Prior to construction of the final design</u>, Venture Global Calcasieu Pass should file plans to equip the LNG storage tank and adjacent piping and supports with permanent**

settlement monitors to allow personnel to observe and record the absolute and relative settlement of the LNG storage tank and adjacent piping.

- **Prior to construction of final design, Venture Global Calcasieu Pass should provide complete plan drawings of lighting, camera coverage, security fencing, including facility access and egress for the entire facility. The lighting should include all lighting, including the process and storage tank areas, and should be supported by a photometric analysis. The camera coverage should include all camera coverage within the site and delineate operator and security camera coverage. The fencing should surround the entire facility, including along the entire shoreline, and should evaluate the mesh size proposed and should show access/egress points and vehicle barriers at those locations and other locations throughout the plant.**
- **Prior to construction of the final design, Venture Global Calcasieu Pass should certify that the final design is consistent with the information provided to the DOT as described in the design spill determination letter dated October 4, 2017 (Accession Number 20171005-3053). In the event that any modification to the design alters the candidate design spills on which the 49 CFR Part 193 siting analysis was based, Venture Global Calcasieu Pass should consult with the DOT on any actions necessary to comply with Part 193.**
- **Prior to construction of the final design, Venture Global Calcasieu Pass should file plant geometry models or drawings that verify the confinement and congestion represented in the front-end engineering design or provide revised overpressure calculations indicating that a 1 psi overpressure would not impact the public.**
- **Prior to construction of the final design, Venture Global Calcasieu Pass should file a detailed quantitative analysis to demonstrate that adequate thermal mitigation would be provided for each significant component that could fail from an impoundment fire. The analysis should consider 4,000 BTU/ft^2-hr or a more detailed analysis of the degradation of strength and pressure rise from the radiant heat exposures. Trucks at the truck transfer station should be included in the analysis. A combination of passive and active protection should be provided and demonstrate the effectiveness and reliability. 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.**
- **Prior to commissioning, Venture Global Calcasieu Pass 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. Venture Global Calcasieu Pass 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, Venture Global Calcasieu Pass should file results of the LNG storage tank hydrostatic test and foundation settlement results along with adjacent piping. At a minimum, foundation settlement results should be provided thereafter annually via a semi-annual operational report.**
- **Prior to commissioning, Venture Global Calcasieu Pass should file plans and detailed procedures for testing the integrity of onsite mechanical installation, functional tests, introduction of hazardous fluids, operational tests, and placing the equipment into service.**

- **<u>Prior to commissioning</u>, Venture Global Calcasieu Pass should tag all equipment, instrumentation, and valves in the field, including drain valves, vent valves, main valves, and car-sealed or locked valves.**
- **<u>Prior to commissioning</u>, Venture Global Calcasieu Pass should file a tabulated list and drawings of the proposed hand-held fire extinguishers. The list should include the equipment tag number, extinguishing agent type, capacity, number, and location. The drawings should show the extinguishing agent type, capacity, and tag number of all hand-held fire extinguishers.**
- **<u>Prior to commissioning</u>, Venture Global Calcasieu Pass should file the operation and maintenance procedures and manuals, as well as safety procedures, hot work procedures and permits, abnormal operating conditions reporting procedures, and management of change procedures and forms.**
- **<u>Prior to commissioning</u>, Venture Global Calcasieu Pass should provide a detailed training log that demonstrates that operating staff has completed required training.**
- **<u>Prior to introduction of hazardous fluids</u>, Venture Global Calcasieu Pass should complete all pertinent tests (Factory Acceptance Tests, Site Acceptance Tests, Site Integration Tests) associated with the Distributed Control System and the Safety Instrumented System that demonstrates full functionality and operability of the system.**
- **<u>Prior to introduction of hazardous fluids</u>, Venture Global Calcasieu Pass 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).**
- **<u>Prior to unloading the first LNG import commissioning cargo and prior to loading the first LNG export commissioning cargo</u>, Venture Global Calcasieu Pass should receive written authorization from the Director of OEP. After first production of LNG, Venture Global Calcasieu Pass 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 block, 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 the FERC <u>within 24 hours</u>.**
- **<u>Prior to commencement of service</u>, Venture Global Calcasieu Pass should specify an alarm management program to ensure effectiveness of process alarms.**
- **<u>Prior to commencement of service</u>, Venture Global Calcasieu Pass should develop procedures for offsite contractors' responsibilities, restrictions, and limitations and for supervision of these contractors by Venture Global Calcasieu Pass staff.**
- **<u>Prior to commencement of service</u>, Venture Global Calcasieu Pass 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).**

- **<u>Prior to commencement of service</u>, Venture Global Calcasieu Pass should notify the FERC staff of any proposed revisions to the security plan and physical security of the plant.**
- **<u>Prior to commencement of service</u>, Venture Global Calcasieu Pass should file documentation confirming a determination by the USCG, under its authorities under the Ports and Waterways Safety Act, the Magnuson Act, the Maritime Transportation Security Act, and the Safety and Accountability For Every Port Act, that Venture Global Calcasieu Pass has installed appropriate measures to ensure the safety and security of the facility and the waterway.**

In addition, **we recommend that the following measures should apply <u>throughout the life</u> of the LNG Terminal facilities:**

- **The facility should be subject to regular FERC staff technical reviews and site inspections on at least an <u>annual basis</u> or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, Venture Global Calcasieu Pass should respond to a specific data request, including information relating to possible design and operating conditions that may have been imposed by other agencies or organizations. Up-to-date detailed piping and instrumentation diagrams reflecting facility modifications and provision of other pertinent information not included in the semi-annual reports described below, including facility events that have taken place since the previously submitted semi-annual report, should be submitted.**
- **<u>Semi-annual</u> operational reports should be filed with the Secretary to identify changes in facility design and operating conditions, abnormal operating experiences, activities (e.g., ship arrivals, quantity and composition of imported and exported LNG, liquefied and vaporized quantities, boil-off/flash gas, number and volume of trucking, etc.), plant modifications, including future plans and progress thereof. Abnormalities should include, but not be limited to: unloading/loading/shipping problems, potential hazardous conditions from 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 <u>within 45 days after each period ending June 30 and December 31</u>. In addition to the above items, a section entitled "Significant Plant Modifications Proposed for the Next 12 Months (dates)" should be included in the semi-annual operational reports to provide FERC staff with early notice of anticipated future construction/maintenance projects at the LNG facility.**
- **In the event the temperature of any region of any secondary containment, including imbedded pipe supports, becomes less than the minimum specified operating temperature for the material, the Commission should be notified <u>within 24 hours</u> 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**

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 five minutes or more;

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

g. any crack or other material defect that impairs the structural integrity or reliability of an LNG 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 LNG facilities) plus the build-up allowed for operation of pressure limiting or control devices;

i. a leak in an LNG facility that contains or processes 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 an LNG facility that contains or processes hazardous fluids;

l. safety-related incidents to 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 facility's incident management plan.

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

In addition to the final design review, we would conduct inspections during construction of the Terminal and would review additional materials, including quality assurance and quality control plans, non-conformance reports, and cool down and commissioning plans, to ensure that the installed design would be consistent with the safety and operability characteristics of the FEED. We would also conduct inspections during operation to ensure that the Terminal facilities would be operated and maintained in accordance with the filed design throughout the life of the facilities. Based on our analysis and recommendations presented above, we believe that the Terminal FEED would include acceptable layers of protection or safeguards which would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public.

4.12.6 Siting Requirements

The principal hazards associated with the Terminal facility result from cryogenic and flashing liquid releases; flammable and toxic vapor dispersion; vapor cloud ignition; pool fires; jet fires; BLEVEs; and overpressures. As discussed in section 4.12.5, our FEED review indicates that sufficient layers of protection would be incorporated into the facility design to mitigate the potential for an initiating event to develop into an incident that could impact the safety of the offsite public. Siting the facilities with regard to potential offsite consequences to ensure the impact on the public would be minimized is also required by DOT's regulations in 49 CFR Part 193, Subpart B. The Commission's regulations under 18 CFR §380.12(o)(14) require Venture Global Calcasieu Pass to identify how the proposed design complies with the siting requirements of 49 CFR Part 193, Subpart B. As part of our review, we used Venture Global Calcasieu Pass's information, provided to show compliance with DOT's regulations, to assess whether or not the proposed facilities would have a public safety impact.

The requirements in 49 CFR Part 193 state that an operator or government agency must exercise control over the activities that can occur within an "exclusion zone," defined as the area around an LNG facility that could be exposed to specified levels of thermal radiation or flammable vapor in the event of a release of LNG. Approved mathematical models must be used to calculate the dimensions of these exclusion zones. The siting requirements of the 2001 edition of NFPA 59A, an industry consensus standard for LNG facilities, are incorporated into 49 CFR Part 193, Subpart B by reference, with regulatory preemption in the event of conflict.

The following sections of Part 193 specifically address siting requirements for each LNG container and LNG transfer system:

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

- 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); and

- 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).

The above LNG siting requirements would be applicable to the following Terminal facilities:

- Two 200,000 m^3 LNG full-containment storage tanks and appurtenances;
- All LNG piping, including the 36-inch ship transfer line and 24-inch liquefaction rundown line;
- Eight 13,208 gpm LNG in-tank loading pumps and two 880 gpm LNG in-tank recirculation pumps; and
- Various LNG process vessels, exchangers, and other facilities.

Previous FERC environmental assessments and impact statements for past projects have identified inconsistencies and areas of potential conflict between the requirements in Part 193 and NFPA 59A (2001). Sections 193.2057 and 193.2059 require exclusion zones for each LNG container and LNG transfer system. An LNG transfer system is defined in §193.2007 to include cargo transfer systems and transfer piping, and does not distinguish between permanent or temporary. However, NFPA 59A (2001) requires exclusion zones only for "transfer areas," which is defined as the part of the plant where the facility introduces or removes the liquids, such as truck loading or ship unloading areas. The NFPA 59A (2001) definition does not include permanent plant piping, such as cargo transfer lines. Section 2.2.3.1 of NFPA 59A (2001) also states that transfer areas at the water edge of marine terminals are not subject to the siting requirements in that standard.

The DOT has addressed some of these issues in a March 2010 Letter of Interpretation. In that letter, DOT stated that: (1) the requirements in the NFPA 59A (2001) for transfer areas for LNG apply to the marine cargo transfer system at a proposed waterfront LNG facility, except where preempted by the regulations in Part 193; (2) the regulations in Part 193 for LNG transfer systems conflict with NFPA 59A (2001) on whether an exclusion zone analysis is required for transfer piping or permanent plant piping; and (3) the regulations in Part 193 prevailed as a result of that conflict. The DOT has determined that an exclusion zone analysis of the marine cargo transfer system is required.

In FERC environmental assessments and impact statements for past projects, we have also noted that when the DOT incorporated NFPA 59A into its regulations, it removed the regulation that required impounding systems around transfer piping. As a result of that change, it is unclear whether Part 193 or the adopted sections of NFPA 59A (2001) require impoundments for LNG transfer systems. We note that Part 193 requires exclusion zones for LNG transfer systems and that those zones were historically calculated based on impoundment systems. We also note that the omission of containment for transfer piping is not a sound engineering practice. For these reasons, we generally recommend containment for all LNG transfer piping within the plant's property lines.

As stated in §193.2051, LNG facilities must be provided with the siting requirements of NFPA 59A (2001). The siting requirements for flammable liquids within an LNG facility are contained in NFPA 59A, Chapter 2:

- NFPA 59A (2001) section 2.1.1 requires consideration of clearances between flammable refrigerant storage tanks, flammable liquid storage tanks, structures and plant equipment, both with respect to plant property lines and each other. This section also requires that other factors applicable to the specific site that have a bearing on the safety of plant personnel and surrounding public be considered, including an evaluation of potential incidents and safety measures incorporated in the design or operation of the facility.

- NFPA 59A (2001) section 2.2.2.2 requires impoundments serving flammable refrigerants or flammable liquids to contain a 10-minute spill of a single accidental leakage source or during a shorter time period based upon demonstrable surveillance and shutdown provisions acceptable to the DOT. In addition, NFPA section 2.2.2.5 requires impoundments and drainage channels for flammable liquid containment to conform to NFPA 30, *Flammable and Combustible Liquids Code*.

- NFPA 59A (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 cubic foot per hour (Btu/ft^2-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 are acceptable to DOT.

- NFPA 59A (2001) 2.2.3.3 and 2.2.3.4 require provisions to minimize the possibility of any flammable mixture of vapors from an LNG tank impoundment and a design spill from reaching a property line that can be built upon and, for design spills, 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. Alternative models must have been validated by experimental test data appropriate for the hazard to be evaluated and must be acceptable to the DOT. NFPA 59A (2001) section 2.2.3.5 requires the design spill for impounding areas serving vaporization and process areas to be based on the flow from any single accidental leakage source.

The above siting requirements from 49 CFR Part 193 and NFPA 59A (2001) would be applicable to the following Terminal facilities:

- Refrigerant, diesel, and other storage tanks and associated piping and equipment;

- Piping and equipment associated with the liquefaction blocks; and

- Piping and equipment associated with the feed gas pre-treatment.

4.12.7 Siting Analysis for Facilities at the Terminal

4.12.7.1 Impoundment Sizing

Under NFPA 59A (2001) section 2.2.2.2, the capacity of impounding areas for vaporization, process, or LNG transfer areas must equal the greatest volume that can be discharged from any single accidental leakage source during a 10-minute period or during a shorter time period based upon demonstrable surveillance and shutdown provisions acceptable to the DOT. We recommend that impoundments be sized based on the largest flow capacity from a single pipe for 10 minutes or the capacity of the largest vessel served, whichever is greater, while recognizing that different spill scenarios may be used for the single accidental leakage sources for the hazard calculations required by 49 CFR Part 193.

Section 193.2181 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. 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.

Venture Global Calcasieu Pass proposes two full-containment LNG storage tanks for which the outer tank wall would serve as the impoundment system. DOT regulations require the outer tank provide 110 percent of the LNG tank volume capacity. Venture Global Calcasieu Pass provided calculations for the capacity that demonstrated the outer tank exceeded 110 percent. FERC staff also calculated the outer tank volumetric capacity and also determined it would exceed the 110 percent capacity of the inner tank requirement. In addition, Venture Global Calcasieu Pass indicates that sloped areas for stormwater run off over the site would have enough capacity to retain the full contents of an LNG storage tank, in the unlikely event that this amount of retention would be needed. However, it is not clear that the LNG in this scenario would not reach the metal storm surge wall, which may not be designed to withstand the thermal shock of sudden cryogenic exposure. Therefore, we included a recommendation in section 4.12.5 that, prior to construction of the final design, Venture Global Calcasieu Pass should provide details to address this issue.

In addition, Venture Global Calcasieu Pass indicated that all piping, hoses, and equipment that could produce a hazardous liquid spill would be provided with spill collection and proposes to construct five spill impoundment basins for process fluids. Each of these impoundment systems and its sizing spill are discussed below. Venture Global Calcasieu Pass also indicated that all containment would have automatic sumps pumps that remove stormwater runoff and transfer that runoff outside of the facility or to water treatment. However, every sump would have multiple devices interlocked to prevent hazardous fluid transfer out of the sump. These devices would include low temperature switches to prevent pump operation if the high vapor pressure constituents, such as propane, ethylene, liquid nitrogen or LNG, are present and analyzers to prevent pump operation where liquid hydrocarbons, including lube oil, heat transfer oil, heavy condensate or amines, are present.

The proposed Spill Impoundment Basin (127-M0003), located between the two LNG storage tanks, would collect spilled LNG, hot oil, condensates, and refrigerants from the LNG storage areas, dock, trestle, and liquefaction areas. This impoundment would be 61 feet long by 61 feet wide and 28.5 feet deep below the bottom of the trench that directs liquid into it. These dimensions result in a volumetric capacity of about 793,298 gallons. Venture Global Calcasieu Pass designed the Spill Impoundment Basin to contain a 10-minute spill from a full rupture of the 36-inch-diameter LNG pump discharge header, which it calculated would produce a total volume of 788,655 gallons. This volume includes an extra 20 percent over the pump flow rate to account for the maximum pump runout on the pump curve, with four of the ten the in-tank LNG pumps running, and also includes the de-inventory volume of the pipe. In order to prevent greater flow rates from occurring in the ship loading lines, Venture Global Calcasieu Pass would provide a mechanism with a SIL2 or higher rating that would limit maximum sustained operational flow rates in the ship transfer piping to no more than 120 percent of the intended maximum loading rate of 12,000 m^3/hr.

Additionally, the Discharge Holding Basin (127-M0006) would collect spilled liquid from the refrigerant storage piping from the mounded refrigerant tanks. This impoundment would be 20 feet long by 10 feet wide by 14 feet deep below the bottom of the trench, resulting in a volumetric capacity of 20,945 gallons. Venture Global Calcasieu Pass indicates that the depletion of one of the refrigerant storage tanks would be the largest potential spill into this impoundment, and the largest of those vessel capacities is less than the impoundment volume. Therefore, this spill would be completely contained by the impoundment.

The Discharge Holding Basins 127-M0011, 127-M0021, and 127-M0041 would collect spilled hot oil, condensates, and/or amine from various areas. The 127-M0011 impoundment would have dimensions of 45 feet long by 20 feet wide by 7.5 feet deep below the spillway intersection, resulting in a volumetric capacity of 50,494 gallons. The 127-M0021 impoundment would have dimensions of 45 feet long by 20 feet wide by 8 feet deep below the spillway intersection, resulting in a volumetric capacity of 53,860 gallons. The 127-M0041 impoundment would have the dimensions of 30 feet long by 20 feet wide by 11 feet deep below the spillway intersection, resulting in a volumetric capacity of 49,731 gallons. The company indicates that the largest sizing spill that would be directed to these impoundments would come from piping associated with the hot oil surge drum and circulation pumps and that spill would total 48,743 gallons. However, this does not appear to account for potential higher liquid levels in the vessel, which staff calculated as corresponding to over 60,000 gallons. Therefore we have included a recommendation in section 4.12.5 for these impoundments to contain a volume that accounts for the high liquid level in the hot oil surge drum, unless Venture Global Calcasieu Pass can demonstrate that this sizing spill could not involve a greater liquid volume than already considered.

Venture Global Calcasieu Pass indicates that the liquid nitrogen storage tank would be located within a curbed area but that no other impoundment would be intended because PHAST modeling indicates no rainout for a catastrophic failure of the liquid nitrogen storage tank. However, these results seem to suggest that relatively low percentages of flashing would result in complete breakup of large volumes of liquid into small droplets and full vaporization of those droplets before reaching the ground. Therefore we included a recommendation in section 4.12.5 for Venture Global Calcasieu Pass to provide validation for these PHAST modeling results or to revise the containment design to account for the potential liquid nitrogen spill from a full tank failure. In addition, the Diesel Storage Impoundment would collect a spill from the diesel storage tank. The impoundment would have dimensions of 56 feet long by 56 feet wide by 4.3 feet deep. This would result in a volumetric capacity of 100,866 gallons. This would contain the full capacity of the diesel storage tank, which would be 65,582 gallons.

Table 4.12.7.1-1 summarizes the impoundments and their sizing spills discussed above.

TABLE 4.12.7.1-1

IMPOUNDMENT SIZING SPILLS

Impoundment System	Sizing Spill Source	Sizing Spill (gallons)	Impoundment Size (gallons)
LNG Full-Containment Storage Tank	Tank Contents	56,828,164	62,511,033
LNG Full-Containment Storage Tank	Tank Contents	56,828,164	62,511,033
Spill Impoundment Basin (127-M0003)	LNG Pump Discharge Header	788,655	793,298
Discharge Holding Basin (127-M0006)	Refrigerant Storage Tank	<20,000	20,945
Discharge Holding Basin (127-M0011)	Hot Oil Circulation Pumps	48,743	50,494
Discharge Holding Basin (127-M0021)	Hot Oil Circulation Pumps	48,743	53,860
Discharge Holding Basin (127-M0041)	Hot Oil Circulation Pumps	48,743	49,371
Diesel Storage Impoundment	Diesel Storage Tank	65,582	100,866

All of the LNG spill containment basins and trenches have been designed using insulated concrete with the exception of spill trays near the base of the LNG storage tanks to the trough system. While insulated concrete is typically considered suitable for sudden exposure to cryogenic liquids, it is unclear as to whether the spill trays would be suitable for sudden exposure to cryogenic liquids. In addition, Venture Global Calcasieu Pass stated that 140 percent of the hot oil circulation pump flow would be used for the sizing spills to account for pump run out, but indicated it would not matter for the impoundment volume because the entire volume would be depleted in less than 10 minutes. However, the sizing spill flow rate does matter for trench sizing, which conveys the sizing spills to the impoundment. FERC staff was not able to confirm that the associated trench system could convey the sizing spill flow rate with all hot oil circulation pumps running. Therefore, we included these issues in a recommendation in section 4.12.5 indicating that, prior to construction of the final design, Venture Global Calcasieu Pass should provide the details of the spill containment system for review and approval.

4.12.7.2 Design Spills

Design spills are used in the determination of the hazard calculations required by 49 CFR Part 193. Prior to the incorporation of NFPA 59A in 2000, the design spill in Part 193 assumed the full rupture of "a single transfer pipe which has the greatest overall flow capacity" for not less than 10 minutes (old Part 193.2059[d]). With the adoption of NFPA 59A (2001), the basis for the design spill for impounding areas serving only vaporization, process, or LNG transfer areas became the flow from any single accidental leakage source. Neither Part 193 nor NFPA 59A (2001) define "single accidental leakage source."

In a letter to the FERC staff, dated August 6, 2013, the DOT requested that LNG facility applicants contact the Office of Pipeline Safety's Engineering and Research Division regarding the Part 193 siting requirements.[51] Specifically, the letter stated that the DOT required a technical review of the applicant's design spill criteria for single accidental leakage sources on a case-by-case basis to determine compliance with Part 193.

Venture Global Calcasieu Pass provided the DOT with its design spill criteria and identified leakage scenarios for the proposed equipment. The DOT reviewed the data and methodology Venture Global Calcasieu Pass used to determine the single accidental leakage sources for the design spills, which were based on the flow from various leakage sources including piping, containers, and equipment containing LNG, refrigerants**,** and other hazardous fluids. On October 4, 2017, the DOT provided a letter to the FERC staff stating that the DOT had no objection to Venture Global Calcasieu Pass's methodology for determining the single accidental leakage sources for candidate design spills to be used in establishing the Part 193 siting requirements for the proposed facilities.[52] The design spills produced by this method were identified in the documents reviewed by the DOT and have been filed in the FERC docket for this Project.

The DOT's conclusions on the candidate design spills used in the siting calculations required by Part 193 were based on preliminary design information which may be revised as the engineering design progresses. If Venture Global Calcasieu Pass's design or operation of the proposed facilities differs from the details provided in the documents on which the DOT based its review, the facilities may not comply with the siting requirements of Part 193. As a result, we included a recommendation in section 4.12.5 for Venture Global Calcasieu Pass to provide certification that the final design is consistent with the information provided to DOT.

A different subset of design spills would be applicable to each type of hazard. Therefore, the specific design spills used for each part of the Terminal facility siting analysis are listed in the applicable hazard analysis sections below.

4.12.7.3 Flammable Vapor Dispersion Analysis

As discussed in section 4.12.3, a large quantity of flammable material released without ignition would form a flammable vapor cloud that would travel with the prevailing wind until it either dispersed below the flammable limit or encountered an ignition source. To address this hazard, 49 CFR §193.2051 and §193.2059 require the evaluation of flammable vapor dispersion in accordance with applicable sections

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[51] August 6, 2013 letter from Kenneth Lee, Director of Engineering and Research Division, Office of Pipeline Safety to Terry Turpin, LNG Engineering and Compliance Branch, Office of Energy Projects. Filed in Docket No. PF13-14 on August 13, 2013. Accession Number 20130813-4015.

[52] October 4, 2017 letter "Re: Venture Global Calcasieu Pass, LLC, FERC Docket No. CP15-550-000, "Venture Global Calcasieu Pass LNG Project" from Kenneth Lee to Rich McGuire. Filed in Docket No. CP15-550-000 on October 5, 2017. Accession Number: 20171005-3053.

of NFPA 59A (2001). Taken together, Part 193 and NFPA 59A (2001) require that flammable vapors either from an LNG tank withdrawal impoundment or a single-accidental LNG leakage source do not extend beyond areas in which the operator or a government agency legally controls all activities. NFPA 59A section 2.2.3.4 also requires provisions to minimize the possibility of any flammable mixture of vapors from any design spill reaching a property line that can be built upon and that would result in a distinct hazard. In addition, NFPA 59A section 2.1.1 requires that factors applicable to the specific site with a bearing on the safety of plant personnel and surrounding public be considered, including an evaluation of potential incidents and safety measures incorporated into the design or operation of the facility.

Title 49 CFR §193.2059 requires that dispersion distances be calculated for a 2.5 percent average gas concentration (one-half the LFL) of LNG vapor under meteorological conditions which result in the longest downwind distances at least 90 percent of the time. Alternatively, where the models give longer distances at lower wind speeds, §193.2059 indicates that maximum downwind distances may be estimated for stability Class F, a wind speed of 4.5 mph, 50 percent relative humidity, and the average regional temperature. However, based on the DOT PHMSA's Final Decisions that FERC staff assisted in developing, the intention of these alternative conditions was to reduce the climate data and dispersion modeling processing needs. Moreover, at the time these alternative conditions were specified, the only approved pool source dispersion model that was being used generated maximum dispersion distances at those wind conditions. Since that time, computational time and capability has greatly improved for dispersion models and, as discussed in PHMSA's Final Decisions for those models, the leakage source scenarios currently being analyzed, using the models discussed below, can produce maximum dispersion distances over a wider array of wind conditions. For other flammable fluids, similar parameters have been recommended, and the calculation of the dispersion distances to the one-half LFL level has been recommended to account for uncertainty in the computer models currently approved by DOT.

The regulations in Part 193 specifically approve the use of two models for performing these dispersion calculations, DEGADIS and FEM3A, but also allow the use of alternative models approved by the DOT. Although Part 193 does not require the use of a particular source term model, modeling of the spill and resulting vapor production is necessary prior to the use of vapor dispersion models. In August 2010, the DOT issued Advisory Bulletin ADB-10-07 to provide guidance on obtaining approval of alternative vapor-gas dispersion models under Subpart B of 49 CFR 193. In October 2011, two dispersion models were approved by DOT for use in vapor dispersion exclusion zone calculations: PHAST-UDM Version 6.6 and Version 6.7 (submitted by Det Norske Veritas) and FLACS Version 9.1 Release 2 (submitted by GexCon). Venture Global Calcasieu Pass used PHAST 6.7 and FLACS 9.1, with their built-in source term models, to calculate vapor dispersion distances.

For the Terminal dispersion scenarios, Venture Global Calcasieu Pass used the following conditions: average regional temperature of 70 °F, relative humidity of 50 percent, wind speeds of 1 to 7 meters per second (m/s) based on discussion in the PHAST and FLACS Final Decisions, and Pasquill-Gifford Atmospheric Stability Classes D, E and F. We agree with Venture Global Calcasieu Pass's selection of atmospheric conditions. A ground surface roughness of 0.03 meter was used for all scenarios.

A storm surge wall, 26.5 feet higher than the process areas, would surround the terminal to the north, east, and south and act as a vapor dispersion barrier. One additional 10-foot high wall was added to the south of the liquefaction trains as an additional vapor dispersion barrier. There would also be a berm, 21 feet higher than the process areas, that runs north-south to the west of the LNG storage tanks and continues east. Figure 4.12.7.3-1 shows the location of the storm surge wall and the 10-foot high wall with respect to the terminal.

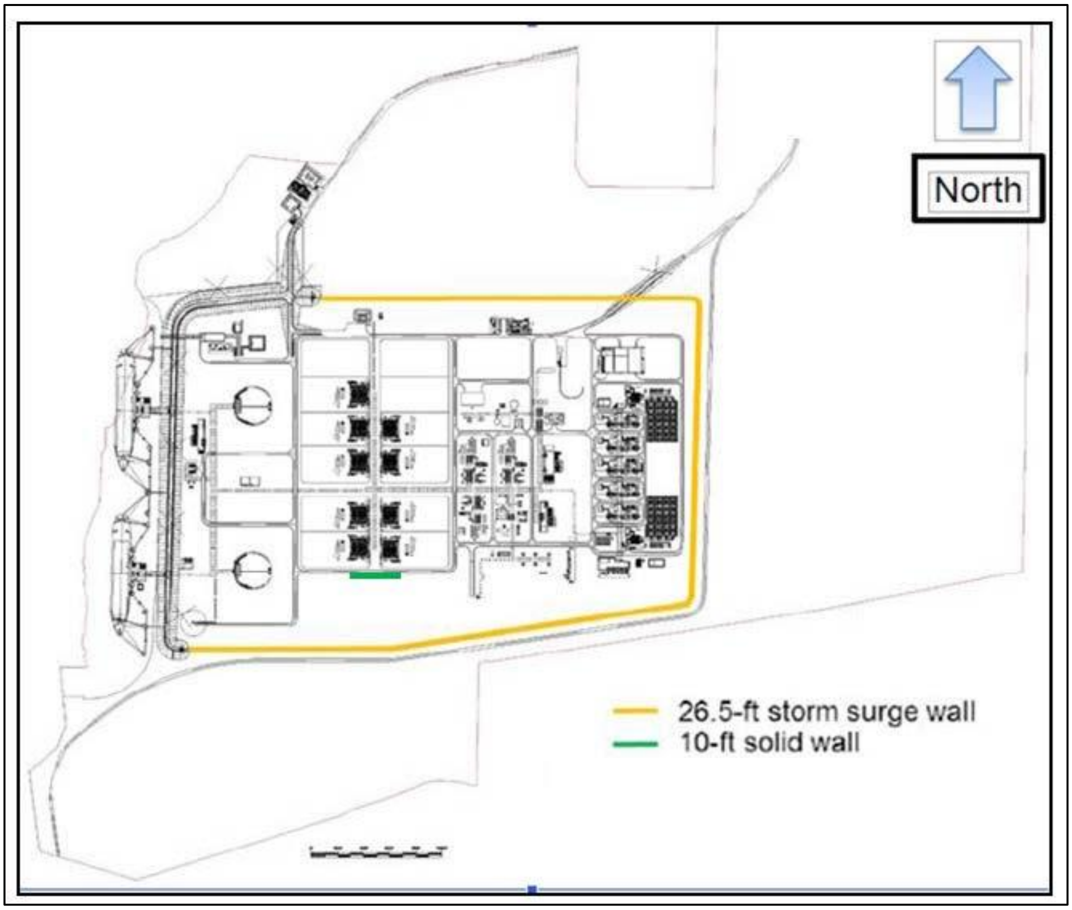

Figure 4.12.7.3-1 26.5 Foot High Storm Surge Wall Surrounding the Terminal to the North, East, and South *(The thin outer line is the property line)*

As discussed under "Design Spills," failure scenarios must be selected as the basis for the Part 193 dispersion analyses. Process conditions at the failure location would affect the resulting vapor dispersion distances. In determining the spill conditions for these leakage sources, process flow diagrams for the proposed design, used in conjunction with the heat and material balance information (i.e., flow, temperature, and pressure), can be used to estimate the flow rates and process conditions at the location of the spill. In general, higher flow rates would result in larger spills and longer dispersion distances, higher temperatures would result in higher rates of flashing, and higher pressures would result in higher rates of jetting and aerosol formation. If a release may drain into a spill containment system with an impoundment located relatively far from the release, two different pressure scenarios may be considered for each design spill:

1. The pressure in the line is assumed to be maintained by pumps and/or hydrostatic head to produce the highest rate of flashing and jetting (i.e., flashing and jetting scenario).
2. The pressure in the line is assumed to be depressurized by the breach and/or emergency shutdowns to produce the highest rate of liquid flow within a curbed, trenched, or impounded area (i.e., liquid scenario).

Alternatively, a single scenario for each design spill could be selected if adequately supported with an assessment of the depressurization calculations and/or an analysis of process instrumentation and shutdown logic acceptable to the DOT.

In addition, the location and orientation of the leakage source must be considered. The closer a leakage source is to the property line, the higher the likelihood that the vapor cloud would extend offsite. As most flashing and jetting scenarios would not have appreciable liquid rainout and accumulation, the siting of impoundment systems would be driven by liquid scenarios, while siting of piping and other remaining portions of the plant would be driven by flashing and jetting scenarios.

For impoundments other than the main LNG impoundment, Venture Global Calcasieu Pass indicated that the liquid spill dispersion analysis from leakage sources would not be necessary. We note that the leakage source spill impoundments would be located near to or more central to the site than the pressurized flashing and jetting dispersion release sources, and the depressurized liquid scenarios into these impoundments would not be expected to produce greater vapor flow rates or longer vapor dispersion distances. The liquid release from the full LNG storage tank withdrawal line failure, specified in NFPA 59A (2001) section 2.2.3.5 for the LNG container penetration design spill, would be a more significant liquid scenario than the leakage source design spills and has been modeled for flammable vapor dispersion in FLACS, which found the flammable vapors to remain onsite, and the dispersion was more significant with 1 m/s wind than 2 m/s wind. Venture Global Calcasieu Pass modeled this tank withdrawal line scenario with all of the pumps in an LNG tank running at an extra 20 percent flow rate to account for the maximum pump run out rate determined from the supporting LNG pump data sheets. Figures 4.12.7.3-2 and 4.12.7.3-3 show the flammable vapor dispersion clouds would not reach beyond the berm to the west of the LNG storage tanks and would therefore stay on the plant property.

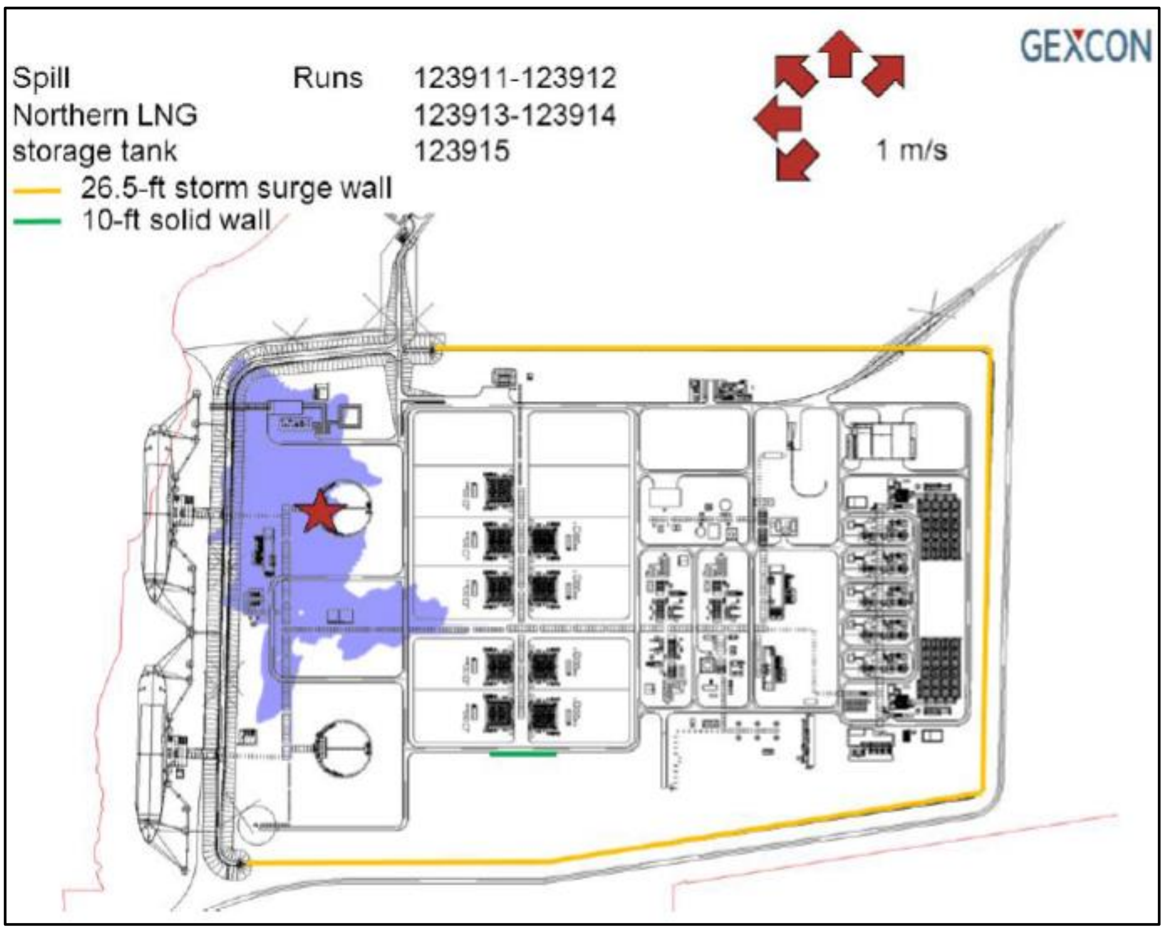

Figure 4.12.7.3-2 Maximum Flammable Vapor Dispersion from the LNG Tank Top Withdrawal Line Spill Scenario with 1 m/s wind *(using a model uncertainty factor of two – red line is the property line)*

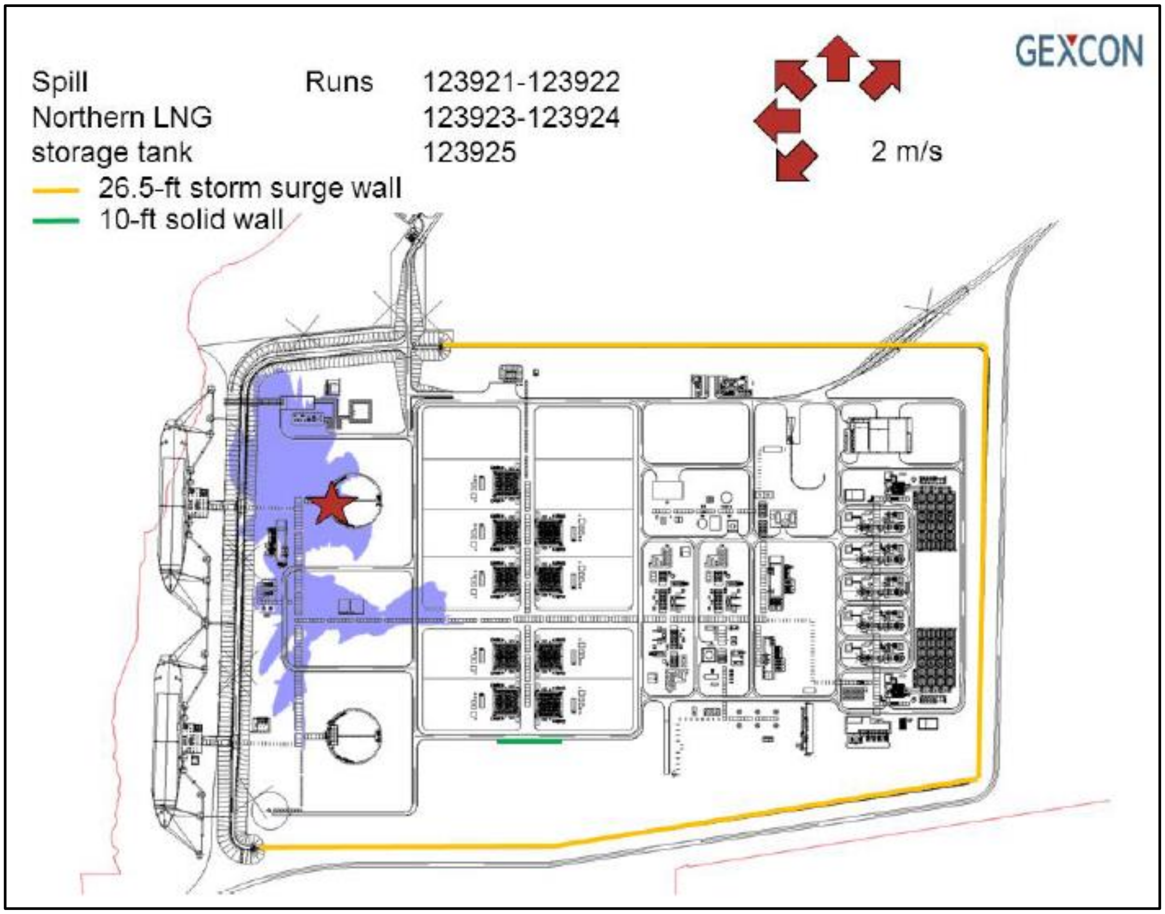

Figure 4.12.7.3-3 Maximum Flammable Vapor Dispersion from the LNG Tank Top Withdrawal Line Spill Scenario with 2 m/s wind *(using a model uncertainty factor of two – red line is the property line)*

The leakage source design spill selection methodology discussed under "Design Spills" was applied to the facilities to determine the flashing and jetting design spill cases that would produce the greatest vapor flow rates and dispersion characteristics from each process fluid in each area of the plant. The company's flammable vapor dispersion results are presented in table 4.12.7.3-1.

The scenarios with distance results in table below were modeled by Venture Global Calcasieu Pass using PHAST to the ½ LFL to account for an uncertainty factor of two based on the model validation results showing it can underpredict by a factor of two. None of Venture Global Calcasieu Pass's reported flammable vapor dispersion distances would extend beyond the plant property line, except for portions to the west over the Calcasieu River Ship Channel, which cannot be built upon.

TABLE 4.12.7.3-1 DESIGN SPILL SCENARIOS						
Scenario	Location	Line Diameter (*inches*)	Hole Diameter *(inches)*	Release Mass Flow Rate *(lb/hr)*	Rainout *(%)*	Distance to Flammable Dispersion With 1-7 m/s wind *(feet)*
LNG container withdrawal line	Storage tank area	Full pipe diameter	Full pipe diameter	13,428,797	100	See FLACS results
LNG-1	Liquefaction Area – Cold Box	6	2	162,077	0	See FLACS results
LNG-3	LNG Rundown	24	2	231,810	0	See FLACS results
LNG-6	Jetty Area	36	2	235,546	0	1,142
LNG-14C	LNG Storage Area	4	4	945,970	0	1,326
MR-4F	Liquefaction Area	N/A	2	380,721	0	265
MR-7	Liquefaction Area	20	2	147,299	0	230
MR-11	Liquefaction – MR Separator	8	2	578,751	0	See FLACS results
MR-13H	Liquefaction Area	3	3	380,721	0	1,167
PRO-1	Trucking Area	3	3	568,800	0	1,149
PRO-2 (Vessel)	Propane Storage Tank	2	2	282,855	0	772
PRO-2	Propane Storage Tank	2	2	9,899	0	67
ETH-1	Trucking Area	3	3	588,260	0	Bounded by ETH-2
ETH-2 (Vessel)	Near Ethylene Storage Drum	3	3	730,667	0	See FLACS results
ETH-2	Liquefaction Area	3	3	13,450	0	101
PEN-1	Trucking Area	3	3	162,285	59	Bounded by PEN-3
PEN-3 (Vessel)	Near Pentane Storage Drum	3	3	296,289	4	See FLACS results
PEN-4	Near Pentane Storage Drum	2	1	15,459	19	264
NGL-1	Liquefaction Area – Separator	3	3	846,600	0	1,115
NGL-3	Liquefaction Area – Reboiler	8	4	2,019,510	0	1,083
NGL-5A	Liquefaction Area – Flash Drum	2	2	1,073,260	0	931

In addition, Venture Global Calcasieu Pass filed flammable vapor dispersion modeling for scenarios LNG-1, LNG-3, MR-11, ETH-2, and PEN 3 using FLACS, which takes into account the plant geometry or other features such as the berm and storm surge wall for these scenarios. Multiple runs were conducted for each scenario with consideration of the 1 m/s to 7 m/s wind speed range in several different wind directions and accounting for a model uncertainty factor of 2. Figures 4.12.7.3-4 through 4.12.7.3-10 show the flammable vapor dispersion clouds would not extend beyond the plant property line when taking into account the plant geometry and other features using FLACS.

Staff's analysis found that the flammable vapor dispersion distance for scenario MR-13H, as calculated by PHAST without consideration of the 26.5 foot storm surge wall, would actually be 1,267 feet, with 3 m/s wind, rather than the 1,167 feet listed by Venture Global Calcasieu Pass and shown in table 4.12.7.3-1. This distance would extend beyond the property line by less than 100 feet. However, this PHAST result would be comparable to the PHAST result for scenario MR-11, which has a higher mass flow rate for the same hole size and was also modeled in FLACS from the same plant location with consideration of the 26.5 foot storm surge wall. This FLACS modeling demonstrated that flammable vapor from scenario MR-11 would remain onsite as shown in figures 4.12.7.3-9 and 4.12.7.3-10 below, and therefore, staff believes the flammable vapor from scenario MR-13H would also be expected to comparably remain onsite when accounting for the storm surge wall.

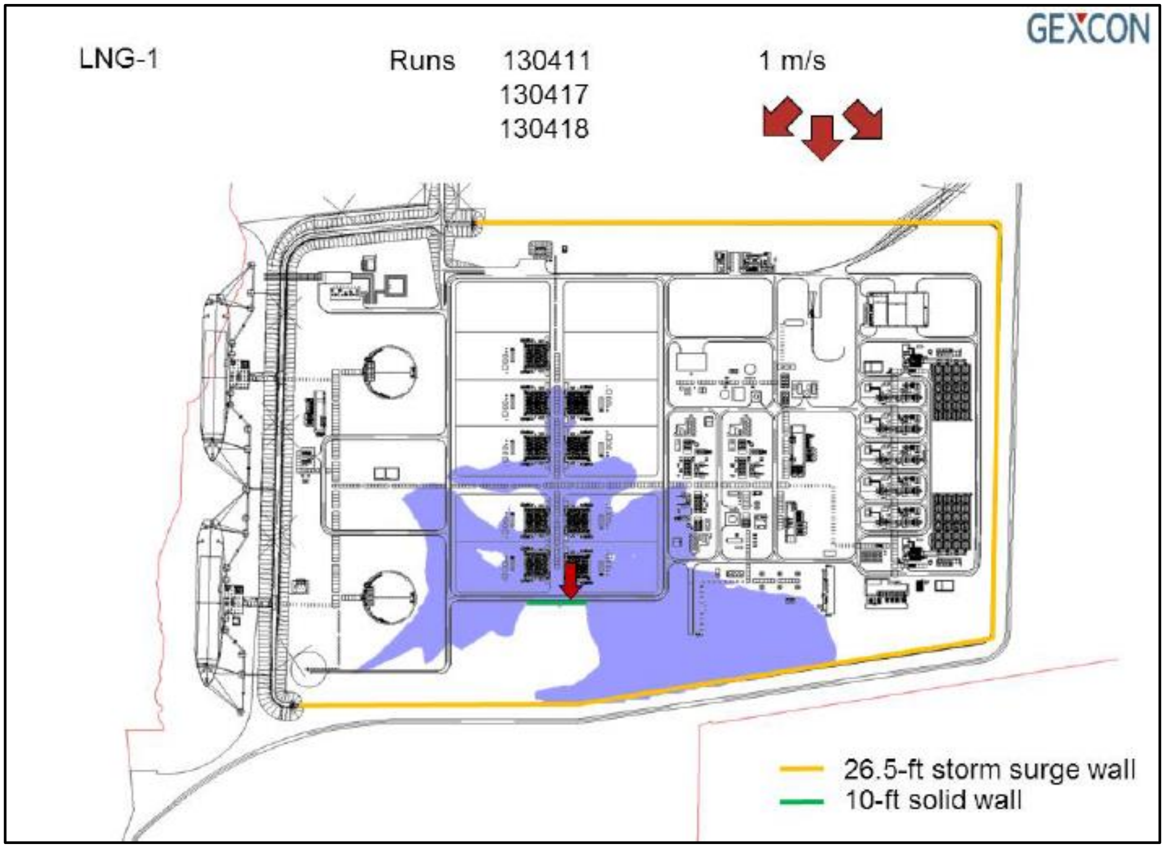

Figure 4.12.7.3-4 Maximum Flammable Vapor Dispersion from Scenario LNG-1 with Release at Liquefaction Train 2 *(using a model uncertainty factor of two – red line is the property line)*

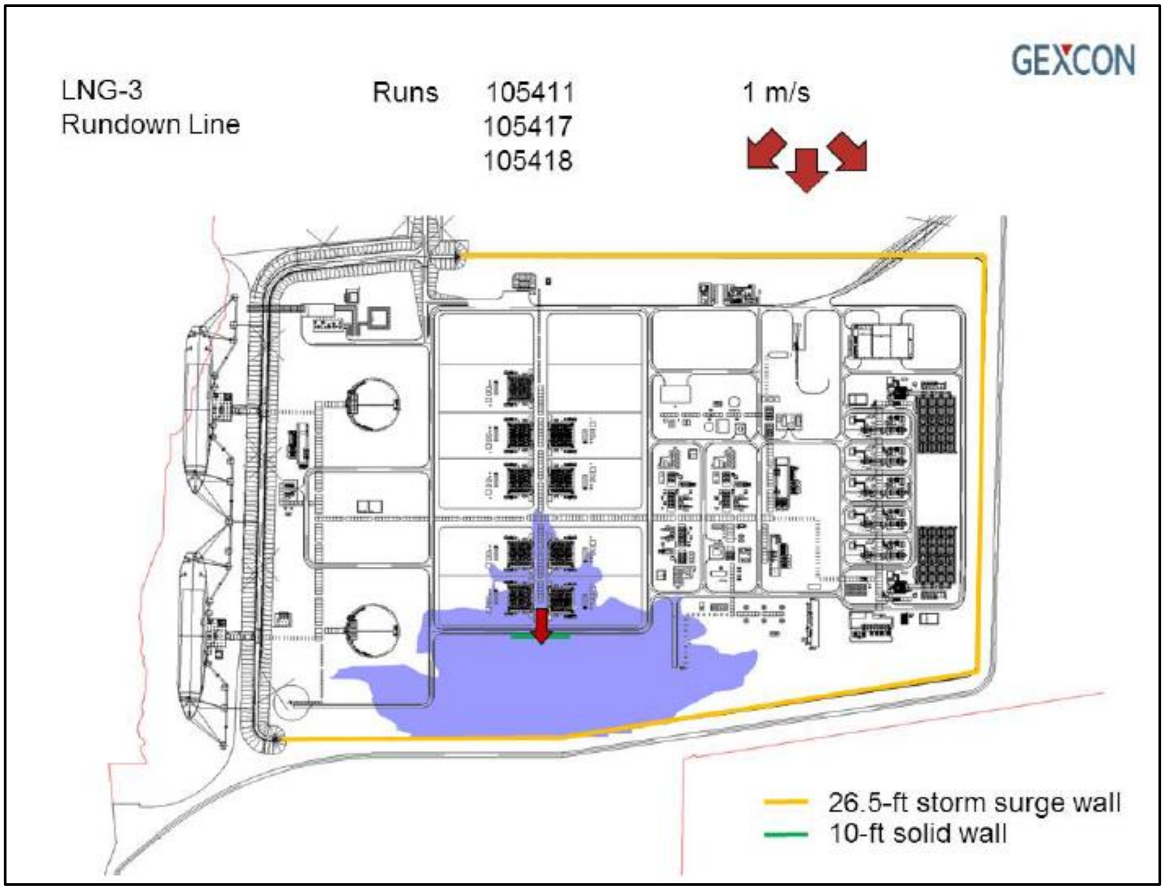

Figure 4.12.7.3-5 Maximum Flammable Vapor Dispersion from Scenario LNG-3 with Release at the Rundown Line *(using a model uncertainty factor of two – red line is the property line)*

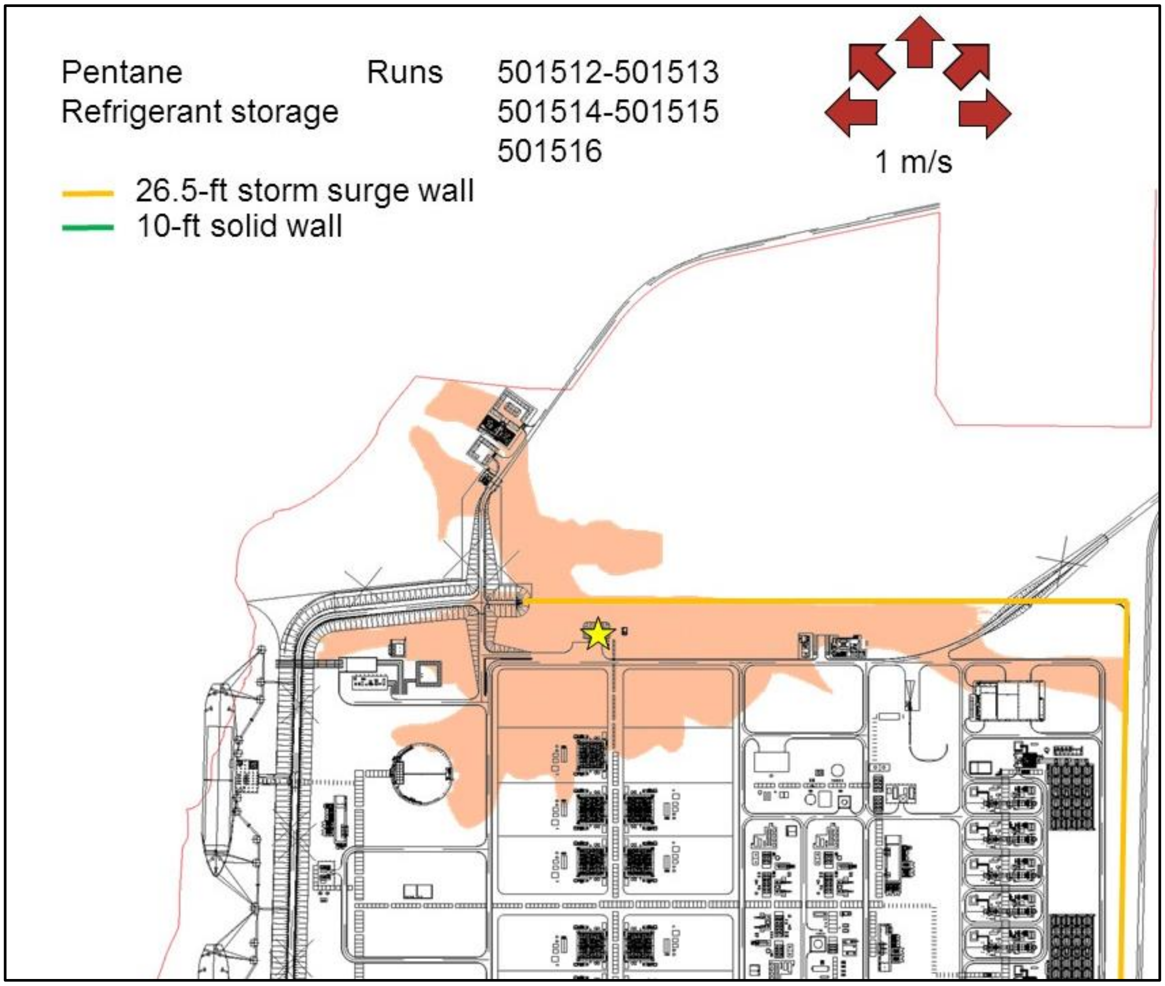

Figure 4.12.7.3-6 Maximum Flammable Vapor Dispersion from Scenario PEN-3 in the Vertically Upward Orientation at the Refrigerant Storage Area *(using a model uncertainty factor of two – red line is the property line)*

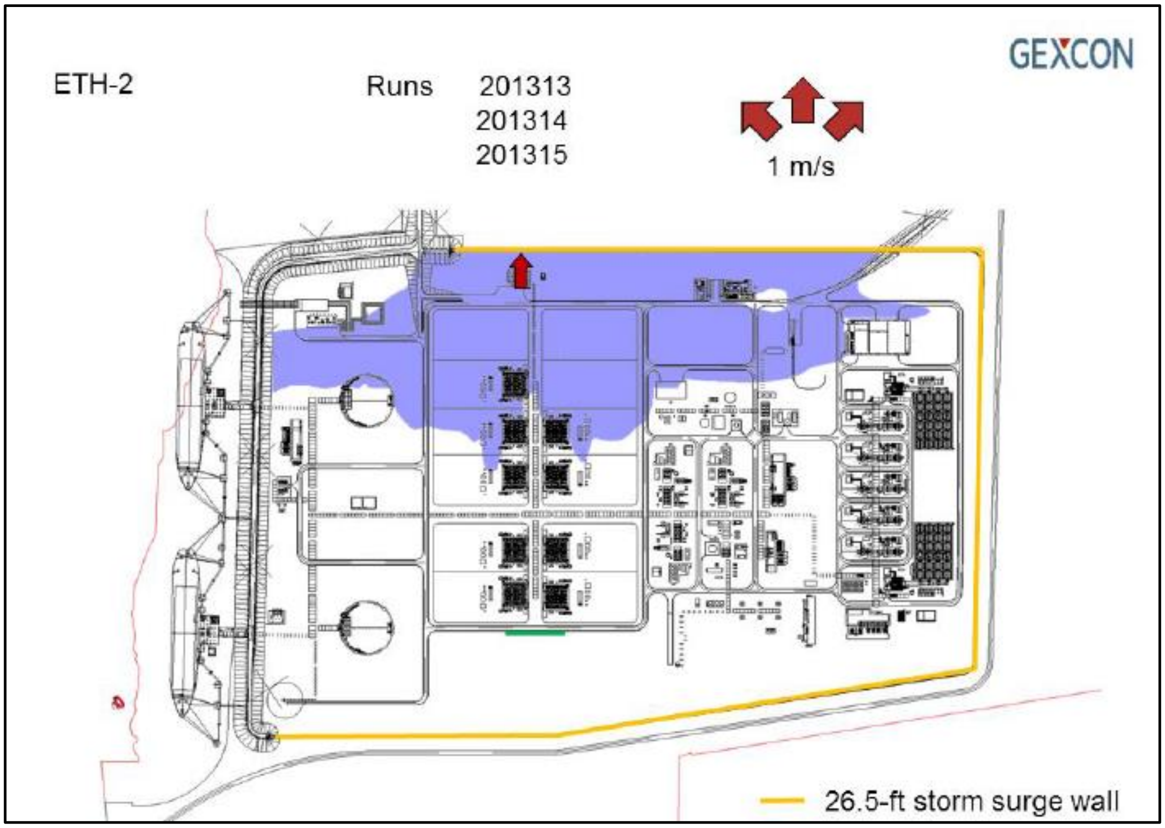

Figure 4.12.7.3-7 Maximum Flammable Vapor Dispersion from Scenario ETH-2 at the Refrigerant Storage Area with 1 m/s wind *(using a model uncertainty factor of two – red line is the property line)*

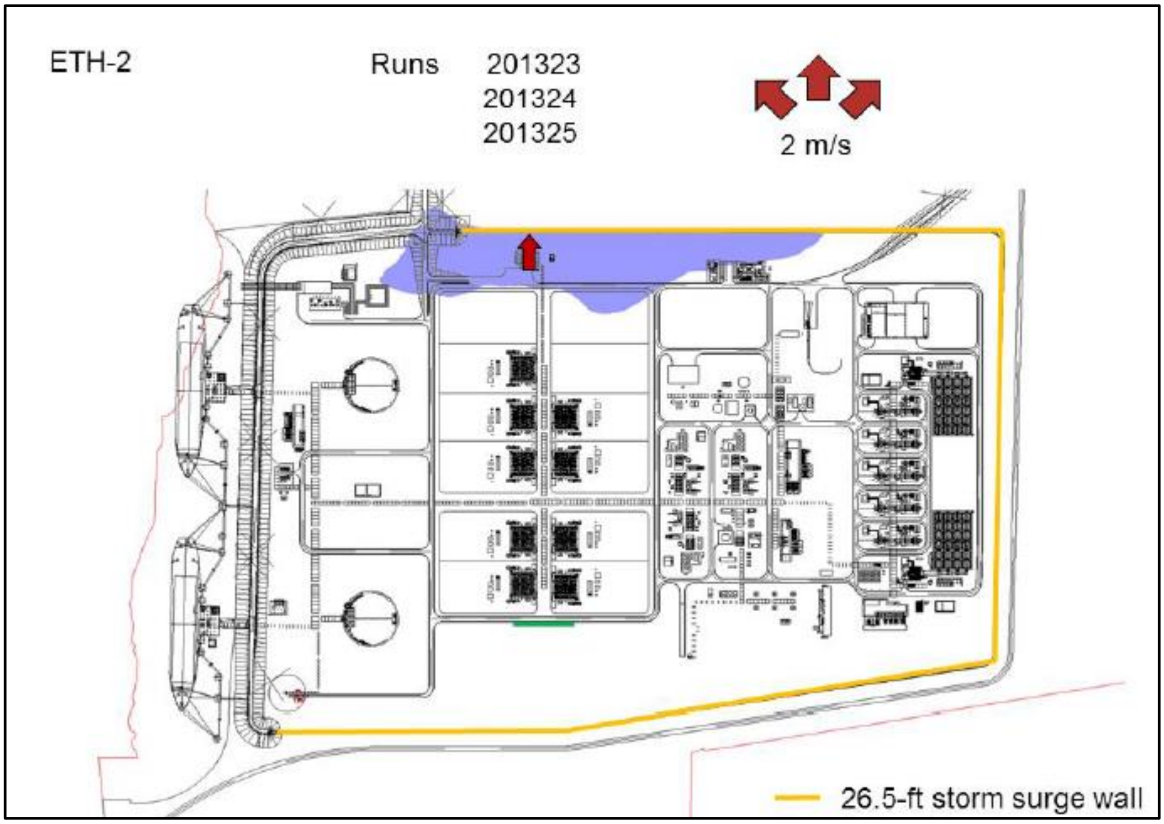

Figure 4.12.7.3-8 Maximum Flammable Vapor Dispersion from Scenario ETH-2 at Refrigerant Storage Area with 2 m/s wind *(using a model uncertainty factor of two – red line is the property line)*

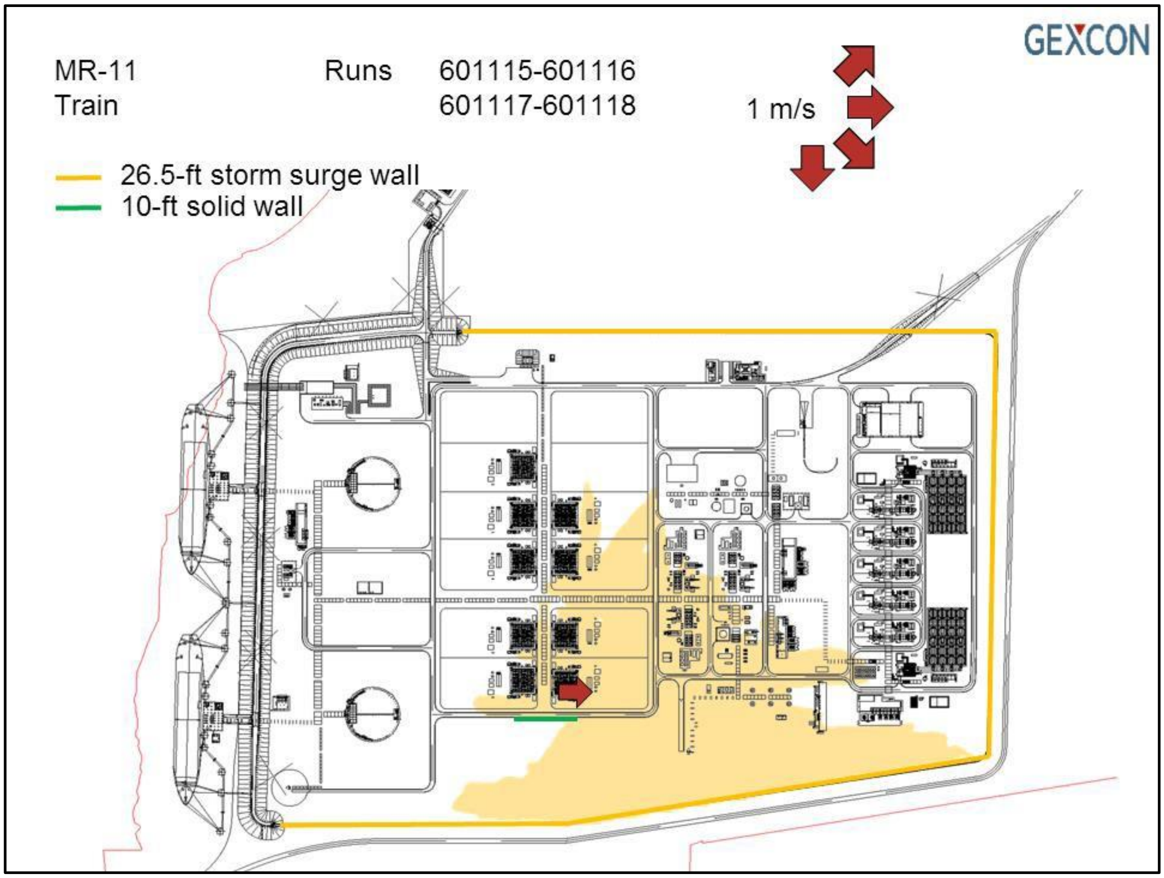

Figure 4.12.7.3-9 Maximum Flammable Vapor Dispersion from Scenario MR-11 with Release to the East at the Southern End of Train 2 *(using a model uncertainty factor of two – red line is the property line)*

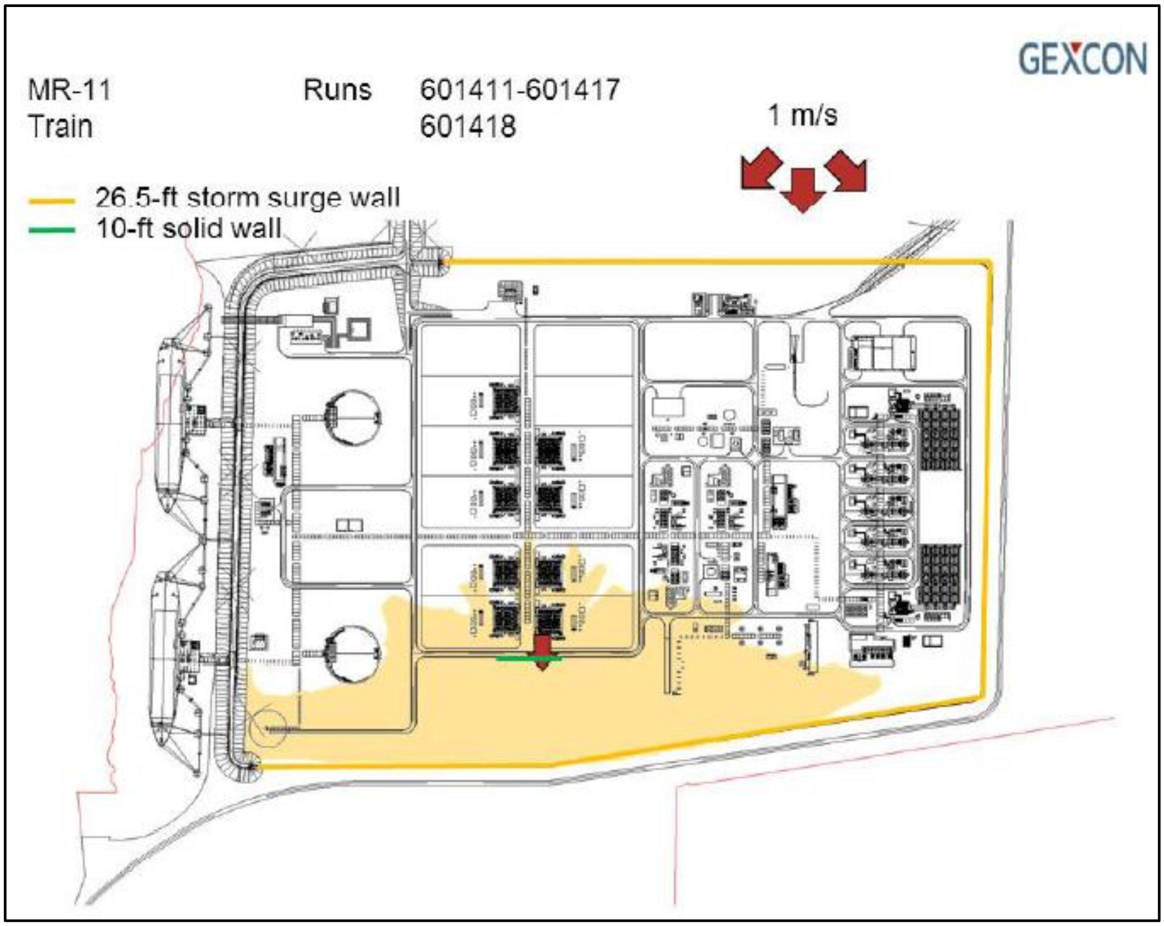

Figure 4.12.7.3-10 Maximum Flammable Vapor Dispersion from Scenario MR-11 with Release to the South at the Southern End of Train 2
(using a model uncertainty factor of two – red line is the property line)

Based on the analysis presented in this section, we conclude that the siting of the proposed Terminal, with respect to flammable vapor dispersion, would not cause a significant impact on public safety or reliability. If the facility is constructed and operated, compliance with the requirements of 49 CFR Part 193 would be addressed as part of the DOT's inspection and enforcement program.

4.12.7.4 Toxic and Asphyxiant Dispersion Analysis

As discussed in section 4.12.3, a release of condensate, aqueous ammonia, propane, or acid gas may form a toxic cloud. To address these hazards, 49 CFR §193.2051 requires siting provisions in accordance with applicable sections of NFPA 59A (2001 edition). NFPA 59A, section 2.1.1 requires that factors applicable to the specific site with a bearing on the safety of plant personnel and surrounding public be considered, including an evaluation of potential incidents and safety measures incorporated into the design or operation of the facility. Taken together, Part 193 and NFPA 59A (2001 edition) require that potential incidents (e.g., toxic releases) must be considered.

For the LNG vapor dispersion analysis, 49 CFR §193.2059 requires that dispersion distances be calculated for a 2.5 percent average gas concentration (one-half the LFL) under meteorological conditions that result in the longest downwind distances at least 90 percent of the time. Alternatively, maximum downwind distances may be estimated for stability Class F, a wind speed of 4.5 mph, 50 percent relative humidity, and the average regional temperature. Similar uncertainty factors (e.g., one-half the AEGL of toxic materials) and similar relative humidity and temperatures and a parametric analysis of wind speed and stability were used to model the dispersion from toxic fluid releases.

For each of the three AEGLs discussed in section 4.12.3, Venture Global Calcasieu Pass evaluated gaseous releases using a 10 minute exposure time because the gaseous toxic cloud would disperse after that duration. The model averaging time was also set to the exposure time.

As discussed in section 4.12.3, the AEGL-2 would be the expected limit of potential irreversible impacts to the general public, including susceptible individuals, for the exposure time. Venture Global Calcasieu Pass calculated distances to all three AEGLs using the half-AEGL values as the endpoints in order to account for uncertainty in the model. The increased distance to the half-AEGL provides better confidence that the actual maximum distance to the AEGL during a release event would be within the calculated distance.

The design spill releases, as discussed in the "Design Spills" section that were analyzed by Venture Global Calcasieu Pass for toxic and asphyxiant dispersion are described below.

Acid Gases – hydrogen sulfide (H_2S)

As discussed in section 4.12.2, acid gas, containing hydrogen sulfide, is removed from the feed via an amine-based solvent solution in an absorber column. The acid gas design spill releases that were analyzed by Venture Global Calcasieu Pass for toxic dispersion are listed in table 4.12.7.4-1 below. These scenarios represent the bounding acid gas leakage sources in the acid gas service area.

TABLE 4.12.7.4-1

ACID GAS DESIGN RELEASES

Service	Toxic Components	Scenario#	Line Size *(inch)*	Single Accidental Leakage Source *(inch)*
Acid Gas	H_2S	5	24	2.0
Acid Gas	H_2S	7	28	2.0
Acid Gas	H_2S	9	28	9.3

Each acid gas release was modeled in PHAST in both the horizontal and vertically downward orientations. As shown in table 4.12.7.4-2 below, the dispersion results indicate that these releases would not produce an AEGL-2 or AEGL-3 H_2S hazard. Figure 4.12.7.4-1, further below, depicts the farthest distances that the AEGL-1 would potentially extend, based on the wind speed range for the site. AEGL-1 concentrations are associated with temporary and reversible effects, and none of the AEGL-1 H_2S levels would reach beyond the property line.

TABLE 4.12.7.4-2 MAXIMUM DISTANCES TO H_2S AEGLS FOR ACID GAS DESIGN RELEASES (USING A MODEL UNCERTAINTY FACTOR OF TWO)		
Scenario #	AEGL Level	Distance *(feet)*
H_2S-5	AEGL-1	322
	AEGL-2	No Hazard
	AEGL-3	No Hazard
H_2S-7	AEGL-1	463
	AEGL-2	No Hazard
	AEGL-3	No Hazard
H_2S-9	AEGL-1	791
	AEGL-2	No Hazard
	AEGL-3	No Hazard

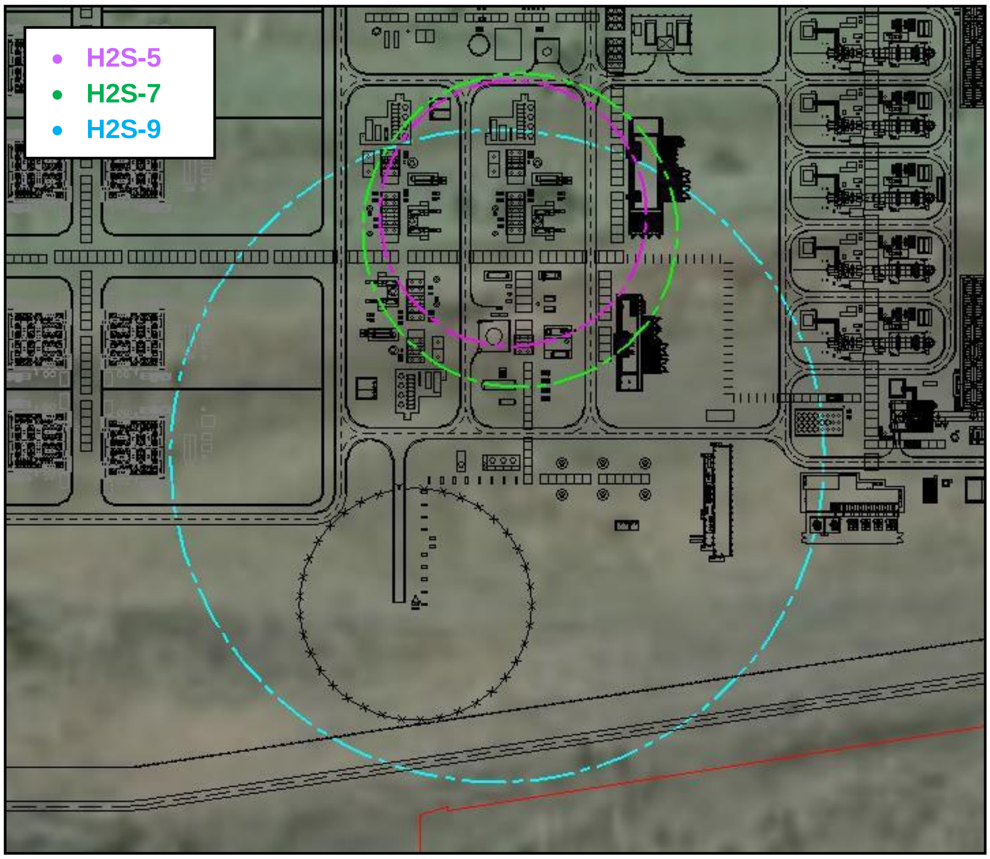

Figure 4.12.7.4-1 Maximum Distances to the H_2S AEGL-1 for Acid Gas Design Releases
(using a model uncertainty factor of two – red line is the property line)

Condensate (NGL)

Toxic components such as benzene, toluene, and xylene, as well as hexane, propane, butane, and mercaptans would be present in the condensate.

The CGA P-20 Standard for Classification of Toxic Gas Mixtures (2009 edition) provides a method for calculating the summation of more than one toxic component within a mixture. Venture Global Calcasieu Pass used this method to consider the total toxic load of components within the condensate mixtures. The calculated AEGL concentrations for these mixtures are presented in table 4.12.7.4-3.

The maximum distances to the AEGL concentrations for the most significant condensate scenarios, as modeled in PHAST and considering 1 to 7 m/s winds, are presented in table 4.12.7.4-3 below. While the AEGL-2 and -3 distances modeled in PHAST would remain onsite, the AEGL-1 distances would extend offsite, but the toxicity effects associated with AEGL-1 concentrations are non-disabling and reversible. The company indicates that the AEGL-1 zones would also remain outside of sensitive areas, such as those containing schools and hospitals. In addition, we have recommended that Venture Global Calcasieu Pass develop emergency response plans with federal, state, and local agencies that includes procedures for notifying residents and recreational users within areas of potential hazard including, but not limited to, the calculated AEGL dispersion zones.

TABLE 4.12.7.4-3

MAXIMUM DISTANCES TO CONDENSATE AEGLs
(USING A MODEL UNCERTAINTY FACTOR OF TWO)

Scenario	Bounding Hole Size *(inches)*	AEGL Level	Concentration of Interest *(ppm)*	Distance *(feet)*
NGL-3 (Near Debutanizer)	2.0	AEGL-1	1,251	4,532
		AEGL-2	5,242	646
		AEGL-3	16,402	132
NGL-3a	3.0	AEGL-1	1,251	5,698
		AEGL-2	5,242	See FLACS results
		AEGL-3	16,402	No Hazard
NGL-3b	4.0	AEGL-1	1,251	6,396
		AEGL-2	5,242	See FLACS results
		AEGL-3	16,402	455
NGL-3H	2.0	AEGL-1	1,251	4,111
		AEGL-2	5,242	797
		AEGL-3	16,402	No Hazard
NGL-5A	2.0	AEGL-1	1,161	5,997
		AEGL-2	5,204	See FLACS results
		AEGL-3	16,431	469

Venture Global Calcasieu Pass used FLACS to model the maximum AEGL-2 dispersion distances for the NGL-3, the 3-inch and 4-inch hole sizes (NGL-3a and NGL-3b, respectively), and NGL-5A scenarios to account for the 26.5 foot tall storm surge wall. Figures 4.12.7.4-2 through 4.12.7.4-6 show the most significant dispersion modeling results for these scenarios.

Figure 4.12.7.4-4 shows that the maximum dispersion results to a dose equal to a 10 minute exposure to the AEGL-2 for scenario NGL-5A would go beyond the property line to the south by approximately 475 feet and over a relatively small area. However, Venture Global Calcasieu Pass appears to have modeled the flow rate from a 3-inch diameter scenario, which is larger than the 2-inch pipe for scenario NGL-5A. It is not clear whether the maximum AEGL-2 dispersion distance from this 2-inch scenario would actually extend offsite. In addition, Figure 4.12.7.4-5 shows a disconnected portion of a dispersion cloud within a similar offsite distance for scenario NGL-3a with 2 m/s wind. FERC staff review of the FLACS hazard modeling input and output files was not able to reproduce the figure provided by Venture Global using 3D cut planes or isocontours. Nonetheless, Venture Global Calcasieu Pass indicates that both of these offsite AEGL-2 dispersion areas would be over land owned by the state of Louisiana, and these areas do not contain any buildings, structures, or assembly areas. In addition, Venture Global Calcasieu Pass indicates that, in the event that an incident would be large enough to have an off-site excursion of a half AEGL-2 concentration, visual and audible alarms would be present at the facility, which would warn anyone who would be near the facility. Further, for the AEGL dispersion zones that could go beyond the property line, we included a recommendation in section 4.12.5 for Venture Global Calcasieu Pass to develop an ERP that would include procedures for notifying residents and recreational users within these areas of potential hazard. For these reasons, we conclude that this dispersion would not expected to represent a significant impact to public safety.

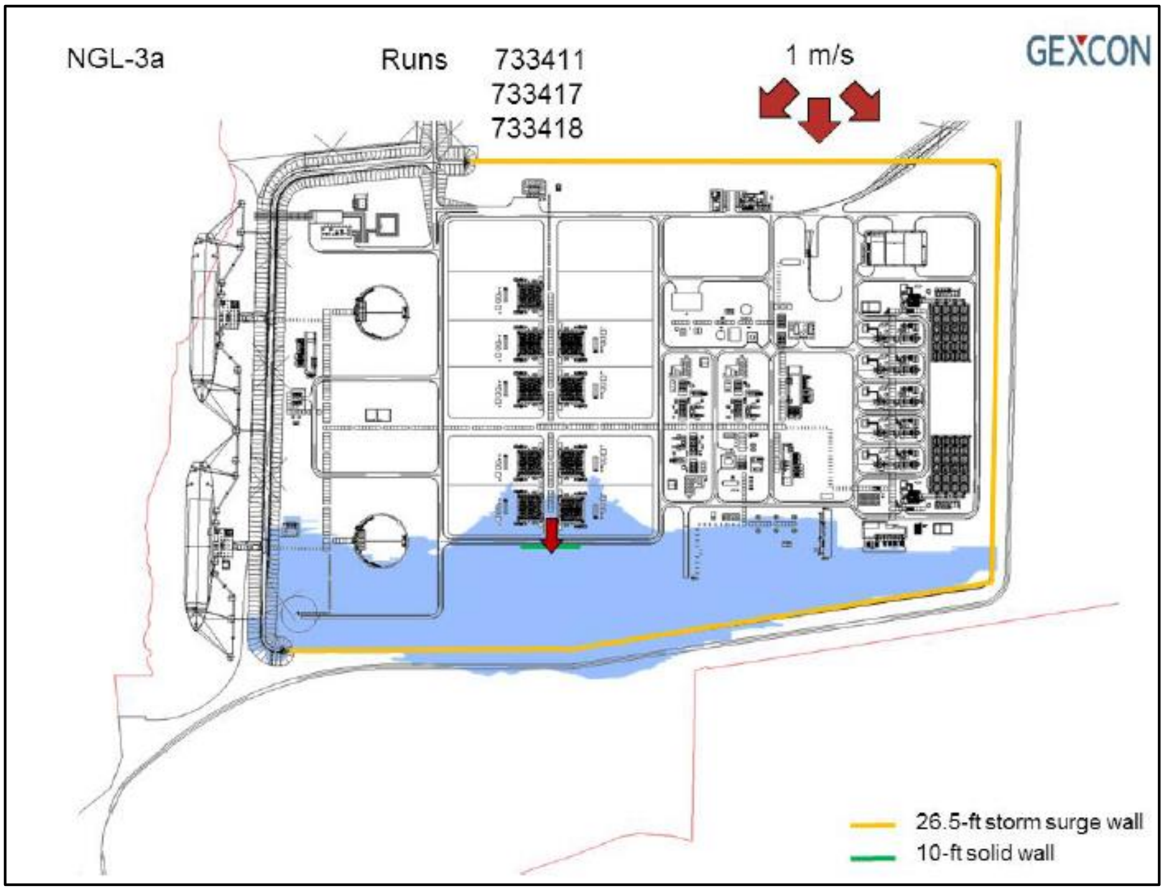

Figure 4.12.7.4-2 Maximum Distance to the Dose Equal to a 10 Minute Exposure to the AEGL-2 for Scenario NGL-3a with 1 m/s Wind *(using a model uncertainty factor of two – thin red line is the property line)*

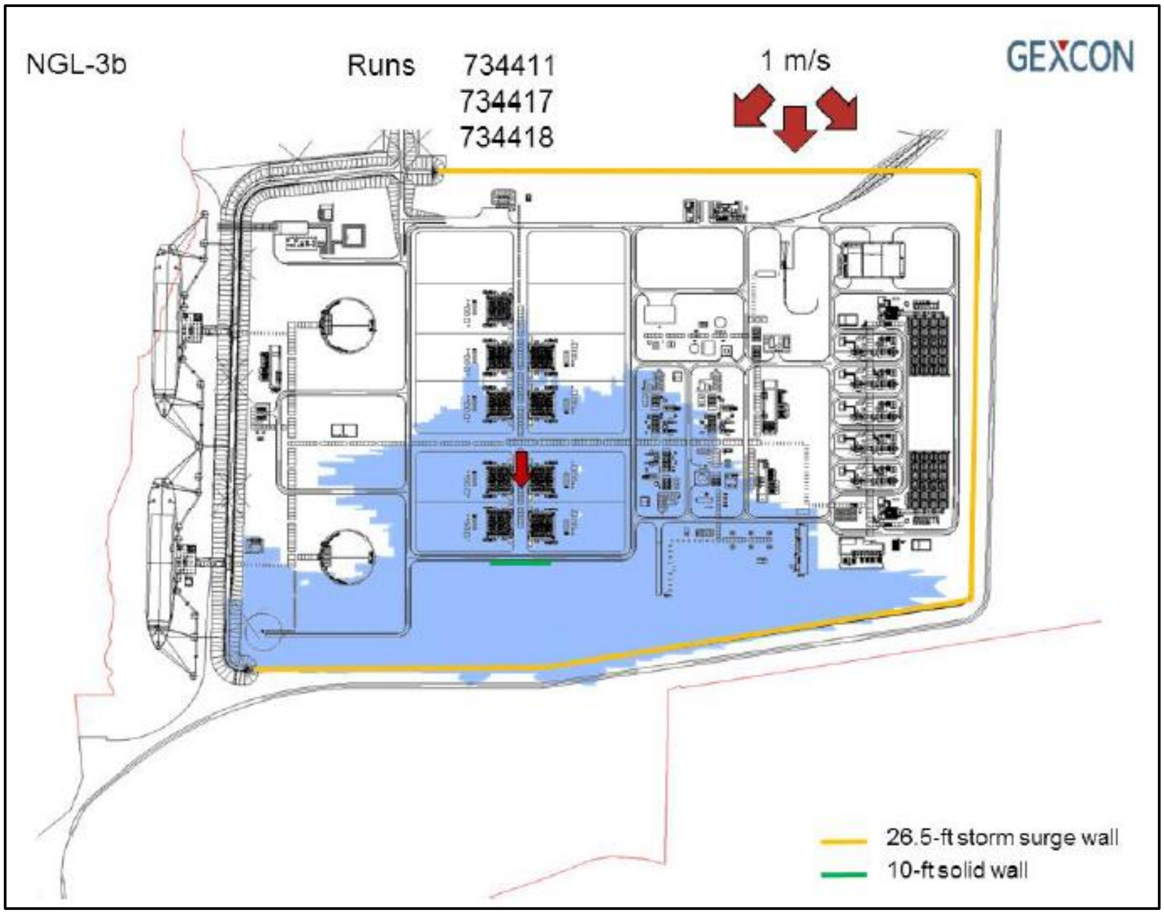

Figure 4.12.7.4-3 Maximum Distance to the Dose Equal to a 10 Minute Exposure to the AEGL-2 for Scenario NGL-3b *(using a model uncertainty factor of two – thin red line is the property line)*

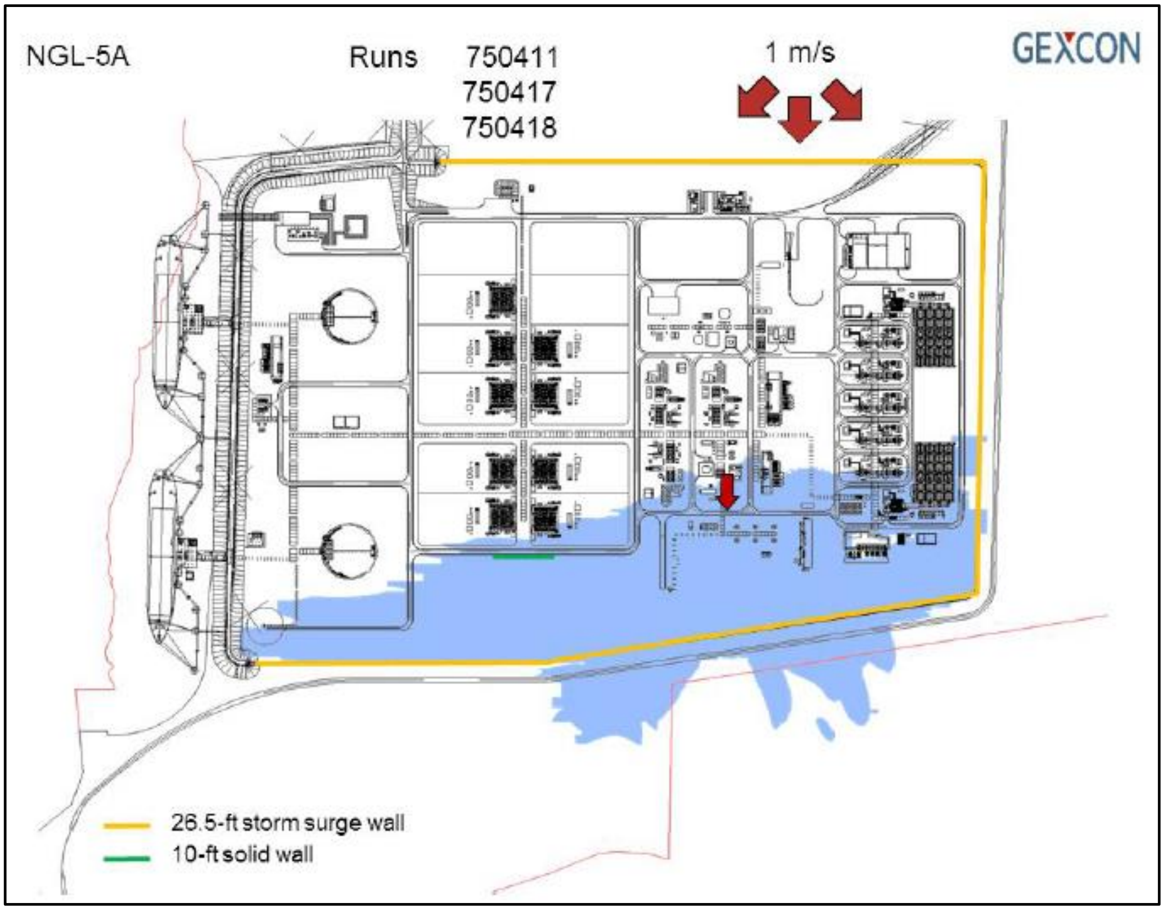

Figure 4.12.7.4-4 Maximum Distance to the Dose Equal to a 10 Minute Exposure to the AEGL-2 for Scenario NGL-5A *(using a model uncertainty factor of two for a three-inch diameter hole, which is larger than the proposed 2-inch pipe – thin red line is the property line)*

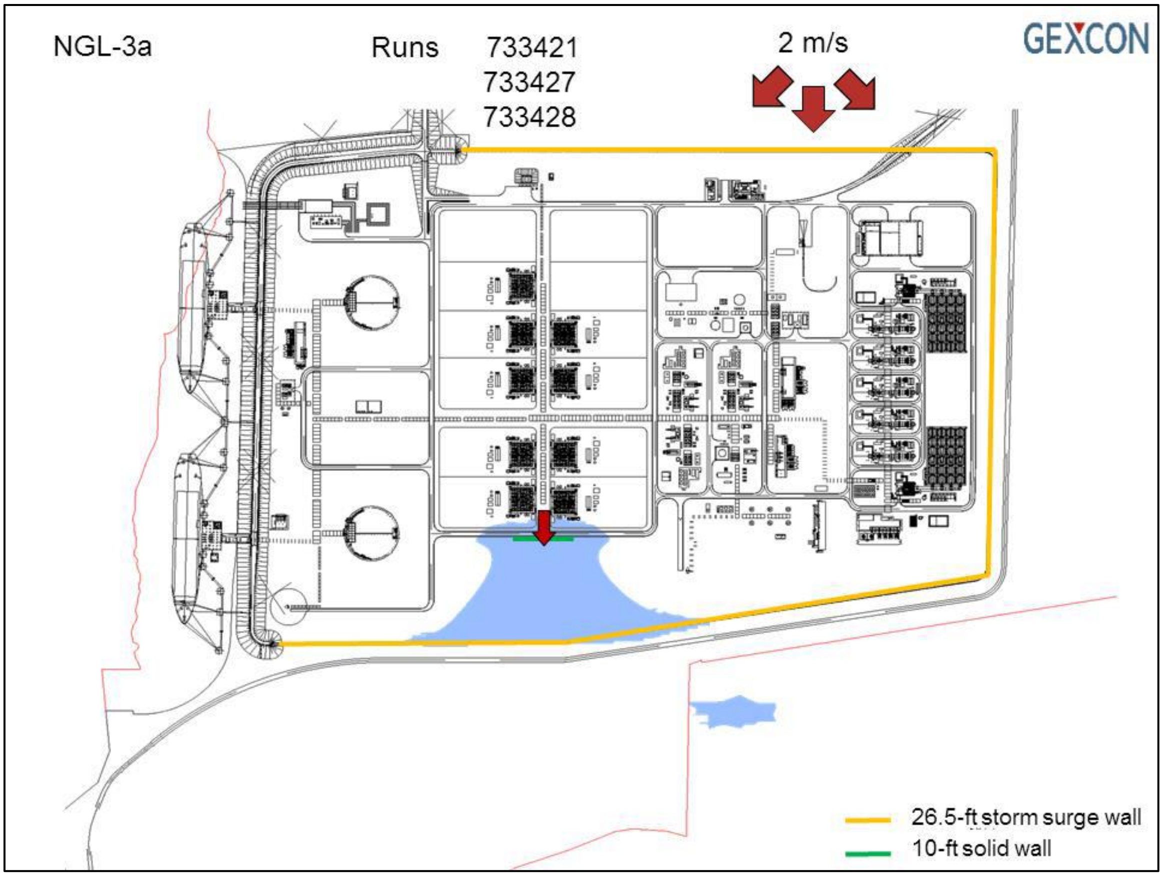

Figure 4.12.7.4-5 Maximum Distance to the Dose Equal to a 10 Minute Exposure to the AEGL-2 for Scenario NGL-3a with 2 m/s Wind *(using a model uncertainty factor of two – thin red line is the property*

Propane

Venture Global Calcasieu Pass also performed a toxic dispersion analysis for the propane design spills, PRO-1 and PRO-2 (Vessel), from table 4.12.7.3-1. The company used similar assumptions as the other toxic modeling cases, including consideration of the half AEGL concentrations to account for a model uncertainty factor of two. These propane scenarios were modeled with a release location in the refrigerant storage area, north of the liquefaction area, and the PHAST dispersion distances are presented in table 4.12.7.4-4. For scenario PRO-1, Venture Global Calcasieu Pass modeled the maximum distance to the AEGL-2 level in FLACS in order to account for the 26.5 foot storm surge wall. This result is presented in figure 4.12.7.4-6.

While the AEGL-2 and -3 distances for scenarios PRO-1 and PRO-2 (Vessel) would remain onsite, the AEGL-1 distances would extend offsite, but the toxicity effects associated with AEGL-1 concentrations are non-disabling and reversible. The company indicates that the AEGL-1 zones would also remain outside of sensitive areas, such as those containing schools and hospitals. In addition, we have recommended that Venture Global Calcasieu Pass develop emergency response plans with federal, state, and local agencies that includes procedures for notifying residents and recreational users within areas of potential hazard including, but not limited to, the calculated AEGL dispersion zones.

TABLE 4.12.7.4-4

MAXIMUM DISTANCES TO PROPANE SCENARIO AEGLS
(USING A MODEL UNCERTAINTY FACTOR OF TWO)

Scenario #	AEGL Level	Distance *(feet)*
PRO-1	AEGL-1	2,132
	AEGL-2	See FLACS results
	AEGL-3	703
PRO-2 (Vessel)	AEGL-1	1,429
	AEGL-2	900
	AEGL-3	425

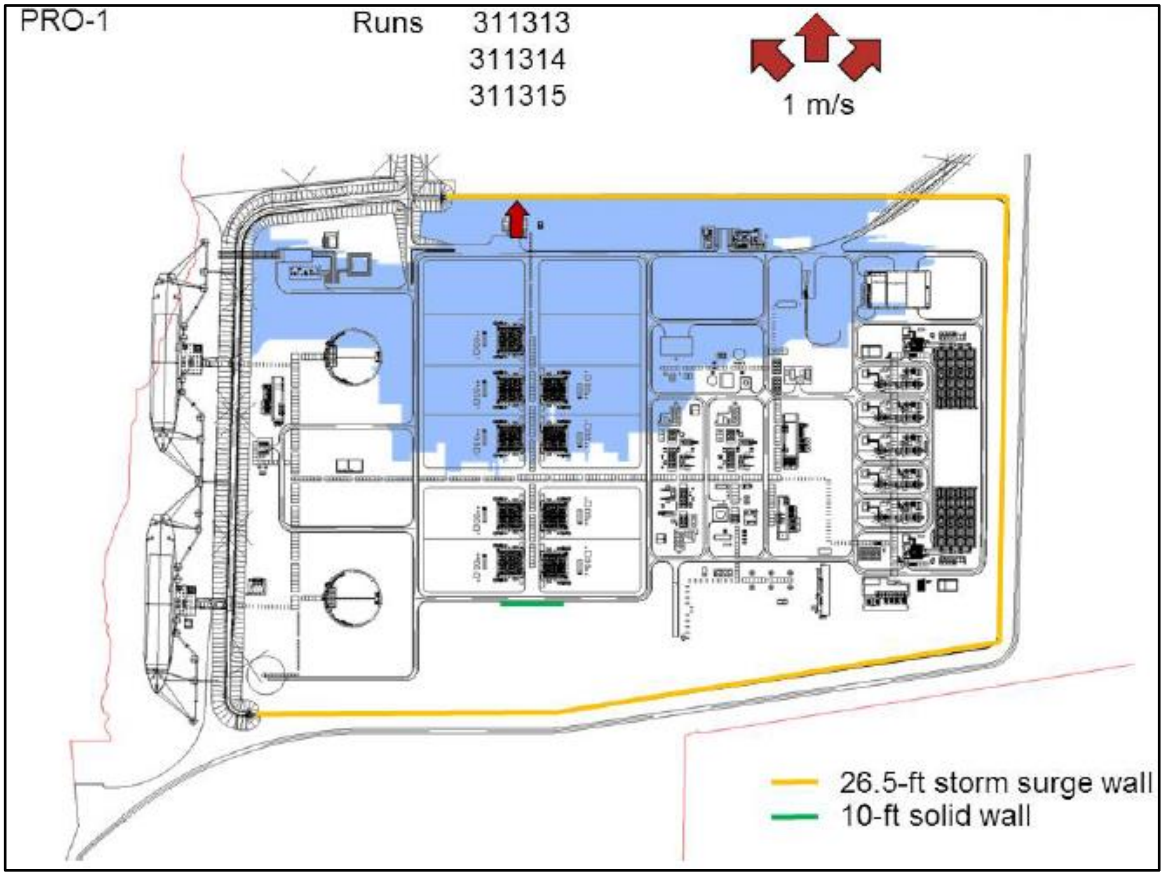

Figure 4.12.7.4-6 Maximum Distance to the Dose Equal to a 10 Minute Exposure to the Propane AEGL-2 for Scenario PRO-1 (*as calculated in FLACS with a model uncertainty factor of two – thin red line is the property line)*

Aqueous Ammonia

Venture Global Calcasieu Pass used PHAST to calculate the half AEGL-1, -2, and -3 distances for a horizontal release of aqueous ammonia scenarios AM-1 as the maximum dispersion distances for the toxic AEGL concentrations. Venture Global conducted PHAST and FLACS modeling of the aqueous ammonia using a variety of source terms, wind speeds, and exposure durations. The results indicate the AEGL-2 and AEGL-3 toxic vapors would remain onsite, but the AEGL-1 toxic vapors would extend offsite. However, the toxicity effects associated with AEGL-1 concentrations are non-disabling and reversible and we have recommended that Venture Global Calcasieu Pass develop emergency response plans with federal, state, and local agencies that includes procedures for notifying residents and recreational users within areas of potential hazard including, but not limited to, the calculated AEGL dispersion zones.

Nitrogen

In addition to considering toxic effects, Venture Global Calcasieu Pass evaluated the need for oxygen sensors near the liquid nitrogen storage area to protect operators from a localized asphyxiation hazard. The company used PHAST modeling to show the extent of 19.5 percent-vol, 16 percent-vol, and 12.5 percent-vol oxygen concentrations due to a 2-inch-diameter nitrogen leakage source release in the liquid nitrogen storage area. These concentration levels are based on values from the U.S. Department of Labor, Occupational Safety and Health Administration's (OSHA), *Respiratory Protection Standard*[53], which states that any atmosphere with a concentration below 19.5 percent oxygen by volume, air is considered oxygen-deficient and would cause impaired thinking or coordination. Concentrations of 12.5 percent to 16 percent oxygen by volume causes tachypnea (increased breathing rates), tachycardia (accelerated heartbeat), impaired attention, thinking, and coordination, even in people who are resting. Oxygen levels less than 12.5 percent could result in death.

Venture Global Calcasieu Pass provided PHAST dispersion for this 2-inch nitrogen leakage source, using an uncertainty factor of two, which indicated that the maximum distance to the 19.5 percent oxygen concentration would be 406 feet at 7 m/s winds, with no hazard distance predicted by PHAST for the 16 percent and 12.5 percent oxygen concentrations. This distance would remain within the plant property line and would not extend over occupied buildings onsite. Further, Venture Global Calcasieu Pass has indicated it would provide two oxygen sensors near the nitrogen storage tank.

Based on the analysis presented in this section, we conclude that the siting of the proposed Terminal, with respect to toxic and asphyxiant dispersion, would not have a significant impact on public safety. If the facility is constructed and operated, compliance with the requirements of 49 CFR Part 193 would be addressed as part of DOT's inspection and enforcement program.

4.12.7.5 Vapor Cloud Overpressure Considerations

As discussed in section 4.12.3, the propensity of a vapor cloud to detonate or produce damaging overpressures is influenced by the reactivity of the material, the level of confinement and congestion surrounding and within the vapor cloud, and the flame travel distance. It is possible that the prevailing wind direction may cause the vapor cloud to travel into a partially confined or congested area. Section 2.1.1 of NFPA 59A (2001 edition), as adopted by 49 CFR Part 193, requires consideration of factors applicable to the specific site with a bearing on the safety of plant personnel and the surrounding public.

LNG Vapor Cloud Explosions

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

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[53] U.S. Department of Labor, Occupational Safety and Health Administration, *Respiratory Protection Standard*, 63 Fed. Reg. 1152 – 1300, Jan. 1998, (https://www.osha.gov/laws-regs/federalregister/1998-01-08).

Additional tests were conducted to study the influence of confinement and congestion on the propensity of a vapor cloud to detonate or produce damaging overpressures. The tests used obstacles to create a partially confined and turbulent scenario but found that flame speeds developed for methane were not significantly higher than the unconfined case and were not in the range associated with detonations.

To examine the potential for detonation of an unconfined natural gas cloud containing heavier hydrocarbons that are more reactive, such as ethane and propane, the USCG conducted further tests on ambient-temperature fuel mixtures of methane-ethane and methane-propane. Explosive charges were used as ignition sources for these tests. For the vapor clouds containing from 86 to 96 percent methane in near stoichiometric proportions, the USCG indicated that the overpressures produced during those tests were the same overpressures produced by the ignition source alone. However, the USCG found that less processed natural gas with greater amounts of heavier hydrocarbons and less methane would be more sensitive to detonation.

Although it has been possible to produce damaging overpressures and detonations of unconfined LNG vapor clouds, the proposed terminal would be designed to receive feed gas with methane concentrations as low as 90.7 percent, which are not in the range shown to exhibit overpressures and flame speeds associated with high-order explosions and detonations in excess of the initiating charge. The substantial amount of initiating explosives needed to create the shock initiation during the limited range of ignitable vapor-air concentrations also renders the possibility of detonation of these vapors at an LNG plant as unrealistic.

Ignition of a confined LNG vapor cloud could result in higher overpressures. In order to prevent such an occurrence, as discussed in section 4.12.4, Venture Global Calcasieu Pass would take measures to prevent flammable vapor dispersion and ignition in confined areas, such as buildings and fired equipment, and we included a recommendation in section 4.12.5 for our review and approval of the final design details.

Vapor Cloud Explosions from Other Hazardous Fluids

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

Venture Global Calcasieu Pass used the Baker-Strehlow-Tang (BST) Explosion Model in PHAST (v6.7) to estimate the distances to the 1 psi overpressure threshold resulting from the mixed refrigerants, ethylene, propane, pentane and natural gas liquids design spill dispersion scenarios. Other scenarios were not considered for hazard modeling because they would be bounded by the scenarios modeled due to either lower reactivity, lower levels of congestion or confinement, or farther distances from the property line. Venture Global Calcasieu Pass assumed a medium obstacle density in the liquefaction blocks, which appear to provide the only large areas of significant congestion. The company’s PHAST overpressure modeling results, reported in the following table, would not extend beyond the terminal property line, and the full-containment tank outer concrete wall would not be expected to be significantly impacted by the resulting overpressures. In addition, Venture Global Calcasieu Pass provided FLACS overpressure modeling for scenarios MR-11, MR-13H, and ETH-2 that took into account plant geometry and congestion and the wind speed range for the site. These FLACS scenario results are discussed below and presented in table 4.12.7.5-1.

TABLE 4.12.7.5-1

MAXIMUM DISTANCE TO 1 PSI OVERPRESSURE HAZARD AREA

Scenario	Overpressure Scenario	Maximum Distance to 1 psi *(feet)*
MR-4F	Liquefaction Area Dispersion	686
MR-7	Liquefaction Area Dispersion	283
MR-11	Stoichiometric Fill of Liquefaction Block	See FLACS results
MR-13H	Stoichiometric Fill of Liquefaction Block	See FLACS results
PRO-1 and 2	Stoichiometric Fill of Liquefaction Block	1,029
ETH-1	Liquefaction Area Dispersion	Bounded by ETH-2
ETH-2	Liquefaction Area Dispersion	See FLACS results
PEN-1 and 3	Stoichiometric Fill of Liquefaction Block	1,032
NGL-1	Liquefaction Area Dispersion	809
NGL-3	Stoichiometric Fill of Liquefaction Block	961
NGL-5A	Stoichiometric Fill of Liquefaction Block	1,040

For the overpressure scenarios modeled in FLACS, the half-psi was used as the endpoint to account for a model uncertainty factor of two. The composition of both of the large mixed refrigerant scenarios, MR-11 and MR-13H, were modeled as a stoichiometric vapor/air mixture in the entire volume of the liquefaction block. The ETH-2 dispersion scenario was evaluated in more detail to determine the most significant amount of flammable vapor that would occur in a liquefaction block. An equivalent stoichiometric cloud was determined using a Q9 mapping method, which converts realistic inhomogeneous vapor clouds from the dispersion simulations into ideal homogeneous stoichiometric clouds by taking into account that both the reactivity of a mixture and its gas expansion ratio are functions of the local stoichiometry. Ignition of the equivalent stoichiometric volume was modeled in FLACS to demonstrate the potential overpressure from a liquefaction block.

Figures 4.12.7.5-1, 4.12.7.5-2, and 4.12.7.5-3 show that maximum distance to the 1 psig overpressure hazard due to the MR and ethylene scenarios considered from the liquefaction block nearest to the property line would not extend beyond the plant property line to the south. In addition, because the liquefaction train blocks and scenarios would be identical, the hazard zone from other liquefaction blocks would be similar and would not be expected to significantly impact the full-containment LNG tank outer walls. Venture Global Calcasieu Pass indicates that any occupied buildings, LNG storage tanks and critical equipment within areas indicated as subject to significant overpressures shall be designed to withstand such overpressure events.

The overpressure analyses were based on the preliminary information contained in the FEED submitted by Venture Global Calcasieu Pass. Piping and equipment arrangements may differ in final design, potentially resulting in increased congestion or confinement and an increase in the overpressure distance. Therefore, we included a recommendation in section 4.12.5 for Venture Global Calcasieu Pass to provide verification of the congestion or confinement represented in the FEED or provide revised overpressure calculations indicating that a 1 psi overpressure would not impact the public.

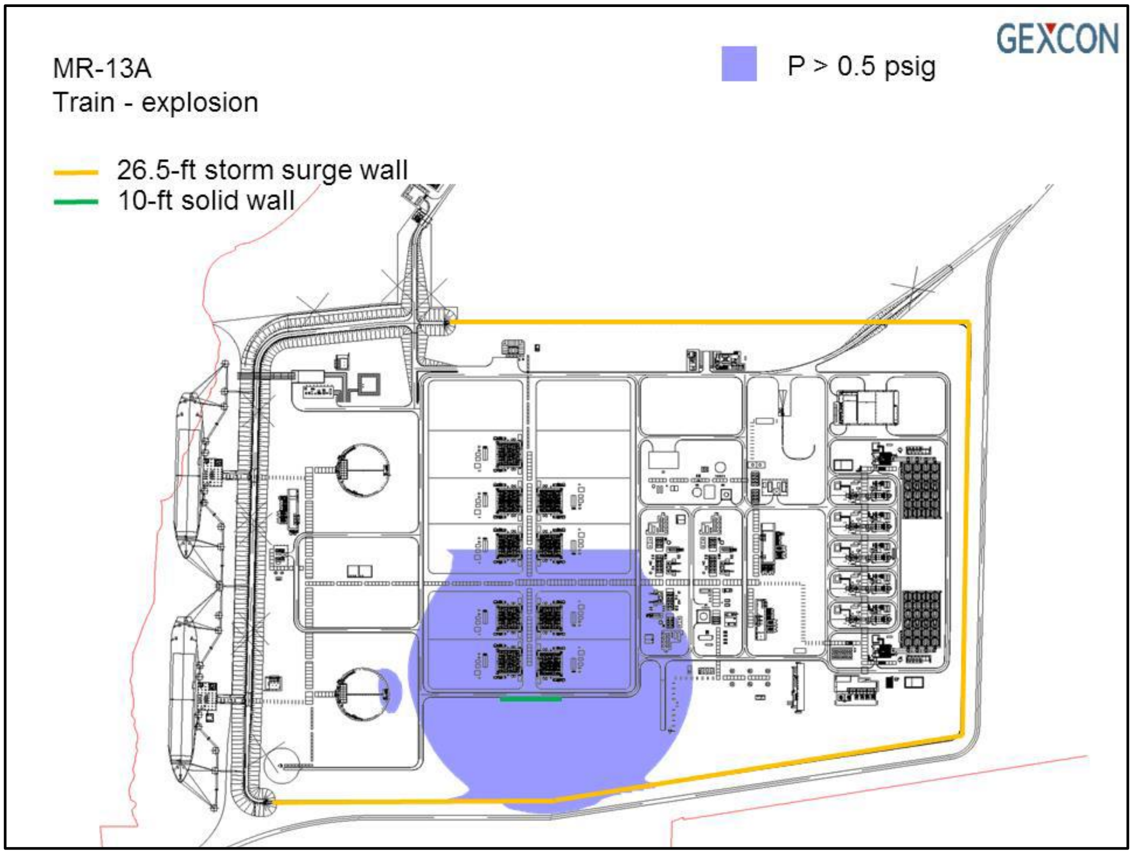

Figure 4.12.7.5-1 Maximum Footprint of the 1 psig Overpressure Hazard Area for MR-13H in Train 2
(*using a model uncertainty factor of two - thin red line is the property line)*

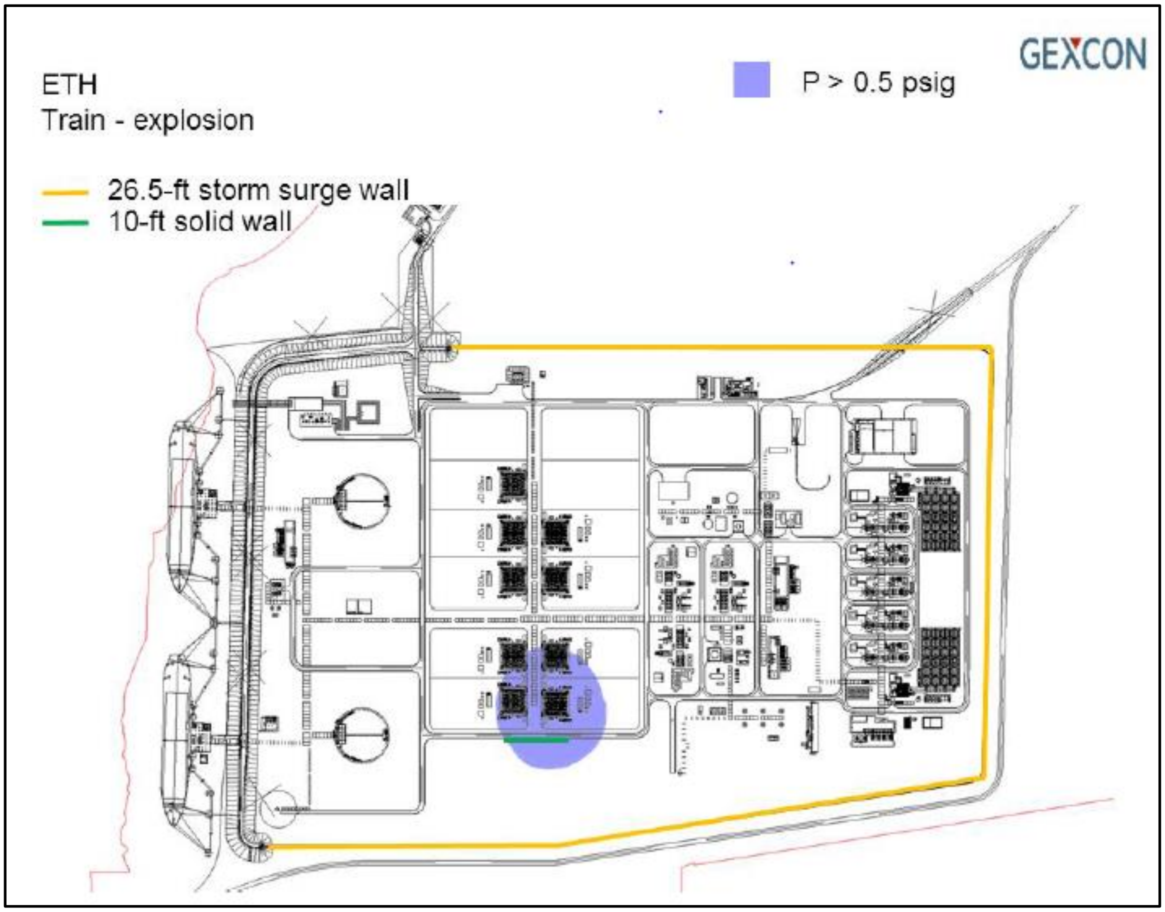

Figure 4.12.7.5-2 Maximum Footprint of the 1 psig Overpressure Hazard Area for Ethylene in Train 2
(using a model uncertainty factor of two – thin red line is the property line)

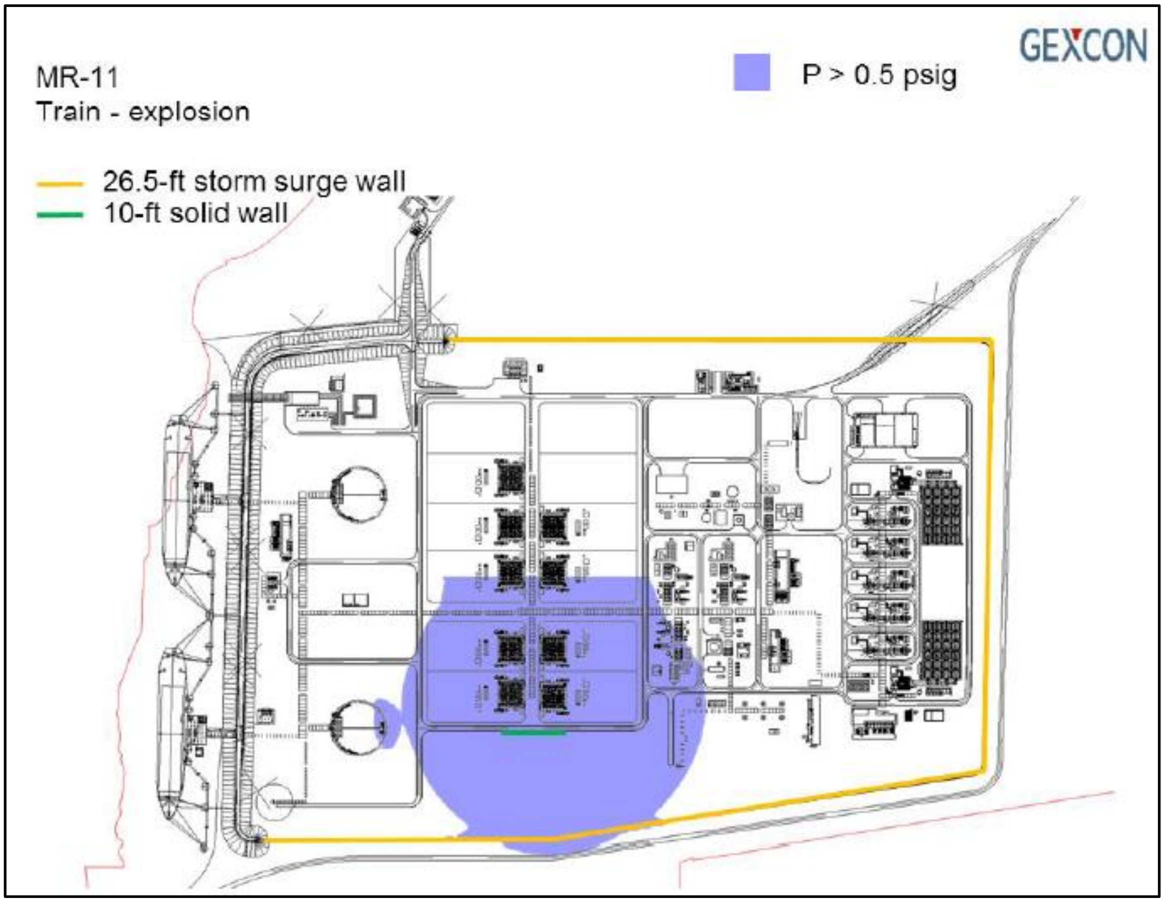

Figure 4.12.7.5-3 Maximum Footprint of 1 psig Overpressure Hazard Area for MR-11 in Train 2 *(using a model uncertainty factor of two – thin red line is the property line)*

Based on the analysis presented in this section, we conclude that the siting of the proposed Terminal facility, with respect to vapor cloud overpressures, would not cause a significant impact on public safety. If the facility is constructed and operated, compliance with the requirements of 49 CFR Part 193 would be addressed as part of the DOT's inspection and enforcement program.

4.12.7.6 Thermal Radiation Analysis

As discussed in section 4.12.3, if flammable vapors are ignited, the deflagration could propagate back to the spill source and result in a pool fire causing high levels of thermal radiation (i.e., heat from a fire). In order to address this, 49 CFR §193.2051 and §193.2057 require evaluation of thermal radiation hazards of potential incidents and exclusion zones in accordance with applicable sections of NFPA 59A (2001). Together, Part 193 and NFPA 59A (2001) specify different hazard endpoints for spills into LNG storage tank containment than for spills into impoundments for process or transfer areas. For LNG storage tank spills, there are three radiant heat flux levels which must be considered:

- 1,600 Btu/ft^2-hr - This level can extend beyond the plant property line that can be built upon but cannot include areas that, at the time of facility siting, are used for outdoor assembly by groups of 50 or more persons;

- 3,000 Btu/ft^2-hr - This level can extend beyond the plant property line that can be built upon but cannot include areas that, at the time of facility siting, contain assembly, educational, health care, detention or residential buildings or structures; and

- 10,000 Btu/ft^2-hr - This level cannot extend beyond the plant property line that can be built upon.

The requirements for spills from process or transfer areas are more stringent. For these impoundments, the 1,600 Btu/ft^2-hr flux level cannot extend beyond the plant property line onto a property that can be built upon. The 1,600 Btu/ft^2-hr flux level is associated with producing second degree burns in approximately 30-40 seconds, assuming no shielding from the pool fire. For distances farther away from the pool fire, the flux levels would be lower. Other potential incidents that could have a bearing on the safety of plant personnel or surrounding public are also required to be evaluated under NFPA 59A, section 2.1.1.

Part 193 requires the use of the LNGFIRE3 computer program model developed by the Gas Research Institute or other approved model to determine the thermal radiation distances. Part 193 also stipulates that the wind speed, ambient temperature, and relative humidity that produce the maximum exclusion distances must be used for LNG fires, except for conditions that occur less than 5 percent of the time based on recorded data for the area. Venture Global Calcasieu Pass selected the following ambient conditions to produce the maximum exclusion or hazard distances for all impoundment fires: wind speeds up to 19 mph, an ambient temperature of 45 °F; and a relative humidity of 29 percent. We agree with Venture Global Calcasieu Pass's selection of atmospheric conditions.

Venture Global Calcasieu Pass used LNGFIRE3 to predict the maximum distance to a thermal radiation level of 1,600 Btu/ft^2-hr for fires from all impoundments. Although LNGFIRE3 is specifically designed to calculate thermal radiation flux levels for LNG pool fires, LNGFIRE3 can also be used to provide conservative thermal radiation flux levels for other flammable hydrocarbons such as ethylene, propane, mixed refrigerant, condensate, and pentane.

LNGFIRE3 calculates thermal radiation flux using parameters that include the mass burning rate of the fuel and the surface emissive power (SEP) of the flame, which is an average value of the thermal radiation flux emitted by the fire. Both the mass burning rate and SEP of an ethylene, propane, pentane, mixed refrigerant, condensate, hot oil, or diesel fire would be less than that of an equally sized LNG fire. Since the thermal radiation from a pool fire is dependent on the mass burning rate and the SEP, the distances to specific thermal flux levels for propane, ethylene, pentane, mixed refrigerant, condensate, hot oil and diesel fires would not extend as far as the distances calculated for an LNG fire in the same sump.

The maximum distance calculated from a fire over the full surface area of each spill impoundment to the 1,600 Btu/ft^2-hr level is listed in table 4.12.7.6-1 below.

TABLE 4.12.7.6-1

THERMAL RADIATION FROM IMPOUNDMENTS

Impoundment	Distance from Center to 1,600 Btu/ft^2-hr *(feet)*
Discharge Holding Basin (127-M0006)	91
Discharge Holding Basin (127-M00011)	176
Discharge Holding Basin (127-M00021)	151
Discharge Holding Basin (127-M00041)	151
Diesel Storage Impoundment	307

As shown in figure 4.12.7.6-1 below, none of the thermal radiation zones would extend onto offsite property that could be built upon or used for assembly.

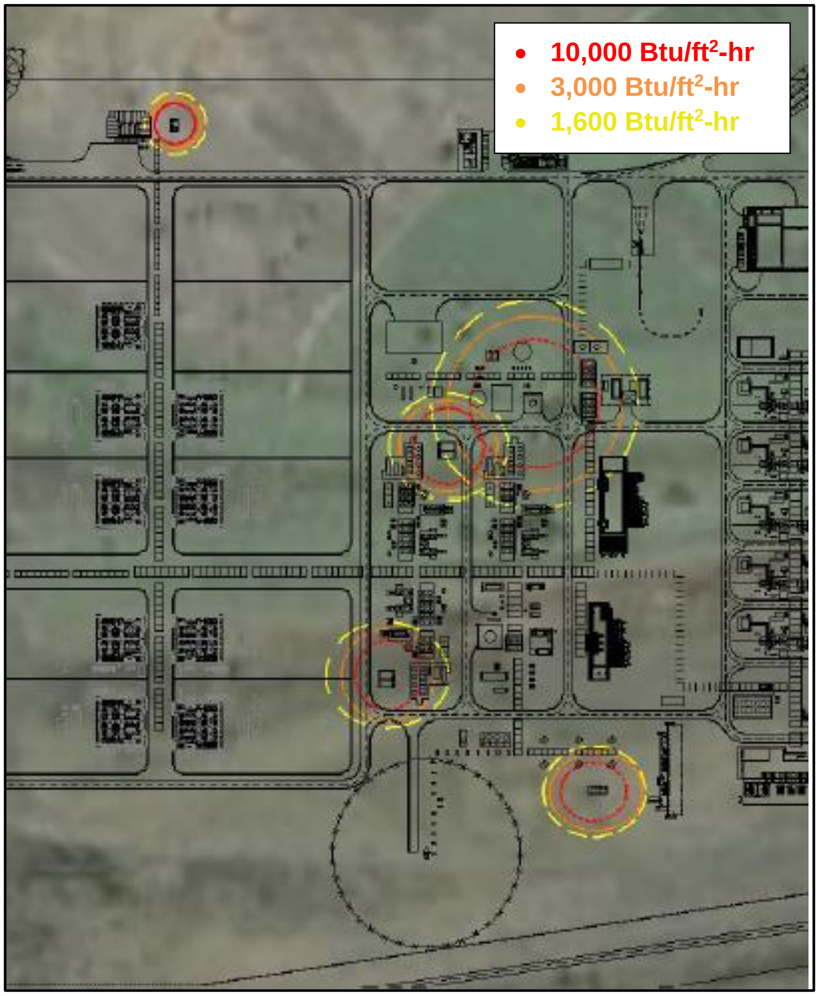

Figure 4.12.7.6-1 Thermal Radiation Isopleths from Impoundments

In their original application filed on September 4, 2015, Venture Global Calcasieu Pass stated the design would include two full-containment tanks. On July 14, 2016 Venture Global Calcasieu Pass submitted a revised design that changed the tank design from full-containment to single-containment tanks. In doing this, the 10,000 Btu/ft^2-hr and 3,000 Btu/ft^2-hr thermal flux levels from the LNG tank container impoundment extended over the LNG vessels at the loading berths. In consultation with PHMSA and the USCG, the FERC sent Venture Global Calcasieu Pass a letter on September 13, 2017 stating that the proposed siting layout and design of the single-containment tanks may not meet the DOT and USCG federal safety regulations promulgated in 49 CFR Part 193 and 33 CFR Part 127. The single-containment tank design and location could have posed a potential significant safety impact to the marine terminal, associated personnel, waterway users, and possible public with regard to the effects of an LNG storage tank fire onto one of the LNG vessels at the loading berth. Based on available heat impact information, the FERC, PHMSA, and USCG determined that thermal flux levels of over 4,900 Btu/ft^2-hr may have the potential to create a loss of strength in structural steel. In response to the September 13, 2017 letter, on October 13, 2017 Venture Global Calcasieu Pass filed a response stating the design of the LNG storage tanks would change back to full-containment tanks. This eliminated the concern of greater than 4,900 Btu/ft^2-hr thermal flux levels from the LNG tank container impoundment potentially extending over the LNG vessels at the loading berths. Below is the thermal radiation analysis for an LNG storage tank fire with a full-containment tank design.

In accordance with the thermal radiation siting regulations in §193.2057, Venture Global Calcasieu Pass also used LNGFIRE3 to predict the maximum distance to the three thermal radiation levels required for fires from the concrete outer tank walls that would serve as impoundment for the inner LNG storage tank. The concrete wall diameter of 294 feet was used as the pool diameter. The flame base height was set to the height of the concrete wall, 133 feet above the surrounding terrain, while target heights were set at the ground level. The results of this analysis are listed in table 4.12.7.6-2 below.

TABLE 4.12.7.6-2

THERMAL RADIATION FOR LNG STORAGE TANK AREA

Impoundment	Thermal flux level *(Btu/ft^2-hr)*	Distance from Center to Each Thermal Flux Level *(feet)*
LNG Storage Tank Outer Concrete Wall	10,000	390
LNG Storage Tank Outer Concrete Wall	4,900	677
LNG Storage Tank Outer Concrete Wall	3,000	828
LNG Storage Tank Outer Concrete Wall	1,600	1,062
Spill Impoundment Basin	1,600	327

As shown in figure 4.12.7.6-2 below, none of the thermal radiation zones would extend onto offsite property that could be built upon or used for assembly. Neither does the 4,900 Btu/ft^2-hr thermal flux level reach the LNG vessels at the loading berth.

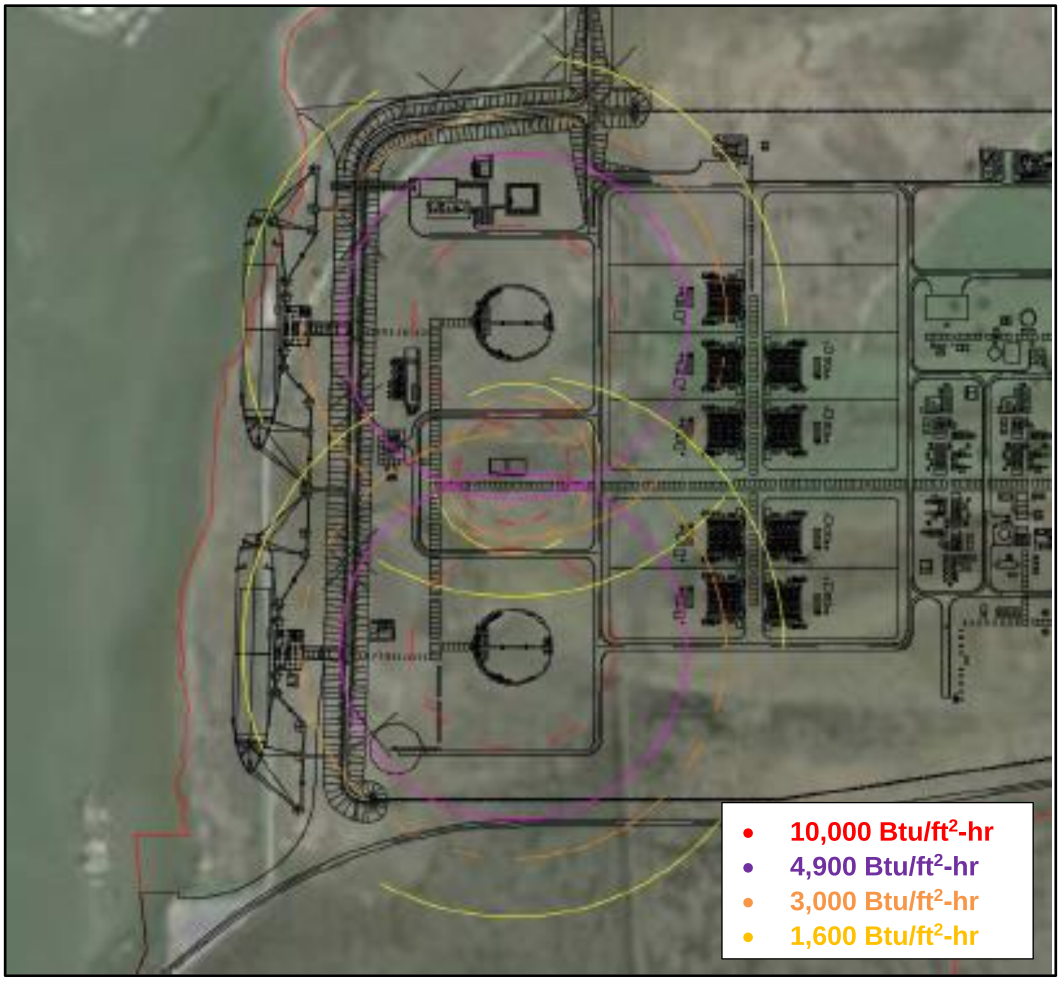

Figure 4.12.7.6-2 Thermal Radiation Isopleths from LNG Storage Tank Area

As a result of Staff's February 27, 2018 data request, Venture Global Calcasieu Pass provided new thermal radiation calculations for jet fires from the flammable design spills with wind speeds from 1 m/s to 7.7 m/s. Table 4.12.7.6-3 summarizes the jet fire thermal radiation distances to the 1,600 Btu/ft^2-hr, 3,000 Btu/ft^2-hr, and 10,000 Btu/ft^2-hr thermal flux levels for the design spill scenarios.

TABLE 4.12.7.6-3

THERMAL RADIATION FROM JET FIRES

Scenario #	Hole Size *(inch)*	1,600 Btu/ft^2-hr Distance *(feet)*	3,000 Btu/ft^2-hr Distance *(feet)*	10,000 Btu/ft^2-hr Distance *(feet)*
LNG-1	2	396	360	306
LNG-3	2	474	428	360
LNG-6	2	476	429	359
LNG-14C	4	840	736	555
MR-4E	2	259	192	66
MR-7	2	231	205	156
MR-11	2	519	451	356
MR-13H	3	356	263	151
PRO-1	3	600	534	442

TABLE 4.12.7.6-3 THERMAL RADIATION FROM JET FIRES				
Scenario #	Hole Size *(inch)*	1,600 Btu/ft^2-hr Distance *(feet)*	3,000 Btu/ft^2-hr Distance *(feet)*	10,000 Btu/ft^2-hr Distance *(feet)*
PRO-2 (Vessel)	2	427	381	317
PRO-2	2	57	Not Reached	Not Reached
ETH-1	3	603	543	457
ETH-2 (Vessel)	3	650	585	493
ETH-2	3	75	60	Not Reached
PEN-1	3	268	207	110
PEN-3 (Vessel)	3	351	271	146
PEN-4	1	139	120	88
NGL-1	3	650	583	489
NGL-3	3	703	623	512
NGL-5A	3	721	635	516

The 1,600 Btu/ft^2-hr, 3,000 Btu/ft^2-hr, and 10,000 Btu/ft^2-hr thermal flux levels would not reach a property line that could be built upon due to a jet fire from any of the design spill releases. Emergency shutdowns and blow down systems would be expected to reduce the duration and extent of jet fires and pressures within the vessels, so that the structural integrity of equipment and vessels at the site would not be significantly impacted by these scenarios.

Fires may also cause failures of nearby storage vessels, piping, and equipment. The failure of a pressurized vessel could cause fragments of material to fly through the air at high velocities, posing damage to surrounding structures and a hazard for operating staff, emergency personnel, or other individuals in proximity to the event. In addition, failure of a pressurized vessel when the liquid is at a temperature significantly above its normal boiling point could result in a BLEVE. BLEVEs can produce overpressures when the superheated liquid rapidly changes from a liquid to a vapor upon the release from the vessel. BLEVEs of flammable liquids can produce a subsequent fireball if they are ignited upon their release. Venture Global indicated that only the equipment within the 7,000 Btu/ft^2-hr zones from impoundment fires would be exposed to fluxes that have the potential to damage equipment. However, this may not consider the associated pressure rise within equipment, which could be a factor in the development of a BLEVE or pressure vessel burst, and may also not provide assurance that critical emergency equipment within high radiant heat zones would be functional. Other industry groups often consider impacts to equipment within the 3,000-4,000 Btu/ft^2-hr zones. While the refrigerant storage tanks for this Terminal would be mounded to prevent impacts from radiant heat, the Project would have other components within the 3,000-4,000 Btu/ft^2-hr zones from impoundment fires, such as pressure vessels. In order to ensure that thermal protection measures would be applied in a way that adequately protects all significant components from the impacts of a potential impoundment fire, we provided a recommendation in section 4.12.5 for an analysis of this to be filed for approval.

Based on the thermal radiation analysis presented in this section, we conclude that the siting of the proposed Terminal, with respect to thermal radiation, would not cause a significant impact on public safety. If the facilities are constructed and operated, compliance with the requirements of 49 CFR Part 193 would be addressed as part of the DOT's inspection and enforcement program.

4.12.8 LNG Marine Carriers

Since 1959, ships 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 more than 2,600 individual LNG carrier arrivals at terminals in the U.S. For more than 40 years, LNG shipping operations have been safely conducted in U.S. ports and waterways.

LNG from the proposed Terminal may be exported to any importing terminal throughout the world for which Venture Global has authorization to export.[54] There are 29 countries which have facilities to receive LNG: Argentina, Belgium, Brazil, Canada, Chile, China, Dominican Republic, England, France, Greece, India, Indonesia, Italy, Japan, Kuwait, Malaysia, Mexico, Netherlands, Portugal, Singapore, South Korea, Spain, Sweden, Taiwan, Thailand, Turkey, United Arab Emirates, United States, and Wales with another 9 planned or under construction: Albania, Croatia, Cyprus, Germany, Ireland, Lithuania, Pakistan, Philippines, and Poland.

4.12.8.1 Past LNG Vessel Incidents

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 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. The ship crew extinguished the fire and the ship 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.

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[54] Venture Global has authorization to export LNG to Free-Trade Agreements. Authorization to export LNG to Non-Free-Trade Agreement nations are subjected to DOE approval.

- **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 m^3 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 ships 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 vessel 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.

4.12.8.2 LNG Vessel Regulatory Oversight

The USCG exercises regulatory authority over LNG vessels under 46 CFR Part 154, which contains the United States safety standards for vessels carrying LNG in bulk. The USCG also enforces the safety standards of SOLAS and the IGC on US and foreign vessels. The LNG carriers visiting the proposed facility would also be constructed and operated in accordance with the International Maritime Organization (IMO) *Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)* and the *International Convention for the Safety of Life at Sea (SOLAS)*. 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 vessels) or a USCG Certificate of Compliance (for foreign flag vessels). These documents certify that the vessel is designed and operating in accordance with both international standards and the U.S. regulations for bulk LNG vessels under Title 46 CFR Part 154.

The LNG vessels which would transfer LNG to or from the proposed 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 2003. This code requires both ships and ports to conduct vulnerability assessments and to develop security plans. The purpose of the code is to prevent and suppress terrorism against ships; improve security aboard ships and ashore; and reduce the risk to passengers, crew, and port personnel on board ships and in port areas. All LNG vessels, as well as other cargo vessels 500 gross tons and larger, and ports servicing those regulated vessels, must adhere to the IMO standards. Some of the IMO requirements for ships are as follows:

- ships must develop security plans and have a Vessel Security Officer;
- ships must have a ship security alert system. These alarms transmit ship-to-shore security alerts identifying the ship, its location, and indication that the security of the ship is under threat or has been compromised;
- ships must have a comprehensive security plan for international port facilities, focusing on areas having direct contact with ships; and
- ships may have equipment onboard to help maintain or enhance the physical security of the ship.

In 2002, the Maritime Transportation Security Act (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 (ISPS)* 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 resulting USCG regulations, contained in 33 CFR Part 104, require vessels to conduct vulnerability assessments and develop corresponding security plans. All LNG vessels 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 USC Section 191); the Ports and Waterways Safety Act of 1972, as amended (33 USC Section 1221, et seq.); and the MTSA of 2002 (46 USC Section 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 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 Title 33 CFR Part 105.

The USCG regulations in 33 CFR Part 127 apply to the marine transfer area of waterfront facilities between the LNG vessel and the first manifold or valve located inside the containment. Title 33 CFR Part 127 regulates the design, construction, equipment, operations, inspections, maintenance, testing, personnel training, firefighting, and security of LNG waterfront facilities. The safety systems, including communications, emergency shutdown, gas detection, and fire protection, must comply with the regulations in 33 CFR Part 127. Under §127.019, Venture Global Calcasieu Pass 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 Part 127 and FERC regulations under 18 CFR §157.21, require an applicant who intends to build an LNG import facility to submit a Letter of Intent to the USCG at the same time the pre-filing process is initiated with the Commission.

In addition to the Letter of Intent, 33 CFR Part 127 and FERC regulations require each LNG project applicant to submit a WSA to the cognizant COTP no later than the start of the FERC pre-filing process. Until a facility begins operation, applicants must annually review their WSAs and submit a report to the COTP as to whether changes are required. The WSA must include the following information:

- port characterization;
- risk assessment for maritime safety and security;
- risk management strategies; and
- resource needs for maritime safety, security, and response.

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 Related to Waterfront Liquefied Natural Gas (LNG) Facilities* (NVIC 01-11) (NVIC, 2011).

As described in 33 CFR Part 127 and in NVIC 01-11, the applicant develops the WSA in two phases. The first phase is the submittal of the Preliminary WSA, which begins the USCG's review process to determine the suitability of the waterway for LNG marine traffic. The second phase is the submittal of the Follow-On WSA. This document is reviewed and validated by the USCG and forms the basis for the agency's recommendation to the FERC.

The Preliminary WSA provides an outline that characterizes the port community and the proposed facility and transit routes. It provides an overview of the expected major impacts LNG operations may have on the port, but does not contain detailed studies or conclusions. This document is used to start the USCG's scoping process for evaluating the suitability of the waterway for LNG marine traffic.

The Follow-On WSA must provide a detailed and accurate characterization of the LNG facility, the LNG tanker route, and the port area. The assessment should identify appropriate risk mitigation measures for credible security threats and safety hazards. 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 (federal, state, local, and private sector) needed to carry out those measures.

NVIC 01-11 directs the use of the three concentric Zones of Concern, based on LNG vessels with a cargo carrying capacity up to 265,000 m^3, used to assess the maritime safety and security risks of LNG marine traffic. The Zones of Concern are:

- <u>Zone 1</u> – 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/m^2 (12,000 Btu/ft^2-hr) from a pool fire.
- <u>Zone 2</u> – 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/m^2 (1,600 Btu/ft^2-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 LFL from a worst case un-ignited release. Impacts to 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 in the port.

As required by its regulations (33 CFR §127.009), the USCG is responsible for issuing a LOR to the 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 vessel'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 vessels 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 vessels 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.

4.12.8.3 Venture Global Calcasieu Pass's Waterway Suitability Assessment

In a letter to the USCG dated September 26, 2014, Venture Global Calcasieu Pass submitted a Letter of Intent and a Preliminary WSA to the COTP Port Arthur, Marine Safety Unit Lake Charles, to notify the USCG that it proposed to construct an LNG export facility. In the development of the Follow-On WSA, Venture Global Calcasieu Pass consulted with the USCG and other port stakeholders. As part of its assessment of the safety and security aspects of this Project, the COTP consulted various safety and security working groups and other federal, state, and local agencies. Venture Global Calcasieu Pass submitted the Follow-On WSA to the USCG on November 11, 2015.

4.12.8.4 LNG Vessel Routes and Hazard Analysis

Inbound LNG vessels with capacities between 120,000 and 210,000 m^3 would enter the southern entrance to the Calcasieu Pass Safety Fairway and would continue north within the limits of the Calcasieu Pass Safety Fairway to the entrance of the Calcasieu River Ship Channel located approximately 26 nautical miles offshore from Calcasieu Pass in the Gulf of Mexico.

In the northern portion of the Calcasieu Pass Safety Fairway, inbound LNG vessels would embark a Lake Charles Pilot and enter the Calcasieu River Ship Channel at the sea buoy. Larger LNG Q-Flex vessels (between 210,000 and 216,000 m3 capacity) and LNG vessels transiting the channel at night would require two Pilots at all times. From this point, the deep-draft LNG vessels would be confined to the Calcasieu River Ship Channel because of surrounding shallow water depths. LNG vessels would access the Terminal from the Gulf of Mexico through the existing 400-foot-wide navigation channel in the Calcasieu River Ship Channel.

In-bound LNG vessels would turn in the turning basin off the northwest corner of the Terminal site and be moored at the LNG berthing docks with their bows facing southwards toward the Gulf of Mexico. Loaded LNG vessels would transit outbound along the reverse route described for inbound ships.

Ship simulator testing was performed at the Maritime Pilot's Institute (MPI) in May 2015 on behalf of Venture Global Calcasieu Pass. The simulator was utilized to test the boundary conditions for safe operations for entry and departure of a Q-flex LNG vessel to and from the proposed facility. The tests conducted allowed the Pilots to understand the maneuvering limitations of this vessel in the proposed basin under high wind and current scenarios.

Prior to May 2015, preliminary LNG vessel simulations were conducted that indicated that the basin and docks needed to be redesigned to facilitate LNG vessel maneuvering under the current conditions forecast in the proposed basin area. The simulator database was re-modeled to reflect the new basin and dock design and the currents were re-programmed for the new basin geometry. The revised area was vetted by MPI staff prior to testing by the pilots, and subsequently incorporated into the design of the proposed Terminal.

Capt. George Mowbray and Capt. Dave Fath of the Lake Charles Pilots performed 23 simulations to determine the boundary environmental conditions considered safe for navigation for the proposed vessel class in this area. Maneuvering simulations addressed in river current as high as three knots and winds up to thirty knots. The simulations used up to four, seventy-five ton capable, tractor-assist tugs. In general, the pilots were able to safely maneuver the vessel and were able to define the upper limits of maneuverability for the proposed area. Generally, winds in excess of twenty knots and currents above two knots created large problems for the pilots. It is expected that a standard of care for wind and current will be in the range of 1.5 knots of current and 20 knots of wind for LNG operations at the proposed terminal.

NVIC 01-11 references the "Zones of Concern" for assisting in a risk assessment of the waterway. As LNG vessels proceed outbound along the intended track line, Hazard Zone 1 encompasses the entire area between the jetties within the Calcasieu River Ship Channel and approximately 100 m outside the channel on both sides of the jetties, including public boat launch immediately to the south of the site. No residences would be affected.

Hazard Zone 2 encompasses developed properties on the west side of the Calcasieu River Ship Channel, including AB Dock Services, and the Monkey Island Pilot's Dormitory at the southern tip of Monkey Island to the north. No other residences would be affected.

Hazard Zone 3 encompasses several commercial/business properties to the north and northeast of the site including Cameron Fisheries, Newport Drilling/Environmental Services, and a portion of the Omega Protein Inc. site to the north of AB Dock Services on the main channel. No additional residences would be affected.

Commercial vessels, recreational and fishing vessels may also fall within Zone 1, depending on their course. Transit of such vessels through a Zone 1 area of concern can be avoided by timing and course changes, if conditions permit. A Limited Access Area, in the form of a fixed security zone may be established at the discretion of the COTP for normal operations and will envelop the vessel as a normally moored LNG Vessel.

Figure 4.12.8.4-1 Accidental Hazard Zones Along LNG Vessel Route representing Zone 1 37.5kW/m2 (red), Zone 2 5kW/m2 (orange), and Zone 3 flammable vapor dispersion (blue)

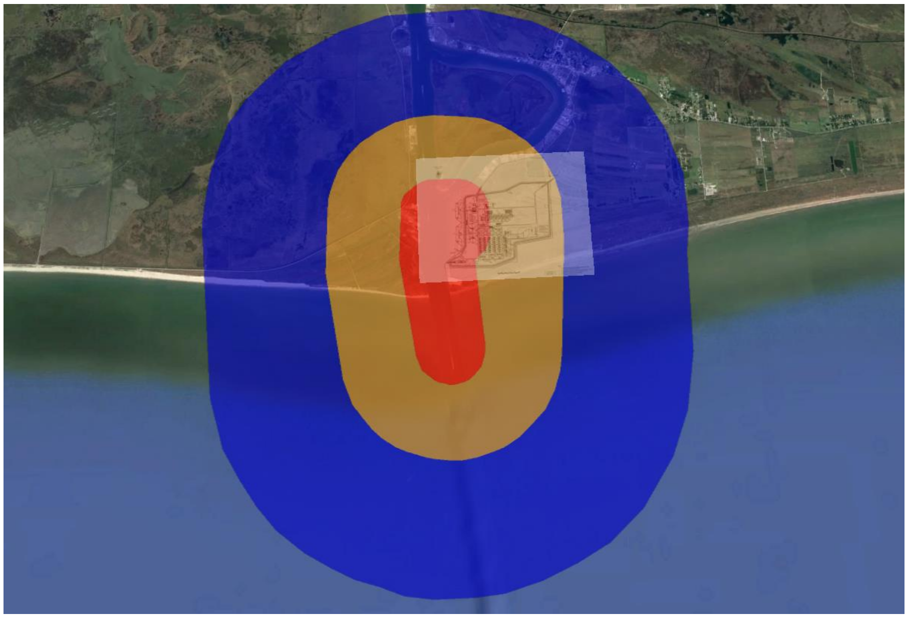

Figure 4.12.8.4-2 Intentional Hazard Zones Along LNG Vessel Route representing Zone 1 37.5kW/m2 (red), Zone 2 5kW/m2 (orange), and Zone 3 flammable vapor dispersion (blue)

4.12.8.5 Coast Guard Letter of Recommendation and Analysis

In a letter dated January 6, 2016, the USCG issued an LOR and LOR Analysis to FERC stating that the Calcasieu River Ship Channel should be considered suitable for LNG marine traffic associated with this Terminal. The recommendation was based on full implementation of the strategies and risk management measures identified to the USCG by Venture Global Calcasieu Pass in its WSA.

Although Venture Global Calcasieu Pass has suggested mitigation measures for responsibly managing the maritime safety and security risks associated with LNG marine traffic, the necessary vessel traffic and/or facility control measures may change depending on changes in conditions along the waterway. The USCG regulations in 33 CFR §127.007 require applicants to annually review its WSA until the proposed facility begins operation. Accordingly, Venture Global Calcasieu Pass 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 vessel route, that would affect the suitability of the waterway.

The USCG's LOR is a recommendation, regarding the current status of the waterway, to the FERC, the lead agency responsible for siting the on-shore LNG facility. Neither the USCG nor the FERC has authority to require waterway resources of anyone other than the applicant under any statutory authority or under the Emergency Response Plan and the Cost Sharing Plan (see section 4.12.9). 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 vessel.

Under the Ports and Waterways Safety Act, the Magnuson Act, the MTSA, and the Safety 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, vessel traffic and/or facility control measures would be appropriate to adequately address navigational safety and maritime security considerations. Therefore, we included a recommendation in section 4.12.5 for Venture Global Calcasieu Pass to file documentation confirming a determination by the USCG that it has installed appropriate measures to ensure the safety and security of the facility and the waterway, prior to commencement of service.

4.12.9 Emergency Response and Evacuation

As required by 49 CFR §193.2509 and 33 CFR §127.019, Venture Global Calcasieu Pass 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, 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.

Section 3A(e) of the NGA, added by section 311 of the Energy Policy Act of 2005 (EPAct 2005), stipulates that in any order authorizing an LNG terminal, the Commission must require the LNG terminal operator to develop an Emergency Response Plan in consultation with the USCG and state and local agencies. The FERC must approve the Emergency Response Plan prior to any final approval to begin construction. The final Emergency Response Plan would need to be evaluated by appropriate emergency response personnel and officials. Therefore, we have made a recommendation in section 4.12.5 for Venture Global Calcasieu Pass to develop an Emergency Response Plan in coordination with federal, state, county, and local entities.

A number of organizations and individuals have expressed concern that the local community would have to bear some of the cost of ensuring the security and emergency management of the LNG facility and the LNG carriers while in transit and unloading/loading at the berth. Section 3A(e) of the NGA (as amended by EPAct 2005) specifies that the Emergency Response Plan 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 vessels that serve the facility. Therefore, we have made a recommendation in section 4.12.5 that Venture Global Calcasieu Pass include a Cost-Sharing Plan identifying the mechanisms for funding the Emergency Response Plan. 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 marine 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.

4.12.10 Conclusions on Reliability and Safety

As part of the NEPA review, Commission staff assessed whether the proposed facilities would be able to operate safely and securely. As a result of our technical review of the preliminary engineering design, we have made a number of recommendations 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 the life of the facility to enhance the reliability and safety of the facility and to mitigate the risk of impact on the public. Based on our analysis and recommended mitigation, we believe that the Venture Global Calcasieu Pass 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.

In addition, we analyzed whether the Venture Global Calcasieu Pass Project would be sited consistently with federal regulations promulgated by the DOT in 49 CFR Part 193. As a cooperating agency, the DOT assisted the FERC staff in evaluating whether Venture Global Calcasieu Pass's proposed design would meet the DOT siting requirements. The DOT reviewed the data and methodology Venture Global Calcasieu Pass used to determine the design spills from various leakage sources, including piping, containers, and equipment containing hazardous liquids. Venture Global Calcasieu Pass used those design spills to model hazardous releases. On October 4, 2017, the DOT provided a Letter of Opinion to the FERC staff stating that the DOT had no objection to Venture Global Calcasieu Pass's methodology for determining the single accidental leakage sources for candidate design spills to be used in establishing the Part 193 siting requirements for the proposed LNG liquefaction facilities. Based on the hazardous area calculations we reviewed and upon satisfactory resolution of our recommendations, we would conclude that potential hazards from the siting of the facility at this location would not cause a significant impact on public safety. The areas impacted by these design spills also appear to meet the DOT's exclusion zone requirements by either being within the facility property boundary or over a navigable body of water. If the facility is constructed and becomes operational, the facility would be subject to the DOT's inspection and enforcement program. Final determination of whether a facility is in compliance with the requirements of 49 CFR Part 193 would be made by the DOT staff.

The USCG also reviewed the proposed LNG terminal and the associated LNG marine traffic. In a Letter of Recommendation dated January 6, 2016, the USCG stated that the Calcasieu River Ship Channel would be suitable for increased LNG marine traffic, in accordance with the guidance in the USCG's Navigation and Vessel Inspection Circular 01-11. The Waterway Suitability Assessment review focused on the navigation safety and maritime security aspects of LNG vessel transits along the affected waterway. Based on the results of the assessment of potential risks to navigation safety and maritime security associated with the LNG terminal, the USCG determined that the Calcasieu River Ship Channel would be suitable for accommodating the type and frequency of LNG marine traffic associated with this Project. Based on engineering design analysis and the additional recommendations, we conclude that the Project would not result in significantly increased public safety risks.

4.12.11 Pipeline Safety Standards

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. CH_4, 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. CH_4 is inactive biologically and essentially nontoxic. It is not listed in the International Agency for Research on Cancer (2017), National Toxicology Program (2017), or by the Occupational Safety and Health Administration (2017) as a carcinogen or potential carcinogen. CH_4 has an auto-ignition temperature of 1,000 °F and is flammable at concentrations between 5 percent and 15 percent in the air (NIOSH, 2017). Unconfined mixtures of CH_4 in air are not explosive; however, it may ignite 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.

The DOT is mandated to provide pipeline safety under Title 49, USC Chapter 601. PHMSA's Office of Pipeline Safety 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 the required safety standard. PHMSA's mission is to protect people and the environment from the risks of pipeline incidents. This work is shared with state agency partners and others at the federal, state, and local level.

Title 49, USC 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. The State of Louisiana has delegated authority to inspect interstate pipeline facilities.

The DOT pipeline standards are published in 49 CFR Parts 190–199. Part 192 specifically addresses natural gas pipeline safety issues.

Under a *Memorandum of Understanding on Natural Gas Transportation Facilities* dated January 15, 1993, between the DOT and FERC, the DOT is recognized as having 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 would design, install, inspect, test, construct, operate, replace, and maintain the facility for which a Certificate is requested in accordance with federal safety standards and plans for maintenance and inspection; or should 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 other than the DOT standards. If the Commission becomes aware of an existing or potential safety problem, there is a provision in the MOU to promptly alert the DOT. The MOU also provides instructions 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 would be designed, constructed, operated, and maintained in accordance with or to exceed the DOT *Minimum Federal Safety Standards* in 49 CFR 192. These regulations, which are intended to protect the public and to prevent natural gas facility accidents and failures, include specifications for material selection and qualification; minimum design requirements; and protection of the pipeline from internal, external, and atmospheric corrosion.

The DOT defines area classifications based on population density in the vicinity of the pipeline, and specifies more rigorous safety requirements for populated areas. 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. The class locations 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; and,
- Class 4 – Location where buildings with four or more stories aboveground are prevalent.

In accordance with federal standards, class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. Pipelines constructed on land in Class 1 locations must be installed with a minimum depth of cover of 30 inches in normal soil and 18 inches in consolidated rock. Class 2, 3, and 4 locations, as well as drainage ditches of public roads and railroad crossings, require a minimum cover of 36 inches in normal soil and 24 inches in consolidated rock. We note that the proposed Pipeline does not cross any areas of consolidated rock within trenching depth. All pipelines installed in navigable rivers, streams, and harbors must have a minimum cover of 48 inches in soil or 24 inches in consolidated rock. Class locations also specify the maximum distance to sectionalized block valves (that is 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).

Preliminary class locations for the Venture Global Calcasieu Pass Project have been developed based on the relationship of the pipelines centerline to other nearby structures and manmade features. About 89 percent of the proposed Pipeline route would cross Class 1 locations, about 0.02 percent of the route would cross Class 2 locations, and only 0.09 percent of the route would cross Class 3 locations. No Class 4 areas would be crossed by the proposed Pipeline.

If the Project is approved, the regulations require that the pipeline be designed, at a minimum, to the appropriate class location standards and that the spacing between the MLVs meets the DOT requirements.

During operation of a pipeline, if a subsequent increase in population density adjacent to the right-of-way indicates a change in class location for the pipeline, TransCameron Pipeline would be required to reduce the MAOP or replace the segment with pipe of sufficient grade and wall thickness, if required, to comply with the DOT regulations for the new class location. The Pipeline Safety Improvement Act of 2002 also requires operators to develop and follow a written integrity management program that contains all the elements described in 49 CFR 192.911 and addresses the risks on each transmission pipeline segment. Specifically, the law establishes an integrity management program that applies to all high consequence areas (HCAs).

The DOT 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 the 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 locations where the potential impact radius is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle; or,
- any area in Class 1 or 2 locations where the potential impact circle includes an identified site.

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 that contains:

- 20 or more buildings intended for human occupancy; or
- an identified site.

Once a pipeline operator has determined the HCAs on its pipeline, it must apply the elements of its integrity management plan to those segments of the pipeline within the HCAs. The DOT regulations specify the requirements for the integrity management plan at Part 192.911. The pipeline integrity management rule for HCAs requires inspection of the pipeline every 7 years. There is only one HCA along the proposed pipeline route; a 1.4-mile segment between approximately MPs 7.7 and 9.0.

After construction, and as required by the DOT regulations, the pipeline would be marked at line-of-sight intervals and at crossings of roads, railroads, and other key points. The markers would indicate the presence of the pipeline and provide a telephone number and address where a company representative could be reached in the event of an emergency or before any excavation in the area of the pipeline by a third-party.

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 contractors or other maintenance workers on the underground location of pipes, cables, and culverts. TransCameron Pipeline would participate in the “Call Before You Dig” and “One Call” programs and other related pre-excavation notification organizations in the states in which they operate. TransCameron Pipeline would develop and employ an integrity management plan for the pipeline. TransCameron Pipeline would also follow a Continuing Pipeline Surveillance Plan, which specifies procedures for performing routine surveillance of the pipeline.

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 must establish an emergency plan that includes procedures to minimize the hazards in a natural gas pipeline emergency. Key elements of the plan would include procedures for:

- receiving, identifying, and classifying emergency events such as gas leakage, fires, explosions, and natural disasters;
- establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- ESD of system and safe restoration of service;
- making personnel, equipment, tools, and materials available at the scene of an emergency; and
- protecting people first and then property, and making them safe from actual or potential hazards.

TransCameron Pipeline would prepare an emergency response plan that would provide procedures to be followed in the event of an emergency that would meet the requirements of 49 CFR 192.615. The plan would include the procedures for communicating with emergency services departments, prompt responses for each type of emergency, logistics, ESD and pressure reduction, emergency service department notification, and service restoration.

4.12.12 Pipeline Accident Data

The DOT requires all operators of natural gas transmission pipelines to notify the DOT of any significant incidents and to submit a report within 30 days. Significant incidents are defined as any leaks that:

- cause a death or personal injury requiring hospitalization; or
- involve property damage of more than $50,000 in 1984 dollars.[55]

Data available from PHMSA indicates that during the 20-year period from 1996 through 2015, a total of 1,310 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 4.12.12-1 provides a distribution of the causal factors, as well as the number of each incident by cause.

[55] $50,000 in 1984 dollars is approximately $112,955.73 as of May 2015 (CPI, Bureau of Labor Statistics, 2015)

TABLE 4.12.12-1

NATURAL GAS TRANSMISSION DOMINANT INCIDENT CAUSES, 1996 – 2015 [a]

Incident	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] DOT 2016.
[b] All other causes include miscellaneous, unspecified, or unknown causes.
[c] Natural forces 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 dominant incident cause of pipeline incidents are corrosion and pipeline material, weld, or equipment failure, and excavation constituting 66.7 percent of all significant incidents. The pipelines included in the data set in table 4.12.12-1 vary widely in terms of age, pipe diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline. The frequency of significant incidents is strongly dependent on pipeline age. Older pipelines have a higher frequency of corrosion incidents, since corrosion is a time-dependent process.

There were 260 reportable and 170 significant incidents on gas transmission pipelines in Louisiana between 1996 and 2015. Six fatalities and 13 injuries were recorded for these significant incidents (PHMSA, 2017). The use of both an external protective coating and a cathodic protection system,[56] required on all pipelines installed after July 1971, significantly reduces the corrosion rate compared to unprotected or partially protected pipe.

Outside forces, including excavations and natural events were the cause of 33.5 percent of significant pipeline incidents nationwide from 1996 to 2015. Table 4.12.12-2 provides a breakdown of outside force incidents by cause. These mostly result from the encroachment of mechanical equipment such as bulldozers and backhoes; earth movements due to soil settlement, washouts, or geologic hazards; weather effects such as winds, storms, and thermal strains; and willful damage.

Older pipelines have a higher frequency of outside forces incidents partly because their location may be less well known and less well marked than newer lines. In addition, the older 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.

[56] 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.

TABLE 4.12.12-2 OUTSIDE FORCES INCIDENTS BY CAUSE, 1996 – 2015 [a]		
Cause	Number of Incidents	Percent of All Incidents [b, c]
Third party excavation damage	172	13.1
Heavy rains, 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
Natural force (unspecified or other)	13	1
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] DOT 2016.
[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 4.12.3-1.
[c] Due to rounding, column does not equal 33.6 percent.

4.12.13 Impact on Public Safety

The service incident data summarized in table 4.12.12-1 include pipeline failures of all magnitudes with widely varying consequences. Table 4.12.13-1 presents the annual injuries and fatalities that occurred on natural gas transmission lines between 2011 and 2015. The data has been separated into employees and nonemployees to better identify a fatality rate experienced by the general public.

TABLE 4.12.13-1 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] DOT 2015.

The majority of fatalities from pipelines involve local distribution pipelines (not included in table 4.12.13-1). These are natural gas pipelines that are not regulated by FERC and that distribute natural gas to homes and businesses after transportation through interstate natural gas transmission pipelines. In general, these distribution lines are smaller diameter pipes, often made of plastic or cast iron rather than welded steel, and tend to be older pipelines that are more susceptible to damage. In addition, distribution systems do not have large rights-of-way and pipeline markers common to the FERC-regulated natural gas transmission pipelines.

The nationwide totals of accidental fatalities from various manmade and natural hazards are listed in table 4.12.13-2 in order to provide a relative measure of the industry-wide safety of natural gas transmission pipelines. Direct comparisons between accident categories should be made cautiously, however, because individual exposures to hazards are not uniform among all categories. Furthermore, the fatality rate is more than 25 times lower than the fatalities from natural hazards such as lightning, tornados, floods, etc.

TABLE 4.12.13-2

NATIONWIDE ACCIDENTAL DEATHS

Type of Accident	Annual Number of Deaths
Motor vehicle [a]	35,369
Poisoning [a]	38,851
Falls [a]	30,208
Drowning [a]	3,391
Fire, smoke inhalation, burns [a]	2,760
Floods [b]	81
Tornado [b]	72
Lightning [b]	49
Hurricane [b]	47
Natural gas distribution lines [c]	13
Natural gas transmission lines [c]	2

[a] Accident data presented for motor vehicle, poisoning, falls, drowning, fire, smoke inhalation, and burns represent the annual accidental deaths recorded in 2013 (CDC 2013).

[b] Accident data presented for floods, tornados, lightning, and hurricanes represent the 30 year average of accidental deaths between 1985 and 2014 (NOAA, 2016).

[c] Accident data presented for natural gas distribution lines and transmission pipelines represent the 20-year average between 1996 and 2015 (DOT 2016a).

The available data show that natural gas transmission pipelines continue to be a safe, reliable means of energy transportation. From 1996 to 2015, there was a national average of 65.4 significant incidents, 9.1 injuries and 2.3 fatalities per year. For Louisiana over the past 20 years there was an average of 10.6 incidents and 0.6 injuries per year with only 0.3 fatality over that time period, well below the national average. The number of significant incidents over the more than 300,000 miles of natural gas transmission lines indicates the risk is low for an incident at any given location. The operation of the Pipeline would represent a slight increase in risk to the nearby public.

4.13 CUMULATIVE IMPACTS ANALYSIS

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 future actions, regardless of what agency or person undertakes such actions (CEQ, 1997b). Although the individual impact of each separate project may be minor, the additive effects of multiple projects could 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 geographic scope for each resource is unique, and is generally more localized for somewhat stationary resources such as geological and soil resources; more expansive for resources with a large geographic area, such as visual impacts and air emissions; and based on jurisdictional boundaries for resources such as socioeconomics and public lands. We evaluated cumulative impacts from a geographical perspective recognizing that the proximity of other actions to the Project is a major predictor of where cumulative impacts would most likely result. In general, the closer another action is to the Project, the greater the potential for cumulative impacts. Table 4.13-1 summarizes the resource-specific geographic boundaries considered in this analysis and the justification for each. Actions occurring outside these geographical boundaries were generally not evaluated because their potential to contribute to a cumulative impact diminishes with increasing distance from the Project.

TABLE 4.13-1

RESOURCE-SPECIFIC GEOGRAPHIC REGIONS FOR DETERMINING CUMULATIVE IMPACTS FOR THE CALCASIEU PASS PROJECT

Environmental Resource	Geographic Scope for Cumulative Impacts	Justification for Geographic Scope
Soils and Surficial Geology	Construction workspaces	Impacts on soils and surficial geology would be highly localized and would not be expected to extend beyond the area of direct disturbance associated with the project.
Groundwater, Surface Water, and Wetlands	HUC-12 sub-watershed	Impacts on groundwater and surface water resources could reasonably extend throughout a HUC-12 sub-watershed (i.e., a detailed hydrologic unit that can accept surface water directly from upstream drainage areas, and indirectly from associated surface areas such as remnant, noncontributing, and diversions to form a drainage area with single or multiple outlet points [NRCS, 2007]), as could the related impacts on aquatic resources and fisheries.
Vegetation and Wildlife	HUC-12 sub-watershed	Consideration of impacts within a HUC-12 sub-watershed sufficiently accounts for impacts on vegetation and wildlife that would be directly affected by construction activities and for indirect impacts such as changes in habitat availability and displacement of transient species.
Cultural Resources	Overlapping impacts within the APE	The APE for direct effects (physical) includes areas subject to ground disturbance, while the APE for indirect effects (visual or audible) includes aboveground ancillary facilities or other project elements that are visible from historic properties in which the setting contributes to their NRHP eligibility.

TABLE 4.13-1		
RESOURCE-SPECIFIC GEOGRAPHIC REGIONS FOR DETERMINING CUMULATIVE IMPACTS FOR THE CALCASIEU PASS PROJECT		
Environmental Resource	Geographic Scope for Cumulative Impacts	Justification for Geographic Scope
Socioeconomics	Affected counties	The geographic scope of potential impact for socioeconomics was considered to include Cameron, Calcasieu, and Jefferson Davis Parishes in Louisiana, and Orange, and Jefferson Counties in Texas, where Venture Global would construct the Project and where most workers would be expected to reside during construction and operation of the Project. Affected counties would experience the greatest impacts associated with employment, housing, public services, transportation, traffic, property values, economy and taxes, and environmental justice.
Land Use	1.0-mile radius	Impacts on general land uses would be restricted to the construction workspaces and the immediate surrounding vicinity; therefore, the geographic scope for land use and recreation is 1.0 mile from the Terminal and Pipeline.
Visual	For aboveground facilities, the distance that the tallest feature at the planned facility would be visible from neighboring communities; for pipelines, a distance of 0.25 mile and existing visual access points (e.g., road crossings)	Assessing the impact based on the viewshed allows for the impact to be considered with any other feature that could have an effect on visual resources.
Noise – Operations	NSAs within 1 mile of a noise-emitting permanent aboveground facility	Noise from the Project's permanent facilities could result in cumulative noise impacts on NSAs within 1 mile.
Noise – Construction	0.25 mile from pipeline or aboveground facilities construction activities; NSAs within 0.5 mile of an HDD or direct pipe installation	Areas in the immediate proximity of pipeline or aboveground facility construction activities (within 0.25 mile) would have the potential to be affected by construction noise. NSAs within 0.5 mile of an HDD, direct pipe installation, or pile driving could be cumulatively affected if other projects had a concurrent impact on the NSA.
Air Quality – Operations	50 kilometers (about 31.1 miles) from the LNG Terminal	We adopted the distance used by the EPA for cumulative modeling of large PSD sources during permitting (40 CFR 51, appendix W) which is a 50-kilometer radius. Impacts on air quality beyond 50 kilometers (31.1 miles) would be *de minimis*.
Air Quality – Construction	0.25 mile from pipeline facility and 1 mile of the LNG Terminal	Air emissions during construction would be limited to vehicle and construction equipment emissions and dust, and would be localized to the project construction sites.
Reliability and Safety	Area adjacent to and vicinity of Terminal. Within 660 feet of the pipeline centerline. General vicinity of the Project for emergency services.	Reliability and safety impacts would be localized and would not be expected to extend far beyond the disturbance areas associated with the project.
Road Traffic	Overlapping impacted roads	Roads in the vicinity of the Project that would likely be used by other projects during the same construction phase window.

The temporal scope for each resource is also unique, and depends on the duration and permanency of the impacts associated with the resource. Past, present, and reasonably foreseeable projects and actions where the duration of time for construction, operation, and/or restoration overlaps with the timeframe for construction, operation, and restoration of the Project were included in this analysis. Past projects, including roads, electric transmission lines, pipelines, agriculture, and commercial and residential development, have and continue to cumulatively affect the lands that would be crossed by the Project. Impacts from older projects (completed 5 or more years ago) are considered to have been mitigated over time, with the disturbed environment having become part of the baseline character of the region described in the affected environment for each resource. Therefore, projects completed 5 or more years ago are not considered ongoing contributors to cumulative impacts unless they have ongoing operational impacts (e.g., air emissions, discharges) with potential to contribute to a cumulative impact on air quality. Past projects that have been recently completed (within 5 years of the Project) or that have ongoing operational impacts have been considered for their potential to contribute to a cumulative impact.

We have also considered how concurrent (present) and reasonably foreseeable future projects would contribute further to the cumulative impact of past projects (i.e., baseline conditions) and the Project. The potential for cumulative impacts associated with the Project would be greatest during the construction phase for the Pipeline and throughout construction and operation for the Terminal. The potential long-term cumulative impacts associated with the operation of the Project and other actions (i.e., cumulative impacts extending well beyond the period of construction of the project) would include effects related to wetland fill, channel dredging, and noise and air emissions from the Terminal facilities. For these resources, we expanded the temporal range of our cumulative impact analysis.

Both positive cumulative impacts (i.e., new jobs and tax revenues), and negative cumulative impacts (i.e., contribution to ongoing air emissions) were identified in the analysis. Where we determined that a potential for cumulative impacts exist, we quantified the impacts to the extent practicable. However, in some cases the potential impacts can only be described qualitatively. This is particularly the case for projects in the planning stages; contingent on economic conditions, availability of financing and/or the issuance of permits; or for which there is a lack of available information.

We identified and reviewed a variety of publically available information, including but not limited to pending or approved permit information from federal, state, and local agencies; various organization's websites; commercial company websites; news outlets; and desktop and field review for projects and actions in the Project area. Reasonably foreseeable projects that might cause cumulative impacts in combination with the proposed Project include projects that are under construction, approved, proposed, or planned. For FERC-regulated projects, proposed projects are those for which the proponent has submitted a formal application to the FERC, and planned projects are projects that are either in pre-filing or have been announced, but have not been proposed. Planned projects also include projects not under the FERC's jurisdiction that have been identified through publicly available information such as press releases, internet searches, Venture Global's communications with local agencies, and information available from the SWLA Economic Development Alliance, which monitors proposed development activities in SWLA. We then applied the criteria described above to identify which projects and actions may affect resources within the same temporal and geographic scope as the Project. The anticipated cumulative impacts of the Project and other projects or actions are described below, including any pertinent mitigation actions.

4.13.1 Projects Potentially Contributing to Cumulative Impacts

With respect to past actions, Council on Environmental Quality guidance (2005) allows agencies to adopt a broad, aggregated approach without "delving into the historical details of individual past actions," an approach we have taken here. The current regional landscape in the Project area, which is largely industrial and agricultural, forms the environmental baseline described in other sections of this EIS and against which Project impacts are considered.

Table 4.13.1.1-1 lists the projects and activities we considered in this cumulative impact analysis based on information available at the time this EIS went to print. For each project, the table includes the location, a brief description, distance from the proposed Project, status, or timeframe, and resources that may be cumulatively affected in conjunction with the proposed Project. Project locations are identified on figure 4.13.1.1-1. As noted in the following subsections, some projects were eliminated from further discussion if it was determined that they would not meet the criteria listed above or if sufficient information is not available to allow for a meaningful analysis. Descriptions of potential cumulative impacts by resource category are presented in section 4.13.2.

4.13.1.1 LNG Liquefaction and Export Projects

We identified several liquefaction and export projects that are proposed, planned, or under construction in the vicinity of the proposed Project that have the potential to contribute to cumulative impacts when combined with the proposed Project (see table 4.13.1.1-1 and figure 4.13.1.1-1). In addition to the proposed Project, new liquefaction and export projects are planned, proposed or underway at eight other locations in SWLA and southeast Texas. These include the Lake Charles Liquefaction, Sabine Pass LNG, Golden Pass LNG, Cameron LNG Liquefaction, Magnolia LNG, Port Arthur Liquefaction, Commonwealth LNG, and Driftwood LNG projects. Brief descriptions of each of these projects are provided below. This cumulative impacts analysis considers the impacts of the potential construction and operation of the planned or proposed liquefaction and export projects.

The EPA in their scoping comments expressed concern with induced increased natural gas production from the Project. The Commission has addressed the issue of upstream natural gas production with regards to new natural gas pipelines and LNG export facilities on several recent occasions.[57,58] Furthermore, the United States Court of Appeals for the District of Columbia Circuit examined the Commission's NEPA responsibility to study impacts relating to the export of natural gas when exercising its NGA section 3 responsibilities.[59] We conclude that the environmental effects resulting from natural gas production are generally neither caused by a proposed interstate pipeline (or other natural gas infrastructure) project nor are they reasonably foreseeable consequences of the approval of an infrastructure project, as contemplated by CEQ regulations. In addition, we do not have sufficient information to determine the origin of the gas that would be transported to the Terminal and cannot forecast the likely effects in the context of a meaningful cumulative impact analysis for this Project.

Nonetheless, we note that the DOE has examined the potential environmental issues associated with natural gas production in order to provide the public with a more complete understanding of the potential impacts.[60]

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[57] FERC Order Issuing Certificates, PennEast Pipeline Company, LLC. Docket No. CP15-558-000. Page 197, paragraph 197 (FERC 2018).

[58] FERC Order Issuing Certificates, Magnolia LNG, LLC. Docket Nos. CP14-347-001 and CP14-511-00. Page 3, paragraph 7 (FERC 2016c).

[59] Sierra Club v. FERC, 827 F.3d 59, 68 (D.C. Cir. 2016) (Sabine Pass LNG) and Sierra Club and Galveston Baykeeper v. FERC, 827 F3d 36 (D.C. Cir 2016) (Freeport LNG).

[60] U.S. Department of Energy, *Addendum to Environmental Review Documents Concerning Exports of Natural Gas from the United States*, 79 Fed. Reg. 48,132 (Aug. 15, 2014) (DOE Addendum), http://energy.gov/sites/prod/files/2014/08/f18/Addendum.pdf.

TABLE 4.13.1.1-1

PAST, PRESENT AND REASONABLY FORESEEABLE ACTIVITIES AND PROJECTS CONSIDERED IN THE CUMULATIVE IMPACT ANALYSIS [a]

Activity/Project	Location	Distance from Terminal (miles)	Description	Timeframe/Status [c]	Resources Potentially Cumulatively Affected [b]
LNG Export Projects					
Lake Charles Liquefaction	Calcasieu Parish, LA	23	LCLNG proposes to construct a new liquefaction facility with a send out capacity of 2.1 Bcf/d on 286 acres of land adjacent to Trunkline LNG's existing LNG Terminal. LCLNG estimates an average construction workforce of 2,100 workers over 5 years and 176 new permanent jobs.	FERC issued an FEIS in August 2015 and the Order to construct and operate was issued in December 2015. As of May 2017, LCLNG completed tree clearing of the greenfield site. Construction awaiting FCC permit issuance. Projected to be operational by 2019-2020.[c]	S, AO
Sabine Pass LNG	Cameron Parish, LA	32	Sabine Pass LNG is building a liquefaction facility with a send out capacity of 4.16 Bcf/d on 288 acres of land within its existing Sabine Pass LNG Terminal. Sabine Pass LNG estimates that the facilities will create 356 permanent jobs, 589 new indirect jobs, and 3,000 construction jobs.	Four trains have been constructed and are operational as of May 2016. Two trains are currently under construction and are projected to be operational by the 3rd Quarter of 2019.	S
Golden Pass LNG Liquefaction	Jefferson County, TX	34	Golden Pass Products LLC and Golden Pass Pipeline LLC propose to build a liquefaction facility with a send out capacity of 2.6 Bcf/d. The facility would be contiguous to and integrated with the existing 300-acre Golden Pass LNG terminal site, with about 275 additional acres required, as well as associated natural gas pipeline, compression, and other related facilities. The project sponsor estimates the project would create 1,160 construction jobs during peak construction over 5 years, and 200 operational jobs over the life of the project.	FERC authorized the project December 21, 2016. The July 2016 FEIS indicated construction would occur in three phases, starting in 2017 (assuming receipt of all authorizations and necessary permits) for the first liquefaction train, followed by the second liquefaction train 6 months after initiation of construction of the Terminal Expansion, and followed by the third liquefaction train 6 months after that. Full in service is anticipated for the third quarter of 2022. FERC authorized initial site preparation in September 2017. Construction has not yet commenced for the export terminal or pipeline.	S

TABLE 4.13.1.1-1

PAST, PRESENT AND REASONABLY FORESEEABLE ACTIVITIES AND PROJECTS CONSIDERED IN THE CUMULATIVE IMPACT ANALYSIS [a]

Activity/Project	Location	Distance from Terminal (miles)	Description	Timeframe/Status [c]	Resources Potentially Cumulatively Affected [b]
Cameron LNG Liquefaction	Cameron Parish, LA	18	Cameron LNG is building a liquefaction facility with a send out capacity of 2.1 Bcf/d, including three liquefaction trains (Trains 1 through 3), one additional LNG storage tank (Tank 4), truck loading facilities, and other related facilities. The liquefaction facility is located on a 503-acre site that is north of and partially within the existing Cameron LNG Terminal near Hackberry, Louisiana on the Calcasieu River Ship Channel. Cameron LNG plans to construct two additional liquefaction trains (Trains 4 and 5) with a capacity of 4.985 MTPA and a fifth 160,000-m^3 LNG storage tank (Tank 5). The project sponsor estimates the project will create 135 permanent jobs, and up to 3,900 construction jobs.	FERC authorized the project in June 2014 and construction commenced in October 2014. Anticipated operations for Trains 1, 2, and 3 in 2018/2019. Approval for Trains 4 and 5 authorized in May 2016; anticipated operations for these trains in 2019.	S, VT, AR, LS, SW, AO
Magnolia LNG, Lake Charles Expansion Project	Calcasieu Parish, LA	23	Magnolia proposes to build a liquefaction facility with a send out capacity of 1.08 Bcf/d. The facility would be on an approximately 115-acre tract of land adjacent to the Industrial Canal, off the Calcasieu River Ship Channel. The project would create approximately 67 permanent jobs and a peak construction workforce of approximately 542 workers. Additionally, Kinder Morgan proposes modifications to an existing pipeline system to accommodate the natural gas service request by Magnolia.	FERC application was filed in April 2014 and the FERC Order was received in April 2016. In May 2017 Magnolia LNG reported that it received all required federal authorizations and was granted permission to commence initial site preparation activities by FERC. Scheduled in-service dates for the four proposed liquefaction trains, assuming receipt of regulatory approvals, are December 2018 for the first liquefaction train, with the remaining three liquefaction trains being commissioned at 3-month intervals thereafter.	S, VT,LS, AR, AO

TABLE 4.13.1.1-1

PAST, PRESENT AND REASONABLY FORESEEABLE ACTIVITIES AND PROJECTS CONSIDERED IN THE CUMULATIVE IMPACT ANALYSIS [a]

Activity/Project	Location	Distance from Terminal (miles)	Description	Timeframe/Status [c]	Resources Potentially Cumulatively Affected [b]
Port Arthur Liquefaction	Jefferson County, TX	37	Port Arthur LNG, LLC and Port Arthur Pipeline, LLC (collectively, Port Arthur) have announced plans to develop a liquefaction and LNG export facility with a send out capacity of 1.4 Bcf/d. The facility would be on a portion of Sempra's 2,900-acre site on the Sabine-Neches and Gulf Intracoastal Waterways and would include two liquefaction trains, two LNG storage tanks, two marine berths, LNG truck loading facilities, and natural gas liquids and refrigerant storage facilities. In order to supply natural gas for the facility, the project would also include two natural gas pipelines, two compressor stations, metering stations, and appurtenant facilities. The project sponsor estimates that the project would create 3,000 construction jobs and 200 full-time jobs during operation.	Port Arthur entered the FERC's pre-filing process on March 31, 2015 and filed application on November 29, 2016. Anticipated construction start in 2018 and begin operation in 2023.	S
Commonwealth LNG (aka Waller Point LNG)	Cameron Parish, LA	<1	Commonwealth LNG has announced plans to develop a liquefaction facility with a send out capacity of 0.16 Bcf/d. The facility would be located on a 180-acre site and would require dredging in the Calcasieu Ship River Channel. The project sponsor estimates the project would create 100 to 200 permanent jobs and 250 to 350 construction jobs.	Commonwealth entered in the FERC's pre-filing process on August 15, 2017. Anticipated construction in 2019 with operations starting in 2022.	AO, AC, AR, LS, R, RT, S, VT, SW, NO
Driftwood LNG	Calcasieu Parish, LA	21	Driftwood proposes to construct an LNG liquefaction export facility with a send out capacity of 26 million tonnes per annum of natural gas. In addition, Driftwood proposes to construction 96 miles of pipeline that would connect the liquefaction and export facility to the existing interstate U.S. natural gas grid. The project would require dredging in the Calcasieu River Ship Channel.	Application filed with FERC on March 31, 2017. Anticipated construction in 2018 with operations starting in 2022.	AO, AR, LS, S, VT, SW

TABLE 4.13.1.1-1

PAST, PRESENT AND REASONABLY FORESEEABLE ACTIVITIES AND PROJECTS CONSIDERED IN THE CUMULATIVE IMPACT ANALYSIS [a]

Activity/Project	Location	Distance from Terminal (miles)	Description	Timeframe/Status [c]	Resources Potentially Cumulatively Affected [b]
Pipeline System Projects					
Kinder Morgan Louisiana Pipeline, Lake Charles Expansion	Acadia, Calcasieu, and Evangeline Parishes, LA	23	KMLP proposes to construct a new greenfield compressor station consisting of four 16,000 horsepower gas-fired turbine units near Eunice, LA, as well as one new meter station and two header pipelines (1.2 mile 36-inch low pressure and 700-feet of 24-inch high pressure), and modify six existing meter stations to provide a connection to a new delivery point at the proposed Magnolia LNG Terminal.	FERC Order authorizing the project was issued April 15, 2016. KMLP anticipates beginning construction in June 2018 to meet a June 30, 2019 in-service date.	AO
Columbia Gulf Transmission, Cameron Access	Jefferson Davis, Calcasieu, and Cameron Parishes, LA	18	Columbia Gas Transmission plans to construct about 27 miles of greenfield pipeline, about 7 miles of loop pipeline, and a greenfield compressor station.	FERC application was filed March 2014 and the FERC Order was issued in September 17, 2015. Columbia Gulf began construction in November 2016 and anticipates a January 1, 2018 in-service date.	AO
Other Industrial/Utility Projects					
Port Cameron Project	Cameron Parish, LA	<2	Proposed 500-acre deep water staging port to serve offshore activities in the Gulf of Mexico, with possible additional 750-acre expansion. Will include 21,000 linear feet of waterfront development, 46 dredged slips.	Construction was expected to commence late 2017 and take 4 years to complete.	AR, RT, S, SW, VW, W, AO, R, LS
CMP/BUDM Slurry Line	Cameron Parish, LA	<9	Proposed 8.9-mile slurry line to transport dredged material from Project to off-site wetland mitigation site at the CPNWR, in accordance with the CMP/BUDM Plan.	Slurry line would be implemented at the same time as the dredging for the Project turning basin, projected to commence in 2018/2019	AR, LS, SW, W, VT
Government Activities/Facilities					
Maintenance Dredging of Calcasieu River Ship Channel	Cameron and Calcasieu Parishes, LA	0	The USACE conducts periodic dredging along the 68-mile Calcasieu River and navigation channel.	Dredging is ongoing on a bi-annual basis in the project area (Port of Lake Charles, 2015).	AC, AO, AR, LS, NC, R, SW, VT

TABLE 4.13.1.1-1

PAST, PRESENT AND REASONABLY FORESEEABLE ACTIVITIES AND PROJECTS CONSIDERED IN THE CUMULATIVE IMPACT ANALYSIS [a]

Activity/Project	Location	Distance from Terminal (miles)	Description	Timeframe/Status [c]	Resources Potentially Cumulatively Affected [b]
Residential Developments					
Audubon Trace Subdivision	Calcasieu Parish, LA	>20	Planned 182 single-family homes.	Permitted; construction has not yet begun (SWLA Economic Chamber, 2017).	S
Belle Savannah	Calcasieu Parish, LA	>20	Planned 200 multi-family homes.	Under construction (SWLA Economic Chamber, 2017).	S
Willow Brook	Calcasieu Parish, LA	>20	Planned 138 single-family homes	Permitted (SWLA Economic Chamber, 2017).	S
DR Horton – Graywood	Calcasieu Parish, LA	>20	Planned 93 single-family homes	Permitted (SWLA Economic Chamber, 2017).	S
Berdon – Campbell Building Lofts	Calcasieu Parish, LA	>20	Planned 16 loft homes	Under construction (SWLA Economic Chamber, 2017).	S
Lakes at Morganfield	Calcasieu Parish, LA	>20	Planned 1,000 single- and multi-family homes.	Under Construction (SWLA Economic Chamber, 2017).	S
Walnut Grove Development	Calcasieu Parish, LA	>20	Planned 180 single- and multi-family homes.	Under construction 2013–2020; some home are completed (SWLA Economic Chamber, 2017).	S

[a] This table lists those projects that are most likely to contribute to cumulative impacts in the vicinity of the Venture Global Calcasieu Pass and TransCameron Pipeline Project; it is not intended to provide an all-inclusive listing of projects in the region.

[b] AC – Air Construction; AO – Air Operations; AR – Aquatic Resources; LS – Listed Species; NC – Noise Construction; NO – Noise Operation; R – Recreation; RT – Road Traffic; S – Socioeconomics; SW – Surface Water; VW – Vegetation and Wildlife; VT – Vessel Traffic; W – Wetlands

[c] Project status and timelines are based on FERC eLibrary information unless otherwise specified.

[d] https://energy.gov/sites/prod/files/2017/04/f34/Commonwealth%20SAR%20April%202017_0.pdf

Bcf/d = billion cubic feet per day; FEIS = Final Environmental Impact Statement; FERC = Federal Energy Regulatory Commission; G2 = G2 LNG, LLC; KMLP = Kinder Morgan Louisiana Pipeline LLC; kV = kilovolt; LA = Louisiana; LCLNG = Lake Charles LNG Company, LLC; LNG = liquid natural gas; m^3 = cubic meter; MTPA = million tonnes per annum; SCT&E = Southern California Telephone and Energy LNG, LLC; SWLA = Southwest Louisiana; TX = Texas; USACE = U.S. Army Corps of Engineers

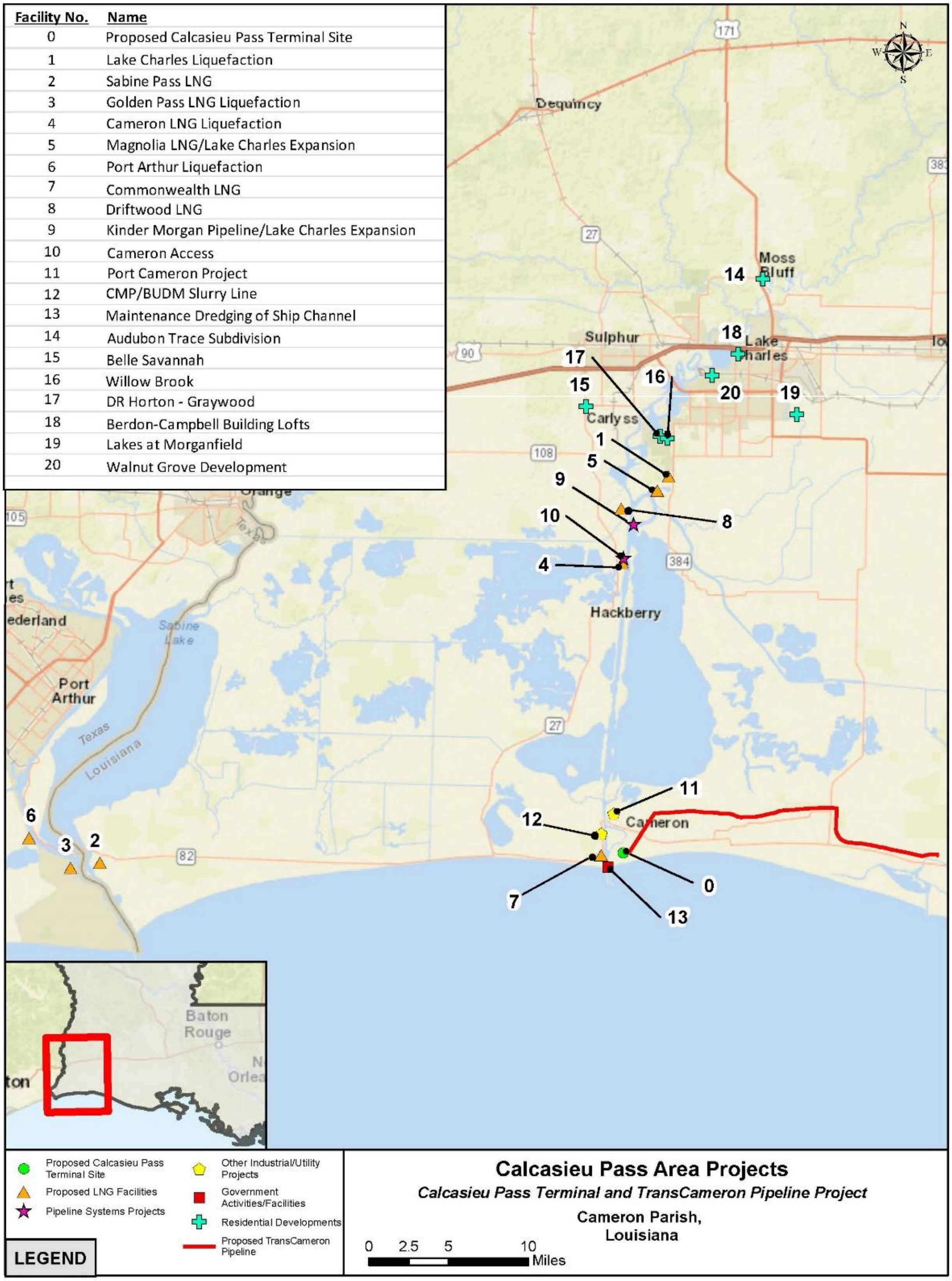

Figure 4.13.1.1-1 Map of Cumulative Projects

Lake Charles Liquefaction Project

Trunkline Gas Company, LLC (Trunkline) operates an LNG Terminal just off the Calcasieu River in Lake Charles, Louisiana about 23 miles from the proposed Project. Trunkline, Lake Charles LNG Export Company, LLC, and Lake Charles LNG Company, LLC (LCLNG) propose to construct a new liquefaction facility with a send out capacity of 2.1 billion cubic feet per day (Bcf/d) on 268 acres of land adjacent to the existing Trunkline LNG Terminal. FERC issued a final EIS[61] in August 2015 and the Order to site, construct, and operate was issued in December 2015. As of May 2017, LCLNG has received all required federal authorizations related to the liquefaction facility and modifications to the existing LNG Terminal and have completed tree clearing of the greenfield site. Initial projections assumed a full in-service date of 2020; however, project construction has proceeded slower than initially expected. Due to the potential overlap of construction schedules, the projected workforce associated with construction of the Lake Charles Liquefaction Project may result in cumulative impacts on housing and other socioeconomic issues. In addition, the Lake Charles Liquefaction Project is within the geographic scope of air quality operations and may result in cumulative impacts. We do not anticipate any other cumulative impacts due to the distance between the Lake Charles Liquefaction Project and the proposed Project.

Sabine Pass LNG Project

Due to the potential overlap of construction schedules, the project workforce associated with the construction of the remaining trains may result in cumulative impacts on available workforce, housing, and other socioeconomic issues. However, we do not believe it would contribute appreciably to the cumulative effects on any socioeconomic resources in the Venture Global Calcasieu Pass Project area as the impacts related to the Sabine Pass LNG Project would likely be concentrated in Port Arthur and Beaumont, Texas whereas the socioeconomic impacts related to the Venture Global Calcasieu Pass Project would be concentrated in Lake Charles, Louisiana.

Golden Pass LNG Liquefaction

Due to the potential overlap of construction schedules, the workforce associated with the construction of the project may result in cumulative impacts on the available workforce, housing, and other socioeconomic issues. However, due to the distance of the Golden Pass LNG Liquefaction Project from the proposed Project, we do not believe it would contribute appreciably to the cumulative effects on socioeconomic resources in the Venture Global Calcasieu Pass Project area as the socioeconomic impacts would likely be concentrated in Port Arthur and Beaumont, Texas whereas the socioeconomic impacts related to the Venture Global Calcasieu Pass Project would be concentrated in Lake Charles, Louisiana.

Cameron LNG Liquefaction

Due to the potential overlapping construction schedules and proposed project locations on the Calcasieu River Ship Channel, the construction and/or operation of the proposed Project and the Cameron Liquefaction Project have the potential to contribute to cumulative impacts relative to aquatic resources, listed species, surface waters, socioeconomics, air quality (operations) and vessel traffic.

Magnolia LNG Project

Due to the potential overlapping construction schedules and proposed project locations on the Calcasieu River Ship Channel, the construction and/or operation of the proposed Project and the Magnolia LNG Project have the potential to contribute to cumulative impacts in the Venture Global Calcasieu Pass

[61] Docket No. CP14-119

Project area relative to, aquatic resources; listed species; air quality (operations); the available workforce, housing, and other socioeconomic issues; and vessel traffic.

Port Arthur Liquefaction Project

Due to the location of this project, construction and operation of the Port Arthur Liquefaction Project may contribute to cumulative impacts on resources in the Venture Global Calcasieu Pass Project area. Due to the potential overlap of construction schedules, the workforce associated with construction of the project may result in cumulative impacts on the available workforce, housing, and other socioeconomic issues. However, due to the distance of the Port Arthur Liquefaction Project from the proposed Project, we do not believe it would contribute appreciably to the cumulative effects on socioeconomic resources in the Venture Global Calcasieu Pass Project area. The socioeconomic impacts would likely be concentrated in Port Arthur and Beaumont, Texas whereas the socioeconomic impacts related to the Venture Global Calcasieu Pass Project would be concentrated in Lake Charles, Louisiana.

Commonwealth LNG

Commonwealth LNG, formerly known as Waller Point LNG, is a planned liquefaction/export terminal on the west side of the Calcasieu Ship Channel, opposite the Project's Terminal site. In November 2013, Commonwealth submitted applications to the DOE/FE for long-term authorization to export LNG and subsequently received its authorization for export to FTA countries. Its application to export to non-FTA countries is pending. The facility would be located on an approximately 180-acre site less than 1 mile from the Project's Terminal site. The Commonwealth project's early proposed pipeline routing would have gone through Venture Global's proposed Terminal site location; however, current routing has shifted north of the site. This project plans to dredge for a proposed turning basin, covering an area of approximately 65 acres; dredge volumes were not available. The project would also require approximately 30,000 cubic meters of water from the Calcasieu River for hydrostatic testing of tanks. Commonwealth entered in the FERC's pre-filing process on August 15, 2017. Construction is anticipated to begin in 2019 with full operations scheduled for 2022.

Due to the potential overlapping construction schedules and proposed project locations on the Calcasieu River Ship Channel, the construction and/or operation of the proposed Project and the Commonwealth LNG Project have the potential to contribute to cumulative impacts in the Venture Global Calcasieu Pass Project area relative to air quality, noise, aquatic resources, listed species, recreation, road traffic, socioeconomics, vessel traffic, and surface waters.

Driftwood LNG

Driftwood LNG is a planned liquefaction/export terminal on the west side of the Calcasieu Ship Channel approximately 20 miles north of the Project's Terminal site. The proposed facilities would occupy approximately 720 acres of an 800-acre site on the west bank of the Calcasieu River in Calcasieu Parish, Louisiana. Driftwood LNG also proposes approximately 96 miles of pipeline that would connect the liquefaction/export facility to the existing interstate natural gas grid. Driftwood LNG file their application with FERC on March 31, 2017 with anticipated construction in 2018 and operations starting in 2022.

Due to the potential overlapping construction schedules and proposed project locations on the Calcasieu River Ship Channel, the construction and/or operation of the proposed Project and the Driftwood LNG Project have the potential to contribute to cumulative impacts in the Venture Global Calcasieu Pass Project area relative to air quality, aquatic resources, listed species, socioeconomics, vessel traffic, and surface waters.

4.13.1.2 Pipeline System Projects

Lake Charles Expansion Project

While the construction schedules may overlap, construction and operation of the Lake Charles Expansion Project is not likely to contribute to cumulative impacts in the Venture Global Calcasieu Pass Project area for most resources due to its limited magnitude and distance from the proposed Project. However, the Lake Charles Expansion Project is within the air quality operations geographic scope for cumulative analysis and could have potential cumulative impacts on air quality. Additionally, potential cumulative impacts are captured concurrently with the Magnolia LNG Project.

Cameron Access Project

Due to the construction schedule of this pipeline project and its distance from the proposed Project, we do not believe that construction and operation of the Cameron Access Project has the potential to contribute to cumulative impacts on most resources in the Venture Global Calcasieu Pass Project area; however, the Cameron Access Project is within the air quality operations geographic scope for cumulative analysis and could have cumulative impacts on air quality.

4.13.1.3 Other Industrial/Utility Projects

Port Cameron Project

Port Cameron LLC has proposed a new deep-water staging port, located a little over 1 mile north of the proposed Project, along the Calcasieu River Ship Channel in Cameron, Louisiana. The project includes a 500-acre deep water staging port to serve offshore activities in the Gulf of Mexico, with a possible addition of another 750-acres in expansion. The port complex would cater to the needs of energy development including energy producers, suppliers, and service companies. The project would include 21,000 linear feet of bulkhead waterfront sites, with 46 dredged slips and dredged depths up to 33 feet. The project also includes approximately 25,000 linear feet of all-weather roads and two new pile-supported concrete bridges to provide added accessibility to the location. According to the USACE webpage for the project, the development will result in approximately 9,665,683 yd^3 of excavation (dredging), with 5,658,636 yd^3 placed onsite and the remaining 4,007,047 yd^3 being hauled off site and placed in a sediment disposal area, as part of a Permittee Responsible Mitigation plan. Approximately 1,138 acres of vegetated marsh may be impacted as a result of their proposed activities. The project would impact an estimated 900 acres of EFH.[62] Due to the location in close proximity to the Venture Global Calcasieu Pass Project, operation of the Port Cameron Project may contribute to cumulative impacts on aquatic resources, road traffic, socioeconomics, surface water, vegetation, wildlife, wetlands, and listed species.

CMP/BUDM Slurry Line

The Project would include off-site mitigation at the CPNWR, located approximately 8.9 miles northeast of the Terminal site. Dredging proposed for the turning basin would be transported through an appropriately sized pipeline to coincide with the cutter-suction dredge. The pipe would be a combination of floating pipe, submerged pipe, and/or overland pipe. The pipe would be routed from the Terminal site north within the Calcasieu River Ship Channel and the east fork of the Calcasieu River for approximately 5.9 miles to Calcasieu Lake, along the east and west banks of the channels with required crossings of the Federal Navigation Channel. The route would then run east along the south shoreline and then turn

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[62] http://www.mvn.usace.army.mil/Missions/Regulatory/Public-Notices/Article/812435/mvn-2013-02424-mb/

southeast into the CPNWR for mitigation restoration. Seven booster pumps on floating platforms would be located along the route during the construction phase. The pipe would be a temporary feature installed, used, and removed during the construction period only. The slurry pipeline would be permitted as part of the Joint Permit Application with the USACE. Due to the location in close proximity to the Venture Global Calcasieu Pass Project, the CMP/BUDM Slurry Line may contribute to cumulative impacts on aquatic resources, listed species, surface waters, wetlands, and vessel traffic.

4.13.1.4 Government Activities/Facilities

Maintenance Dredging of the Calcasieu River Ship Channel

The USACE conducts maintenance dredging in the Calcasieu River Ship Channel every 4 to 5 years. This maintenance dredging is conducted to maintain the ship channel at -40 feet for its 400-foot width. If maintenance dredging in the Project area were to coincide with construction of the Venture Global Calcasieu Pass Project, it would contribute to the cumulative impact on some resources in the Project area.

4.13.1.5 Residential Developments

Several residential developments are planned, permitted, or under construction in the Lake Charles area in Cameron Parish, Louisiana. The residential developments would all be more than 20 miles away from the proposed Venture Global Calcasieu Pass Project and would have no impacts near the proposed Project. However, because the developments could potentially increase available housing by nearly 2,000 homes, these developments were considered in the cumulative socioeconomic impacts analysis as a potential beneficial effect.

4.13.2 Potential Cumulative Impacts by Resource

The following sections address the potential cumulative impacts from Venture Global's Calcasieu Pass Project and other projects identified within the cumulative impact area on specific environmental resources. The other projects considered in each section are those for which impacts on the resource(s) discussed would be within the same geographic scope as those that would result from the Venture Global Calcasieu Pass Project and would occur within the same timeframe.

4.13.2.1 Geologic Resources

The Project impacts to geologic resources would not contribute to a cumulative impact based on the geographic region for consideration of cumulative effects. None of the projects listed in table 4.13-2 cross into the impact area of the Project.

4.13.2.2 Soils

No cumulative impacts to soil resources are expected from construction of the Terminal or Pipeline for land-based related activities. None of the projects listed in table 4.13-2 overlap with the proposed construction activities of the Project. However, the proposed dredging in the Calcasieu River Ship Channel could contribute to the disruption of sediments in combination with the ongoing USACE maintenance dredging of the Calcasieu River Ship Channel and could then cumulatively contribute to water quality impacts as discussed below.

4.13.2.3 Water Resources

Several other LNG export projects are planned within the same region as the Venture Global Calcasieu Pass Project which, if constructed, would also result in ballast water discharges in the Calcasieu River Ship Channel. However, all of the projects are expected to follow USCG and EPA regulations with regard to ballast water which reduces the potential for adversely affecting water quality bacteria and pathogens. Refer to section 4.3.2.2 where surface water impacts for the project are addressed. We do not anticipate the Venture Global Calcasieu Pass Project would contribute significantly to cumulative impacts associated with the intake or discharge of ballast water due to the USCG and EPA regulations applying to all shipping operations.

Venture Global Calcasieu Pass anticipates using existing municipal water supply sources to provide the required industrial and potable fresh water for construction of the Project. In addition, sea water from the Calcasieu River Ship Channel would be used for LNG tank hydrostatic tests and earthworks. The total anticipated water needed for construction is approximately 175,508,700 gallons. Operation of the Terminal would require approximately 600,000 gal/d of water, which would be obtained from a municipal source or new groundwater wells.

There are three active monitoring wells and four abandoned and plugged rig supply wells located within 150 feet of the Project's proposed construction workspaces. The three active monitoring wells are located approximately 80 feet north of the pipeline's construction workspace. According to publicly available information from LDNR (LDNR, 2012), there are no active public or private drinking water supply wells registered within 150 feet of the Project, and there are no springs within 150 feet of the Pipeline.

We were unable to accurately quantify the groundwater withdrawals required for construction of the other planned and proposed projects in the area, but we assume their requirements would be similar in magnitude to the Venture Global Calcasieu Pass Project. If so, the greatest cumulative use of groundwater would occur during the construction of these projects to the extent they are built at the same time. Six LNG facilities either would or could overlap in construction schedules. If these facilities experience concurrent construction, the duration of this cumulative effect would be temporary, primarily limited to the construction period. Similarly, we were unable to accurately quantify the groundwater withdrawals that would be required during operation of the other reasonably foreseeable projects listed in table 4.13.1.1-1; it is possible that several of these projects would have similar water requirements as the Venture Global Calcasieu Pass Project. The Project is not proposed in an "Area of Groundwater Concern" or "Critical Area of Groundwater Concern," which are areas that could require groundwater withdrawal restrictions. In addition, the Project is not proposed within a wellhead protection area. To verify the Project's impacts on the Chicot aquifer, a condition was included in section 4.3.1.4 requiring Venture Global Calcasieu Pass to provide confirmation from LDEQ that there is adequate groundwater supply for both construction and operational demands. As a result, while the Project would contribute to groundwater withdrawals and would potentially lower the water table at the point of withdrawal, the Project would not result in a significant cumulative impact on groundwater supply. It is expected that the other cumulative projects would be required to confirm adequate supply of groundwater from LDEQ.

Construction of the berthing docks would include dredging approximately 2,064,500 yd^3 of material over 29.3 acres. Dredging of the Calcasieu River Ship Channel required to reach the water depth of 44.3 feet below Mean Lower-Low Water would require that approximately 3,033,000 yd^3 of material be dredged in a 64.8-acre area further offshore in the channel. In total, approximately 5.0 million *in situ* yd^3 of material would be excavated or dredged for the Project. There are projects in proximity to the Project that are also proposing dredging, including Port Cameron, Cameron LNG, Commonwealth LNG and the ongoing USACE maintenance dredging of the Calcasieu River Ship Channel. Other projects listed in table 4.13.1.1-1 would require dredging, but are over 20 miles away so the cumulative effects on water resources from dredging would be speculative and dependent on numerous other factors such as sediment transport distance and pace. For the projects in proximity to the proposed project, it is estimated that the dredging would consist of approximately 9.66 million yd^3 for the Port Cameron Project which would be associated with development of marine berths. Ongoing USACE maintenance dredging is estimated at 97 million yd^3 over 20 years.

If the proposed dredging for the Venture Global Calcasieu Pass Project were to occur at the same time as the dredging for the Port Cameron Project, the Cameron LNG Project, the Commonwealth LNG project, and/or concurrently with nearby USACE maintenance dredging of the Calcasieu River Ship Channel, the adverse impacts on water quality (e.g., increased turbidity, total suspended solids, release of nutrient-bound contaminants) in the Project area could be exacerbated. However, dredging impacts tend to be localized (i.e., generally confined to the areas close to the dredging activity) and limited primarily to the time when the dredging is taking place (i.e., the effects cease soon after the dredging stops). Pile driving and sheet pile installation during in-water construction of the Venture Global Calcasieu Pass Project and other planned area projects, should these activities occur concurrently with each other, could also cumulatively affect water quality; however, as with dredging, these impacts would be localized, short-term, and temporary.

Before any dredging or pile driving can occur, Venture Global and the proponents of the other area projects would need to obtain section 10 RHA/section 404 CWA authorizations from the USACE and corresponding section 401 (CWA) Water Quality Certifications from LDEQ. These authorizations would be contingent on the companies' use of BMPs to minimize effects on water quality and to ensure that state water quality standards are not violated. Additionally, the permits would require that the dredged material be tested before being disposed of in an approved offshore or onshore location. These measures would ensure there are no long-term cumulative impacts on water quality as a result of foreseeable dredging and pile driving activities in the area.

Shoreline erosion is a concern along the Gulf Intracoastal Waterway and the Calcasieu River Ship Channel. Erosion may be caused by ship traffic or by engineered structures, such as levees along beaches or rivers. Natural processes, such as tide-induced currents, sea level changes, wind waves, and hurricanes or other extreme storms, also contribute to shoreline erosion. If the Venture Global Calcasieu Pass Project and other planned area projects all receive the necessary authorizations and permits and are constructed concurrently or in close succession, there could be several years of increased barge traffic. The combined barge traffic of these projects would increase the potential for cumulative shoreline erosion impacts in the Gulf Intracoastal Waterway and the Calcasieu River Ship Channel.

Construction of the Pipeline would require a total of 123 waterbody crossings, including 50 centerline crossings and 73 within the construction workspace but beyond the centerline. As noted in table 4.13.1.1-1, all but one of the other pipeline system projects are over 18 miles from the pipeline proposed for the Project. The proposed CMP/BUDM Slurry Line would, however, result in a potential increased risk to surface water impacts should an accidental spill or leak occur where the pipeline crosses approximately 5.9 miles of open waters. The material being transported consists of dredged material from the same area so contamination would not be expected but could result in increased turbidity in proximity to a break in the line. Cumulative impacts on surface water resources due to turbidity or stormwater runoff would be minor. In addition to the USACE permit and section 401 Water Quality Certification, the Venture Global Calcasieu Pass Project and other nearby projects would be required to comply with the LDEQ LPDES regulations for discharge of pollutants in stormwater or point source discharges. Compliance by the proponents of the other projects with these regulations, implementation of FERC's Plan and Procedures and other project erosion and sediment control plans, and project-specific BMPs would minimize cumulative impacts on surface water and groundwater quality.

Two other projects were identified using surface waters for hydrostatic testing. The Commonwealth LNG project would withdraw approximately 30,000 cubic meters (7.9 million gallons) of water from the Calcasieu River Ship Channel for hydrostatic testing of tanks. Prior to placing the LNG tanks into service, the Project would use approximately 77 million gallons of water from the Calcasieu River Ship Channel for hydrostatic testing of the tanks and equipment. The Driftwood LNG project would require six to eight million cubic yards of water from the Calcasieu River Ship Channel for hydrostatic testing of tanks. The Project, in combination with the Commonwealth LNG and Driftwood LNG projects, could result in a cumulative impact to river water withdrawal and discharge, however, each project would be required to comply with General Permit LAG6700 through the LDEQ relative to discharge of hydrostatic test water. The Project would also require approximately 8.3 million gallons of water for hydrostatic pre-testing and testing of the complete lateral pipeline; no other projects in proximity of the Project lateral line were identified that would use surface waters for pipeline testing. We believe the cumulative impacts due to the withdrawal and discharge of hydrostatic test water would be temporary and minor.

4.13.2.4 Wetlands

A total of 510.3 acres of wetlands would be disturbed by the construction and operation of the Project. During Project design, Venture Global minimized the impact on wetlands to the extent practicable. In the case of the Pipeline, impacts on wetlands would be mostly temporary, as they would be restored after construction. Construction of the Terminal site is expected to contribute more to long-term cumulative impacts on wetlands in the region (140.8 acres). Accordingly, as part of the permitting and approval process, Venture Global would prepare a wetlands mitigation plan and provide compensatory mitigation for the impacts on these wetlands. However, when considered with the wetland impacts from other projects, the cumulative impact could be potentially significant if adequate off-sets and mitigation are not implemented. According to publicly available information, other LNG projects in proximity to the proposed Project would have none to very limited impacts on wetlands, with the exception of the Port Cameron Project that would impact an estimated 322.9 acres. Port Cameron LLC proposes to provide compensatory mitigation through an approved Permittee Responsible Mitigation project. As part of the ongoing USACE maintenance dredging of the Calcasieu River Ship Channel, a substantial amount of dredged material is planned to be used for coastal wetlands and marshland creation and restoration (5,840 acres) which could also help offset some of the long-term wetlands losses from other cumulative projects. The CMP/BUDM Slurry Line would result in a beneficial impact to wetlands due to the fact that it will bring dredged material to the CPNWR for wetland mitigation and restoration from Project impacts.

Like Venture Global's proposed Project, impacts on wetlands would require the Port Cameron proponent to develop a wetlands mitigation plan in cooperation with the USACE for compensating wetland losses. Based on the expected wetland mitigation, and the proposed Project's mitigation for wetland losses, the Project would not have substantial or long-term impacts on sensitive wetlands and the project's contribution to cumulative effects would be limited.

4.13.2.5 Vegetation and Wildlife

A total of 737.3 acres of vegetation would be cleared during construction of the Terminal site, off-site support facilities, and proposed Pipeline. After construction, approximately 448 acres would be allowed to return to preconstruction vegetated conditions and 289.4 acres would be permanently altered. Wildlife habitats affected by construction and operation include approximately 403 acres of brackish and salt marsh within the Terminal site and construction support facilities, and 282 acres of wetlands associated with the pipeline and ancillary facilities. The wildlife habitat within the Terminal site would be permanently converted to industrial land where most of the vegetated and open water habitats would be replaced with surfacing materials such as concrete or gravel. Approximately 91.9 acres of marsh habitat is within the

TWS for the Terminal site and approximately 7 acres of marsh and 0.3 acre of water are within the TWS at the Construction Support Facilities site.

Impacts on wildlife could include displacement, stress, and direct mortality of some individuals. Potentially suitable cover, nesting, and foraging habitat for some wildlife species would be reduced due to clearing of vegetation. The greatest contribution to cumulative impacts on wildlife habitat would result from the permanent loss of approximately 304.7 acres of marsh within the Terminal site, Terminal support facilities, access roads, and marine facility area. This effect would be partially offset by Venture Global's implementation of compensatory wetland mitigation. The Port Cameron Project would result in the loss of wetland habitat, estimated at approximately 323 acres. It is anticipated that the cumulative loss of wetland habitat would be partially offset by project-specific mitigation, as well as other beneficial projects such as marsh habitat restoration and creation resulting from dredging material from the ongoing USACE maintenance dredging project (refer to wetlands discussion above).

To minimize impacts on migratory birds that may use forested habitat in the Project area, Venture Global would conduct clearing activities outside of the migratory bird nesting window of March 1 to September 15 at the Terminal site, and where practicable along the pipeline route. Where clearing would not be able to occur outside of the nesting window, Venture Global has indicated it would conduct a walkover of the Project area prior to construction; if active nests were detected, they would be avoided until the migratory bird young have fledged the nest(s).

Operation of the facilities would result in increased noise, lighting, and human activity that could disturb wildlife in the area. However, due to current industrial activities near the Project area, most wildlife in the area are acclimated to these conditions. In addition, Venture Global Calcasieu Pass has developed a Facility Lighting Plan that includes mitigation measures for light pollution, including the use of diffusers, lenses, and shields to reduce glare and light pollution, and to focus light distribution on the LNG loading dock platforms, perimeter fence, and working areas inside the Terminal's perimeter berm. Therefore, we expect cumulative impacts due to noise, light, and human activity during operation of the facilities to be negligible.

Vegetation and wildlife habitat in the vicinity of the Pipeline have been affected by past and ongoing agricultural processes, and construction and maintenance of existing roads, railroads, natural gas and oil pipelines, utility lines, and electrical transmission line rights-of-way. Construction and operation of the Pipeline would affect a total of 370.9 acres of wildlife habitat, including 30.9 acres of agricultural/pasture land, 31.4 acres of herbaceous land, 14.8 acres of open water, 282.2 acres of wetland, and 1.7 acres of shrub/scrub. Approximately 10.1 acres of lands affected by pipeline construction and operation include barren land and developed land, which are not anticipated to provide significant wildlife habitat value. Of this 370.9 acres of impact, approximately 369.7 acres would be temporarily impacted and allowed to revert to preconstruction condition after construction is completed, or avoided through the use of the HDD method. Permanent impacts would be from aboveground facilities and permanent access roads and would total 1.2 acres of wetlands that would not be allowed to revert to preconstruction condition. With the implementation of the Project-specific Plan and Procedures, significant use of the HDD method, and given the lack of other cumulative project activity in the vicinity of the pipeline route, cumulative impacts on vegetation and wildlife would be minimal.

4.13.2.6 Aquatic Resources

Dredging and pile driving during construction at the Terminal site would disturb the estuarine bed and potentially result in mortality of some benthic and aquatic organisms, if present. If Venture Global Calcasieu Pass' dredging and pile driving activities occur concurrently with those required for the other planned area projects (e.g., the Port Cameron Project), this impact would be exacerbated as a direct result of each of the projects' dredge activities and as sediments resettle following construction. However, these impacts would occur within an industrial ship channel that is maintained (including periodic maintenance dredging by the USACE) to support shipping for industrial activity. Venture Global Calcasieu Pass would use a hydraulic dredge with a suction cutter head, which would minimize resuspension of sediments and the resulting increases in turbidity and suspended sediment levels. Additionally, benthos in soft bottom habitats recover rapidly through various reproductive and recolonization mechanisms. Impacts on estuarine fisheries, including those related to changes in benthic forage, should be temporary with habitat use reverting to normal conditions following completion of construction. Therefore, we conclude that cumulative impacts on aquatic resources affected by construction and operation of the Terminal site would be minimal.

The CMP/BUDM Slurry Line would be partially located within the Calcasieu River Ship Channel and would include seven floating platforms to accommodate booster pumps. The slurry pipeline would be installed as a combination of floating and submerged but would be self-contained and temporary. Impacts to aquatic resources would be limited to a potential risk if there is a break in the line and a resulting turbidity plume ensues. A large plume could adversely impact aquatic resources. Where the pipeline is submerged and lying on the channel floor, there could be temporary impacts to the benthic substrate as well. These impacts are considered limited and temporary in nature. The potential for manatees and turtles colliding with the platforms would be negligible. In combination with the Project's impacts, the aquatic resource impacts from the Slurry Line would be minimal.

Hydroacoustic impacts on fish, sea turtles, and other animals with gas-filled cavities as a result of pile driving may include injury, trauma, or displacement of these aquatic resources. Venture Global Calcasieu Pass has indicated that it is considering noise attenuation measures to reduce underwater sound pressure levels produced by pile driving and implementation of suitable noise attenuation measures identified by LDWF and NMFS are likely to significantly reduce the extent of potentially harmful underwater noise impacts. It is expected that other proposed LNG projects and the Port Cameron Project that are in the vicinity of the proposed Project may also generate hydroacoustic impacts on aquatic resources during their construction phase. Should these project schedules overlap and noise and vibration impacts occur within the same impact zones, cumulative impacts on aquatic resources may be expected, but are likely to be minimal with implementation of noise attenuation measures. Refer to section 4.6 for further discussion regarding potential direct hydroacoustic impacts on aquatic species from the Project.

Potential impacts on fisheries resources resulting from construction of the Pipeline include sedimentation and turbidity, alteration or removal of in-stream and stream bank cover, water withdrawal during hydrostatic testing, and introduction of pollutants from inadvertent equipment spills or leaks. The aquatic impacts associated with the Pipeline would be temporary and limited to the construction period. Similar impacts on fisheries resources could occur from the Port Cameron Project. TransCameron Pipeline's implementation of its Project-specific Plan and Procedures, SWPPP, and SPCC Plan would minimize these impacts, and similar plans that would be required for the Port Cameron Project (i.e., SWPPP and SPCC Plan) would also minimize impacts. Water withdrawal and discharge for hydrostatic testing of the proposed pipeline would be conducted in compliance with the Project-specific Plan and Procedures and applicable permits such as General Permit LAG6700 through the LDEQ. As a result, cumulative impacts on aquatic resources associated with construction and operation of the Pipeline would not be significant.

4.13.2.7 Threatened and Endangered Species

As discussed in section 4.7, we have determined that the Project *is not likely to adversely affect* the federally threatened shorebird, red knot, or the federally and state-listed threatened piping plover. As such, no mitigation is proposed and the project would not contribute to cumulative impacts on these species. The Gulf sturgeon, a federally and state-listed threatened subspecies is not expected to be found in the Project area; however, it cannot be completely ruled out. As such, the Project *is not likely to adversely affect* the Gulf sturgeon and because the ESA section 7 consultation with NMFS is not yet complete, we recommend in section 4.7.1.5 that Venture Global not begin construction until consultation is complete. Similarly, while the Project *is not likely to adversely affect* the five federally listed sea turtles and seven federally listed whales that inhabit the Gulf of Mexico, we recommend in section 4.7.1.5 that Venture Global not begin construction until consultation is complete. Because the potential impact is unlikely to the Sturgeon, sea turtles, or whales, the cumulative impact on these resources is expected to be limited as a result of this Project and the other cumulative projects proposed along the Calcasieu River Ship Channel.

We have determined that with implementation of the appropriate mitigation measures, designed in consultation with the FWS and LDWF, construction and operation of the Project *is not likely to adversely affect* the federally and state-listed endangered West Indian manatee. These mitigation measures include Venture Global's implementation of collision avoidance measures recommended by the FWS; the establishment of an appropriate buffer zone for pile driving activities to avoid harassment or injury of marine mammals; and the use of noise minimizing mitigation measures during pile driving.

With the exception of the Commonwealth LNG project and the CMP/BUDM Slurry Line, based on available information and review of aerial photography, the other projects planned in the area appear unlikely to affect suitable habitat for federally listed species. If construction of the Project and Commonwealth LNG occur at the same time, there could be potential cumulative impacts on aquatic threatened and endangered species in the Calcasieu River Ship Channel. Construction of the Commonwealth LNG facility would include similar impacts to the aquatic environment (e.g., underwater noise, turbidity, vessel traffic) as described for the Project. The Commonwealth LNG project, like the Project, will be required to comply with ESA Section 7 to ensure construction and operation of the facility would not jeopardize the continued existence of federally listed species. Since the CMP/BUDM Slurry Line would be installed concurrently with Project dredging activities, there could be a cumulative impact to listed species should the slurry pipeline rupture and result in turbidity impacts. Turbidity from a break in combination with the Project dredging could increase the potential for impacts to habitat for sturgeon, manatees and sea turtles. The risk for pipeline break is limited and therefore this cumulative impact is considered minimal.

Further, any other future cumulative project identified that affects federally listed species would also need to comply with the ESA section 7 (for federal actions) and section 10 (for non-federal actions) to ensure the projects do not jeopardize the continued existence of federally listed species. In conclusion, we have determined that there could be cumulative impacts on aquatic threatened or endangered species due to construction and operation of the Project, but these impacts would be avoided or minimized through measures developed as part of the ESA Section 7 consultation process.

4.13.2.8 Land Use, Recreation, and Visual Resources

Land Use

The Terminal site would impact primarily open, barren wetland land use areas, and to a lesser extent hay/pasture, herbaceous, developed, open water, and scrub/shrub land uses. Most of the area would be permanently converted to industrial use for long-term operation of the Terminal facility. In addition, construction of the Port Cameron Project would result in a cumulative increase in the conversion of a variety of land uses to industrial/commercial use in the cumulative impact area. However, the USACE and LDEQ would require compensatory mitigation for wetland loss for the Venture Global Calcasieu Pass Project and the other projects that have associated loss of jurisdictional wetlands. Because there are many areas of wetlands, and open water that would remain unaffected by the Project and other area projects, we believe that the Venture Global Calcasieu Pass Project would contribute to cumulative land use changes in the area but would not result in a significant cumulative impact.

There would not be any cumulative impacts on land use from construction of the Pipeline, as we did not identify any other projects in the land use geographic scope.

Recreation

There are no federally or state-managed recreational areas or lands located within 0.25 mile of the Project; however, the Davis Road Public Boat Launch and the Cameron Jetty Fishing Pier and RV Facility are located within 0.25 mile of the Terminal site. Access to these facilities would be removed to allow for construction and operation of the Terminal site. Venture Global Calcasieu Pass is supporting Cameron Parish in its efforts to continue the public use of the Jetty Pier and is coordinating with the Parish in review of plans to develop alternate access to these facilities (e.g., a water shuttle service), and to potentially relocate the RV Facility to another location north of the Terminal site. This particular impact is considered a direct effect and would not have cumulative impacts from other projects. As discussed in section 4.8.1.3, the CEA addresses the public's use of the Jetty Pier and we recommend that Venture Global Calcasieu Pass file updated correspondence with the Cameron Parish Police Jury in regard to the Jetty Pier Facility.

The geographic scope of potential impact for recreational fishing was considered to be the barge delivery routes within the Gulf Intracoastal Waterway and the Calcasieu River Ship Channel. Construction of the Project and other planned area projects would temporarily impact local recreational fishing and boating activities. During construction and operation, barges delivering materials and equipment to the docks, and LNG vessels transiting to any of the terminals, may impede or delay recreational boat traffic. However, the cumulative impact of these projects would be mitigated somewhat by the fact that recreational boating and fishing occurs more often on weekends and holidays, and construction activities would likely be reduced during these peak times. Moreover, the cumulative impact of project vessel traffic during construction would be short-term. The long-term vessel traffic from the Project, in combination with vessel traffic from Port Cameron Project, maintenance dredging of the Calcasieu River Ship Channel, and Commonwealth LNG, would increase the shipping traffic in the channel and could cumulatively impact recreational fishing and boating. However, with implementation of project conditions, including ensuring compliance with USCG regulations related to safety and security of the waterway, would limit the potential for significant cumulative effects on recreational fishing and boating.

Visual Resources

The visual character of the Terminal site would be similar to and consistent with the ongoing industrial facilities and activities along the Calcasieu River Ship Channel, as well as the many oil and gas facilities in the area. Construction of the Terminal site would include ten single MR blocks; LNG storage facilities; boil-off, flash, and gas relief systems; two berthing docks; an electric generation facility; support buildings; and facility lighting. Construction of the other planned area LNG projects would involve constructing similar facilities that would contribute to cumulative visual impacts. The Terminal site, as well as the other planned area LNG projects if constructed, would operate flares during start up or upset conditions. If flaring were to occur at more than one facility simultaneously, the temporary visual impact on observers would be exacerbated. However, it is unlikely that the start-up flares from multiple facilities would be in use at the same time due to schedule variability. Moreover, upset conditions that would require the use of flares cannot be predicted, but it is unlikely that upset conditions requiring flaring would occur at the same time at more than one facility. Therefore, we do not believe the Terminal site would result in significant cumulative impacts on visual resources.

The Pipeline would not be in close proximity to other planned area projects identified in table 4.13.1.1-1. As such, impacts resulting from the construction of these facilities would not contribute significantly to cumulative visual impacts. No additional impacts would occur during operation of the Pipeline.

4.13.2.9 Socioeconomics

Socioeconomic Conditions

Construction of the Project would generate a substantial number of jobs. It is estimated that an average of 1,425 workers would be needed over the duration of 38 months beginning in 2018, peaking at 1,610 workers. Construction of 14 other projects listed in table 4.13.1.1-1 could also occur during portions of that time period. Simultaneous construction of those projects would require a large number of workers from the local labor pool. The cumulative effect would be a reduction in local and perhaps regional unemployment.

The abundance of jobs resulting from the Venture Global Calcasieu Pass Project would lead to an influx of non-local workers, which would impact transient housing in the geographic scope of potential impact. Considering the number of temporary housing units currently available, as well as those proposed, in Cameron, Calcasieu, and Jefferson Davis Parishes in Louisiana, and Orange and Jefferson Counties in Texas, sufficient units would be available for the peak temporary construction workforce. Should other major projects listed in table 4.13.1.1-1 be constructed at the same time as the Venture Global Calcasieu Pass Project, the amount of available housing may not be sufficient, and workers would be required to seek transient housing a further distance away with longer commutes. It is expected that the Port Cameron Project will generate 10,000 jobs which would cumulatively strain the demand for housing. As noted in section 4.9, a number of new housing projects are anticipated in the region in addition to the available temporary housing. If all of the proposed housing projects were constructed, an additional 13,348 units would be available. It is expected that like the Project, the majority of workers associated with the Port Cameron Project would be sourced from the five parish/county Study Area, reducing the demand for temporary housing. A significant cumulative impact to housing is not expected.

If several of the projects listed in table 4.13.1.1-1 were to be constructed at the same time, the combined construction workforces would increase the need for some public services, such as police, fire, medical services, and schools. Construction of the Project would result in little to no short-term impact on the availability of these local community facilities and services; however, if the construction schedules of the other projects overlap with the Project, there is greater potential for cumulative impact on such services, particularly in Cameron Parish. If the medical and emergency services, or other public services, are adversely affected during construction, the project sponsors may mitigate the impact by providing funding for temporarily increasing the staff and equipment of the public services affected. In addition, other LNG projects would be required to file an Emergency Response Plan like the Project's requirement, which includes a Cost-Sharing Plan describing any direct cost reimbursements agreed to for state and local agencies.

With construction of some of the major projects listed in table 4.13.1.1-1 having the potential to last several years, it is likely that some construction workers might bring their families, including school-age children. The number of workers choosing to move with their families is expected to be relatively small; however, this would increase the population in some schools in the parishes/counties housing the workers with families. The children of these families would likely be spread across many school districts in the three parishes and two counties, and so the increases in children attending any particular school would likely be minimal. As a result, there would not likely be a significant cumulative impact on schools during the potential concurrent construction periods.

A large workforce for the simultaneously constructed projects would have a beneficial cumulative effect on revenues for the state, and for Cameron, Calcasieu, and Jefferson Davis Parishes in Louisiana, and Orange and Jefferson Counties in Texas, due to expenditures for services and materials for the projects, increased expenditures by local workers, and expenditures by the non-local workforce and any family members accompanying the non-local workers. The parishes and counties would also receive a substantial increase in property taxes from the combined projects.

Marine Transportation

Construction of the Project, and the projects listed in table 4.13.1.1-1 if constructed, would increase barge and support vessel traffic in the Gulf Intracoastal Waterway and the Calcasieu River Ship Channel. Concurrent construction of the Project and the other projects listed in table 4.13.1.1-1 would likely result in a cumulative impact on vessel traffic in the waterway, primarily by increasing congestion and vessel travel times. However, these impacts would be temporary and the extent of the impacts would depend on the frequency and number of deliveries being made for various projects at any given time during the respective construction periods.

The Calcasieu River Ship Channel Traffic Study (Ausenco, 2014) considered the operation of eight other planned and proposed terminal projects in the general Project area to evaluate the cumulative effects of these projects and existing projects on marine vessel traffic. The study concluded that, even with channel traffic expected to double to 2,183 vessel calls in 2023, the Calcasieu River Ship Channel would be able to accommodate the additional traffic. Moreover, LNG carrier traffic associated with operation of the LNG facilities would be governed by USCG requirements. The temporary installation of the CMP/BUDM Slurry Line could interfere with vessel traffic in the channel but the pipeline would likely be located near the shoreline and/or submerged. Likewise, the booster pump platforms could interfere with vessel traffic but would be located in coordination with the USCG requirements and USACE permits. Therefore, we believe that cumulative impacts on marine transportation would not be significant.

Land Transportation

The greatest potential for cumulative impacts on vehicular traffic and roads during construction and operation of the Venture Global Calcasieu Pass Project is associated with the Terminal site. Construction-related traffic associated with the Pipeline would result in only minor, temporary impacts on traffic, would be relatively short-term at any given location, and would not be in close proximity to other known large projects.

During construction of the Terminal site and the Port Cameron Project, roadways in the area would experience a substantial increase in daily vehicle trips as a result of material and equipment deliveries and commuting of construction personnel to and from the project sites. According to the Lake Charles Urbanized Area Transportation Plan 2040 researched and authored by the Imperial Calcasieu Regional Planning and Development Commission, the region is expected to experience a 37 percent increase in population, a 36 percent increase in dwelling units, and a 53 percent increase in employment and projects transportation needs accordingly. Transportation officials in the area have been working to improve transportation corridors to accommodate the economic growth expected in the area. Cumulative impacts on roadway transportation would occur if construction of the Project and the Port Cameron and Commonwealth LNG projects occur at the same time. These impacts would be temporary, however, and would be mitigated as construction phases wind down and transportation improvement projects are completed.

Venture Global Calcasieu Pass prepared a Traffic Management Plan in which it indicates preliminary plans for materials to be transported by barge and delivered to nearby existing aggregate storage and handling facilities prior to completion of the construction berth. Venture Global Calcasieu Pass also states that it plans to address worker and material transport through off-site parking, shuttles, and infrastructure. These measures, in addition to other potential measures such as controlled shift times and coordination among the other projects to reduce peak hour vehicular trips, traffic signal coordination/timing, intersection and road improvements, and use of law enforcement to control traffic, would help mitigate for and alleviate cumulative impacts from the other area projects, if needed. With these mitigation options available, we believe that cumulative impacts on land transportation would not be significant.

4.13.2.10 Cultural Resources

Venture Global has consulted with the appropriate SHPO in regards to the impact of the Project. The necessary cultural resource surveys have been completed and field surveys reports prepared. To date, the SHPO has concurred that construction of the Project facilities would not affect historic properties, and we also concur. Therefore, the Project would not contribute to cumulative impacts on cultural resources.

4.13.2.11 Air Quality and Noise

Construction of the Project and many of the past, present, or future projects listed in table 4.13.1.1-1 would involve the use of construction equipment that generates air pollution, including fugitive dust. Operation of construction equipment would be primarily restricted to daylight hours and would be minimized through typical controls and practices, some of which are required under LDEQ rules. The emissions from construction activities for the Project and other projects in the region would result in short-term emissions; therefore, construction emissions are not expected to have a significant cumulative impact on regional air quality.

Operation of the Project, including LNG carriers and associated support vessels in the vicinity of the Terminal site, would contribute cumulatively to air pollutant levels in combination with some of the other projects identified as part of the cumulative impact analysis. As discussed in section 4.11, detailed air quality impact analyses were conducted by Venture Global to quantitatively evaluate the combined impacts from operation of the Project and other emission sources in the region, including pollutant background concentrations. Those combined impacts were compared against the NAAQS, which are designed to be protective of human health and the environment. The results of the NAAQS analyses demonstrated that there would be no significant impact on regional air quality from operation of the Project. As presented in section 4.11.1.6, Venture Global did not conduct regional modeling analysis for the Terminal plus LNG carrier and supporting vessel mobile emissions with background concentrations for comparison to the NAAQS. We have included a recommendation to provide this modeling analysis before the end of the draft EIS comment period to verify our conclusions regarding the cumulative operational air quality impacts from the Project.

Newly proposed (future) projects in the area would contribute cumulatively to air quality through construction and operation activities. Each of these projects would need to comply with federal, state, and local air quality regulations, which may require controls to limit the emissions of certain criteria pollutants or HAPs. It is anticipated that these project activities would result in increased permanent emissions of criteria pollutants, HAPs, and GHGs within the region. The Project's associated operating emissions would be mitigated by federal and state permits and approvals. The air quality modeling performed for the Project evaluates the project emissions in combination with emissions from other existing and permitted sources (including the four LNG projects listed in Table 4.13.2.11-1 that are located within 50 kilometers from the Terminal site), and demonstrates that the project in combination with these sources will not cause or contribute to a violation of the NAAQS. Like the Project, the cumulative projects are required to demonstrate that they meet the federal and state emissions standards and that they will not cause or contribute to a violation of the NAAQS, either individually or in combination with other existing and permitted sources. Thus, while the Project would incrementally contribute to regional emissions, it is not anticipated to contribute to a significant cumulative air quality impact.

Operational noise levels typically attenuate quickly as the distance from the noise source increases. Therefore, the geographic scope of potential impact considered for noise is within about 1 mile of the Project. The only potential project located within the geographic scope of potential operational noise impact is the Commonwealth LNG project. Operation of the Commonwealth LNG project would generate noise. The Commonwealth LNG project has not completed the FERC approval process and is in the pre-filing phase and has an expected in-service date of 2019 or later.; The EIS process has been initiated but information on operational noise generated at that site is not yet available to determine the cumulative effect when combined with the Project. For the Project, the FERC would require that noise at the NSAs generated during operation would not exceed the 55 decibel limit established by the EPA for protection of public health and welfare. The combined operation of the Commonwealth LNG project, should it be authorized, could result in the raising of the average ambient noise level at the nearest NSAs but not by a significant measure. Cumulative operational noise would be audible at the Terminal site, but should not be significantly greater than current measured ambient noise due to noise attenuation.

No projects are located within the geographic scope of potential cumulative construction noise impacts. There are no NSAs within 0.5 mile of construction activities at the Terminal site, and noise associated with the Pipeline construction (where 14 NSAs are located within 0.5 mile of HDD operations), would be short-term, temporary, and mitigated appropriately. Therefore, cumulative noise impacts associated with construction would be unlikely to be noticeable, unless one or more of the projects were constructed concurrently at the same location which is not anticipated.

4.13.2.12 Climate Change

Climate change is the change in climate over time, whether due to natural variability or as a result of human activity, and cannot be represented by single annual events or individual anomalies. For example, a single large flood event or particularly hot summer are not indications of climate change, while a series of floods or warm years that statistically change the average precipitation or temperature over years or decades may indicate climate change.

Climate Change has already resulted in a wide range of impacts across every region of the country and that impacts extend beyond atmospheric climate change alone and include changes to water resources, transportation, agriculture, ecosystems, and human health. These changes are driven by accumulation of GHG in the atmosphere through combustion of fossil fuels (coal, petroleum, and natural gas), combined with agriculture and clearing of forests. These impacts have accelerated throughout the end of the 20th and into the 21st century. Although climate change is a global concern, for this analysis, we will focus on the potential cumulative impacts in the Project area.

The following observations of environmental impacts with a high or very high level of confidence are attributed to climate change in the Southeast region:

- average temperatures have risen about 2 °F since 1970 and are projected to increase another 4.5 to 9 °F during this century;

- increases in illness and death due to greater summer heat stress;

- the destructive potential of Atlantic hurricanes increased since 1970 and the intensity (with higher peak wind speeds, rainfall intensity, and storm surge height and strength) is likely to increase during this century;

- within the past century in the U.S., relative sea level changes ranged from falling several inches to rising about 2 feet and are projected to increase another 3 to 4 feet this century;

- sea level rise and human alterations have caused coastal wetland loss during the past century, reducing the capacity of those wetlands to protect against storm surge, and projected sea level rise is anticipated to result in the loss of a large portion of the nation's remaining coastal wetlands;

- declines in dissolved oxygen in streams and lakes have caused fish kills and loss of aquatic species diversity;

- moderate to severe spring and summer drought areas have increased 12 to 14 percent (with frequency, duration, and intensity also increasing and projected to increase);

- longer periods of time between rainfall events may lead to declines in recharge of groundwater and decreased water availability;

- responses to decreased water availability, such as increased groundwater pumping, may lead to stress or depletion of aquifers and a strain on surface water sources;

- increases in evaporation and plant water loss rates may alter the balance of runoff and groundwater recharge, which would likely lead to saltwater intrusion into shallow aquifers;

- coastal water temperatures rose about 2 °F in several regions and are likely to continue to warm as much as 4 to 8 °F this century; and

- coastal water warming may lead to the transport of invasive species through ballast water exchange during ship transit.

Climate change in the Project region would have two effects that may cause increased storm surges: increased temperatures of Gulf Waters which would increase storm intensity, and a rising sea level. The ground elevation across the Terminal site would generally be raised to 5 feet or greater above NAVD88 in the liquefaction area and 4 feet or greater above NAVD88 in the construction laydown area. In addition, a protective levee or perimeter berm would be constructed to protect the facility against storm surge and potential wave action, providing sufficient protection for the facility up to the 500-year storm event.

The GHG emissions associated with construction and operation of the Project were identified and quantified in section 4.11. Based on the total annual potential emissions for the constructed Terminal site, Project operations would increase CO_2e emissions by 3,915,514 tpy.

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, hot oil heaters, acid gas thermal oxidizer, fugitive emissions, and flares/purges at the Terminal site which was submitted to EPA for review. CO_2e

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 O&M 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 599,662 tpy of CO_2e emissions based on an annual total, the proposed BACT emission limit for each hot oil heater is 138,618 tpy of CO_2e emissions based on an annual average, and the proposed BACT emission limit for the acid gas thermal oxidizer is 726,480 tpy of CO_2e 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 CO_2 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 3,128 tpy of CO_2e emissions based on an annual total. BACT for the cold, warm, and LP vent flare pilot operations, as well as the cold, warm, and LP vent flare purge operations, would be achieved through proper equipment design, good combustion practices, and good O&M practices. The proposed BACT emissions limit for flare pilot and purge operations is 1,135 tpy of CO_2e emissions based on an annual total.

Venture Global provided an assessment of the feasibility of a carbon capture and storage (CCS) system to LDEQ as part of the GHG permit application BACT analysis. Venture Global provided information on the technical and economic feasibility of developing and using CCS for the Terminal site. This technology involves deploying a method to capture carbon from the exhaust stream of the combustion units and then finding a method for permanent storage (injecting the recovered CO_2 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 to CO_2 emissions from turbines, thermal oxidizers, and flares such as those typically located at an LNG terminal. In addition, no long-term CO_2 storage facilities are located near the Project as the region does not have geological formations that support sequestration. Therefore, 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. EPA and LDEQ are still evaluating the GHG permit application for the Terminal site.

There is no standard methodology to determine whether, and to what extent, a project's incremental contribution to GHG emissions would result in physical effects on the environment for the purposes of evaluating the Project's impacts on climate change, either locally or nationally. Further, we cannot find a suitable method to attribute discrete environmental effects to GHG emissions. We have looked at atmospheric modeling used by the IPCC, EPA, National Aeronautics and Space Administration, 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 CO_2 concentrations, atmospheric forcing, or ocean CO_2 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 CO_2 concentrations, heat forcing, or similar global impacts to project-specific GHG emissions. Similarly, the ability to determine localized or regional impacts from GHGs by use of these models is not possible at this time.

The emissions would increase the atmospheric concentration of GHGs, in combination with past and future emissions from all other sources, and contribute incrementally to future climate change impacts. Because we cannot determine the projects' incremental physical impacts on the environment caused by climate change, we cannot determine whether the projects' contribution to cumulative impacts on climate change would be significant.

4.13.2.13 Safety

Venture Global would mitigate impacts on public safety through implementation of applicable federal, state, and local rules and regulations for the proposed Project as described in section 4.12. Those rules and regulations would ensure that the applicable design and engineering standards would be implemented to protect the public and avoid or minimize the potential for accidents and failures.

Emergency response time is a key aspect of public health and safety. Key emergency services may need to be expanded to accommodate the Project. If so, and in accordance with our regulations, Venture Global would prepare a comprehensive emergency response plan that would meet the requirements of 49 CFR 192.615 and would identify the cost sharing mechanisms for funding these emergency response activities. This plan would minimize the potential for a cumulative public safety impact associated with the Project.

The other LNG projects listed in table 4.13.1.1-1, if authorized, constructed, and operated, each would also have to prepare and implement a similar comprehensive plan to provide emergency services. In addition, we anticipate that the other major planned projects in the area would include emergency services within their facilities, and have emergency response plans developed with the appropriate agencies. Emergency response at any of those facilities could temporarily stress emergency services in the area, but we would not expect them to result in a long-term significant impact on those services. In the unlikely event of major emergencies at several facilities at the same time, there could be a short-term but significant cumulative impact on emergency services within Cameron and Calcasieu Parishes; however, we find this to be highly unlikely and therefore discountable. Furthermore, that impact could be mitigated by assistance from emergency service providers from surrounding parishes and counties. Therefore, long-term significant cumulative impacts on emergency services is not expected.

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, EPA, and DOT 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 Venture Global Calcasieu Pass Project would result in adverse environmental impacts. Most of these environmental impacts would be temporary or short-term during construction and operation, but long-term and permanent environmental impacts on wetlands, vegetation, 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 Calcasieu Pass and TransCameron Pipeline 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. 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 proposed Project is constructed and operated in accordance with applicable laws and regulations, the mitigating measures discussed in this EIS, and our recommendations, all of the adverse environmental impacts would be reduced to less than significant levels. Furthermore, based on our engineering design analysis and recommendations, the design spill methodology reviewed by DOT for the facility, the LOR issued by the USCG for the LNG marine traffic in the Calcasieu River Ship Channel, and the regulatory requirements for the pipeline and liquefaction facility, we conclude that the Project would not result in significant increased public safety risks. A summary of the anticipated impacts from the project and our conclusions regarding impacts are provided below by resource area.

5.1.1 Geology Resources

Construction and operation of the Project would not affect active mining or nonfuel mineral resources during construction or operation. The Project also would not affect any active or abandoned oil or gas wells, or active or potential surface mines. No sensitive paleontological resources have been identified within the Terminal site or Pipeline; therefore, no impacts are anticipated by constructing and operating the Terminal and Pipeline.

In general, the potential for geologic hazards such as earthquakes, soil liquefaction, landslides, or a seismically generated tsunami or seiche to significantly affect construction or operation of the proposed project facilities is low. However, some hazards such as flooding and long-term sea level rise could affect the Project during operation. Venture Global Calcasieu Pass and TransCameron Pipeline would design and construct the aboveground facilities at the liquefaction facility and the meter station at an elevation to minimize the potential impacts from flooding and sea level rise.

A low risk of seismic activity and faulting effects can be reasonably anticipated for the Project area. Venture Global's *Seismic Hazard Assessment* report includes 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 being 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, they may be a potential source of surface deformation. Venture Global Calcasieu Pass conducted a detailed investigation of the potential for surface faulting and concluded that no major growth faults cross the Terminal site.

We conclude that soil liquefaction would not present a significant hazard at the Terminal site or Pipeline. Should soil improvement be required to counteract soil liquefaction, Venture Global would utilize ground improvement techniques (e.g., densification, cementitious strengthening) or removal and replacement of existing soils with non-liquefiable material.

Subsidence is unlikely to present a significant hazard to the Terminal due to limited sub-surface water extraction for agriculture, flood protection, or development on the Project site. The natural subsidence rate for the area where the Terminal site and associated facilities is located is considered low at 0 to 1.0 foot of subsidence every 100 years (USACE, 2013a). Venture Global Calcasieu Pass has indicated that it would conduct maintenance of the perimeter berm to address berm settlement including short- and long-term elevation changes.

Excavation, grading, and filling of the Terminal site and berthing area, and construction of the perimeter berm, would alter the local topography and bathymetry. The overall effect of the project on topography and geology would be minor. Due to the low relief across the Terminal site, there is little likelihood that landslides or slope movement at the Terminal site would be a realistic hazard. Increased storm activities, shortage of sediment supply, and sea level rise have made shoreline erosion a major concern in southern Louisiana. Venture Global Calcasieu Pass has proposed to reinforce the excavated shoreline with rip-rap armoring to minimize the potential for erosion. Further, Venture Global Calcasieu Pass has been consulting with the USCG on its Follow-on WSA to address impacts from ship traffic. Routine inspections of the pipeline in compliance with PHMSA, DOT Part 192 would ensure that accelerated shoreline erosion would be sufficiently monitored.

Because of its location, the Terminal site would likely be subject to hurricane force winds during the life of the Project. LNG facilities, including the LNG tanks and associated safety systems, would be designed for a sustained wind speed of at least 150 mph without the loss of structural or functional integrity.

The Terminal site would be susceptible to flooding caused by hurricanes, tsunamis, and long-term sea level rise. Venture Global Calcasieu Pass proposes to construct an earthen berm on the west side of the site, and a floodwall on the east, north, and south sides of the site to minimize impacts associated with potential storm surge. The berm would have stone armor on the non-protected side and grass cover over the crest and protected side. The floodwall would be a combination wall with steel pipe king piles and intermediate steel sheet piling to provide the structural capacity for protection of the enclosed plant infrastructure.

The LNG Terminal site would be cleared, grubbed, and prepared using standard earthmoving and compaction equipment. Foundations used for the LNG Terminal would range from shallow foundations for lightly loaded structures to deep pile foundations for the LNG storage tanks and the other LNG facilities and buildings. Deep foundations would either be driven precast concrete piles or open-ended steel piles. Impacts within the Terminal site would be limited to construction activities within the work areas.

Venture Global Calcasieu Pass has proposed a feasible design that is currently at the FEED level of completion. We are recommending that Venture Global Calcasieu Pass file its final design drawings, specifications, and quality control and maintenance procedures, stamped and sealed by the professional engineer-of-record, to ensure that the final design addresses the requirements identified in the FEED.

The pipeline would be coated with concrete and buried, which would protect them from the direct physical force of flood waters, waves, and wind. Impacts resulting from grading and trenching along the pipeline rights-of-way would be temporary because TransCameron would restore these areas to preconstruction contours to the maximum extent practicable.

Based on the above discussion, in consideration of Venture Global Calcasieu Pass' and TransCameron Pipeline's proposed mitigation and design criteria, and based on our recommendations, we conclude that the Project would not significantly impact or be impacted by geologic 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, about 56.3 acres of soil in the Terminal site area are considered highly susceptible to erosion by water, while less than 1 acre of soil in the area crossed by the pipeline is considered highly susceptible to erosion by water (0.9 acre) and wind (<0.1 acre). Due to the fine textured soils and nearly level topography in the project area, minimal revegetation concerns were identified (<0.1 acre of Peveto fine sand, 1 to 3 percent slopes soil crossed by the pipeline). However, the majority of the soils in the project area are prone to compaction. About 144 acres (31 percent) of soil impacted by construction of the Terminal and 291.8 acres (78 percent) of soil impacted by construction of Pipeline would be prone to compaction. TransCameron Pipeline would minimize rutting and compaction of soils by constructing pipeline facilities in dry conditions to the extent practicable. In wetter conditions, the selective use of timber mats and low-ground pressure equipment would help to minimize impacts to compaction prone soils.

No prime farmland soils would be impacted by construction or operation of the Terminal facility. Approximately 6 percent (23.5 acres) of soils crossed by the Pipeline are classified as prime farmland. To prevent mixing of soils during construction, the topsoil would be separated from subsoil as appropriate and replaced in the proper order during backfilling and final grading. Following construction, agricultural areas and drainages would be restored to preconstruction conditions in accordance with Venture Global's Project-specific Plan and Procedures.

Venture Global conducted analysis to identify potential contaminated sediments. No contaminated sediments were identified at the proposed Terminal site or along the Pipeline. 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 construction workspace could carry unconfined debris or other materials. Venture Global has developed and would adhere to a SPCC Plan and SWPPP for construction activities. Use of these plans would minimize the potential for spills and provide measures to clean up any inadvertent spills.

No hazardous waste sites are located at the Terminal site or along the Pipeline route. Venture Global conducted several Phase I Environmental Site Assessments that did not reveal any evidence of spills, leaks, or releases such as distressed vegetation, stained or discolored soil, oil sheens, or unusual odors. Additionally, database searches did not reveal any known releases of petroleum products, hazardous materials, or hazardous waste on the Project site or adjacent properties, and no groundwater contamination concerns were raised.

Venture Global would implement the mitigation measures contained in the Project-specific Plan and Procedures to control erosion, enhance successful revegetation, and minimize any potential adverse impacts on soil resources. In addition, disturbed areas would be monitored 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 plans, and with our additional recommendations, we conclude that impacts on soil resources would be adequately minimized.

5.1.3 Water Resources

The Project facilities are underlain by the Chicot aquifer, which is an EPA-designated sole-source aquifer. We do not anticipate any long-term or significant impacts on the aquifer due to construction or operation of the Project.

There are three active monitoring wells and four abandoned and plugged rig supply wells located within 150 feet of the Project. The three active monitoring wells are located approximately 80 feet north of the pipeline's construction workspace. One of the four plugged and abandoned rig supply wells is located within the footprint of the proposed Terminal site and the remaining three within 150 feet of the Terminal site. Venture Global Calcasieu Pass and TransCameron Pipeline propose to conduct pre- and post-construction monitoring of well yield and water quality if any water supply wells are identified within 150 feet of construction activities. If the project results in adverse impacts, Venture Global Calcasieu Pass or TransCameron Pipeline would provide a temporary source of water to those affected and repair or replace the affected water wells.

During construction and operation of the Terminal facility, Venture Global Calcasieu Pass has indicated that it would use existing municipal water supply sources and/or on-site groundwater wells to provide a portion of the required industrial and potable fresh water for the Project's construction and operation. Venture Global Calcasieu Pass estimates that about 61.3 million gallons of water would be withdrawn from municipal or on-site wells in the Chicot aquifer for raw water use during construction of Terminal facilities. An additional approximately 11.4 million gallons of water would be withdrawn from municipal sources for personnel potable water consumption. Seawater would be withdrawn from the Calcasieu River Ship Channel for LNG tank hydrostatic tests on the Terminal site property. Approximately 61.5 million gallons of water used during pipeline construction (e.g., for hydrostatic testing, HDD drilling mud, and dust control) would also be from surface water sources. During operation of the facilities, approximately 600,000 gal/d of water for employees, utility/service water, and process water would be supplied either from the local municipal system or from a new water supply well. Venture Global Calcasieu Pass would coordinate with municipal water suppliers as needed to assure that the local water supply systems could provide adequate supply. Because the location and details of the Terminal's long-term water supply have not been finalized, we are recommending that prior to the end of the draft EIS comment period, Venture Global Calcasieu Pass file the results of its planned aquifer pumping test and provide documentation of consultation with the LDEQ regarding adequate groundwater supply for both construction and operational demands. As a result, while the Project would contribute to groundwater withdrawals and would potentially lower the water table at the point of withdrawal, confirmation of adequate water supply would show that the Project would not result in a significant cumulative impact to groundwater supply.

The installation of piles for the liquefaction facilities, anticipated to be driven to a depth of 110 feet, would not be expected to have direct impact on the underlying aquifer, which ranges about 190 to 210 feet below the surface. The potential for cross-contamination of aquifers by deep piling activities would be low since the pilings would not penetrate the upper Chicot aquifer and would be separated from the upper Chicot aquifer by approximately 80 to 100 feet of low permeability clay, silty clay, and sandy clay.

Other construction activities would not significantly impact groundwater resources because the majority of construction would involve shallow, temporary, and localized excavation. Venture Global Calcasieu Pass and TransCameron Pipeline would use specialized construction techniques such as sheet piling and earthen berms to control surficial water flow and infiltration, and well pointing and/or pit-to-pit dewatering techniques to temporarily lower the water table in the immediate area during trenching and backfilling. Spills or leaks of hazardous materials (e.g., fuel, lubricants) from equipment working in the onshore areas could also result in adverse impacts on water resources. However, with the implementation of the measures in the Project-specific Plan and Procedures and SPCC Plan, impacts on groundwater resources from construction and spills/leaks would be minimized to the extent possible.

At the Terminal facility, the turning basin and all marshlands west of Davis Road are located within designated EFH. The Project would result in permanent impacts on approximately 83.3 acres of EFH associated with construction of the marine berm (3.4 acres) and the dredging/excavation of the shoreline and ship channel (79.9 acres converted to deeper EFH). Permanent impacts on wetlands and waterbodies containing EFH would be mitigated through Venture Global's Compensatory Mitigation Plan, which would include the beneficial use of dredged material. The Project is also expected to result in temporary impacts associated with in-water construction, turbidity, and pile driving-related underwater noise affecting nearshore habitat. Underwater noise would account for the majority of this impact area. These impacts are expected to be of short duration, as populations of FMP 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, the SPCC Plan, development of an agency-approved noise attenuation plan (see conditions in section 4.6.2), and the HDD Contingency Plan. Therefore, we conclude that construction of Terminal facilities would adversely affect EFH, but these adverse effects would be temporary. Permanent adverse effects on EFH would be offset by compensatory mitigation (from the CMP/BUDM) sufficient to produce a net increase in EFH function.

The primary impacts on water quality within this area would be associated with dredging and the associated increased turbidity, total suspended solids, and release of nutrient-bound contaminants. Venture Global Calcasieu Pass proposes to use a hydraulic dredge with a suction cutter head for the offshore dredging, which would minimize turbidity and water quality impacts. Additionally, any effects would be minor since they would be temporary and limited to the immediate area. Venture Global Calcasieu Pass would be required to implement the measures incorporated into the USACE permit, including any special requirements/procedures for handling contaminated sediments, if discovered. Venture Global conducted a Tier I Evaluation, which includes a comprehensive analysis of existing readily available physical, chemical, and biological monitoring data. Based on this analysis, which was included in Venture Global's JPA, Venture Global identified no evidence of potential sediment pollution due to reported release and found that the sediments are from locations far removed from sources of contaminants, that the sediments are from depths deposited in preindustrial times, and that the sediments are composed of sands and consolidated clays. As such, Venture Global's Tier I Evaluation found that no further testing was required.

Thirteen unnamed waterbodies are present within the Terminal site. Eleven of the waterbodies would be permanently affected during construction of the Terminal facilities, and the adjacent Calcasieu River Ship Channel would be both temporarily and permanently impacted. Impacts on these surface waters would be mitigated through implementation of Venture Global's final CMP/BUDM. During construction, land disturbance and vegetation removal could increase stormwater discharges to surface waters at and adjacent to the Terminal facility, resulting in a temporary increase in suspended sediment levels. Operation of the Terminal facility would increase the amount of impervious surface area at the site, which would result in an increased volume of stormwater runoff. Stormwater would be managed in accordance with LDEQ and EPA requirements. Therefore, we conclude that impacts from stormwater runoff would not be significant.

During construction of the project, barges and support vessels would deliver large equipment and materials to the construction support facilities. This traffic may increase shoreline erosion and temporarily increase turbidity levels within the turning basin and along vessel transit routes. The Calcasieu River Ship Channel was specifically created to provide deepwater access for maritime commerce. It is managed by the Port of Lake Charles, a deepwater seaport, and is maintained by regular dredging. As such, use of the channel by barges and support vessels to deliver materials during construction of the liquefaction facility would be consistent with the planned purpose and use of this active shipping channel, and associated impacts on water quality within the channel would be minor.

Venture Global Calcasieu Pass reported that approximately 12 to 13 LNG carriers would call on the LNG Terminal per month. LNG loading would require the discharge of ballast water. Venture Global Calcasieu Pass has indicated the ballast water discharged into the LNG berthing area would be composed mainly of Gulf of Mexico ocean water. Because the proposed Terminal site and turning basin/berthing area are located within the lower Calcasieu River Ship Channel (about 0.2 mile from the Gulf of Mexico), potential impacts are expected to be minor and may not be measurably different under normal tidal cycles. To ensure compliance with U.S. laws and regulations governing ballast water discharges, Venture Global Calcasieu Pass would review applicable documentation that the visiting LNG carrier's operation is in accordance with the federal standards and practices. Therefore, we conclude that significant impacts on surface waters would not occur as a result of ballast water discharges.

A total of 123 waterbodies would be crossed or otherwise affected (e.g., matted) by construction of the Pipeline. The pipeline construction workspace would cross 50 designated waterbodies including 21 perennial channels, 5 intermittent channels, and 24 open waterbodies (e.g., pond or borrow areas/permanently flooded). Named waterbodies that would be crossed by the pipeline include Creole Canal, Little Chenier Canal, and King's Bayou.

None of the waterbodies proposed to be impacted by the Pipeline are listed as Navigable Waterways, National Wild and Scenic Rivers, Outstanding Natural Resource Waters, or Louisiana Natural and Scenic Rivers. None of the waterbodies to be crossed by the Project are listed on the 303 (d) list for contaminated sediments; the Mermentau River is on the list for fecal coliforms, and the Intracoastal Waterway is on the list for fecal coliforms, turbidity, chloride, sulfates, and TDS.

Construction of the meter station and permanent access road at MP 0.0 would permanently fill approximately 1.3 acres of estuarine scrub-shrub and estuarine emergent wetland that is considered EFH. Installation of the pipeline would result in temporary impacts on wetlands and surface waters considered EFH because these wetlands and surface waters would be returned to preconstruction condition in accordance with applicable USACE and LDNR permit conditions and requirements. Approximately 9.0 acres of EFH east of Mermentau Road would be temporarily impacted. Approximately 47.9 acres of estuarine scrub-shrub wetlands, estuarine emergent wetlands, and other waterbodies considered to be EFH would be temporarily impacted between MP 15.2 and MP 18.2 from construction of the pipeline. These impacts would also be minimized through implementation of the Project-specific Procedures, the SPCC Plan, and the HDD Contingency Plan. Therefore, we conclude that the project would adversely affect EFH, but these adverse effects would be temporary. Permanent adverse effects on EFH would be offset by compensatory mitigation (from the CMP/BUDM) sufficient to produce a net increase in EFH function.

TransCameron proposes to conduct eight HDD operations that would avoid impacts on a total of 14 waterbodies. The remaining 36 waterbodies would be crossed by the open-cut method. TransCameron provided site-specific plan and profile drawings for the proposed HDD crossings with its application; however, some of the HDD crossing designs were subsequently modified to reduce impacts on wetlands. As noted in section 4.3, TransCameron Pipeline should file an HDD feasibility study and discuss the potential for hydrofracture and an inadvertent release of drilling fluids. The open-cut method would be implemented primarily for waterbodies located within wetland areas. Waterbodies crossed via the open-cut method could experience a decrease in water quality due to increased turbidity and sedimentation. However, due to the duration of disturbance, these impacts would be short-term. Waterbodies crossed by the pipelines via the open-cut method would experience short-term decreases in water quality resulting from increased turbidity, sedimentation, and overall bed and bank disturbance. However, we have determined that implementation of Venture Global's SPCC Plan, HDD Contingency Plan, and Project-specific Procedures would adequately minimize impacts on surface water resources.

Section V.B.1 of our Procedures require that instream work within coolwater and warmwater 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. Venture Global has requested instream construction in coolwater and warmwater fisheries from May 1 to September 30 for those waterbodies crossed by the open-cut method, and year-round for the construction of the Terminal facilities. We are recommending that Venture Global file written concurrence from LDWF of the proposed instream construction windows.

Section V.B.2.A of our Procedures requires that extra work areas be located at least 50 feet away from the water's edge except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. Extensive wetlands and open waters comprise a significant portion of the Pipeline's environmental terrain. In many cases, linear waterbodies (e.g., ditches and canals) are flanked directly by wetlands and have no upland bank profile, making it infeasible to locate ATWS areas at least 50 feet away from wetland and waterbody boundaries. TransCameron has provided sufficient justification for this proposed deviation or described how it would minimize impacts on the waterbodies.

Section V.B.4.b of our Procedures requires the use of sediment barriers to prevent the flow of spoil or silt-laden water into any waterbody. TransCameron Pipeline would follow its proposed Project-specific Procedures in locations where the poor compaction of native soil in marshland and open water for pipeline construction is not conducive to the installation of sediment barriers due to the poor cohesiveness of the native spoil and the low angle of repose. We agree that use of the Project-specific Procedures would protect waterbodies from introduction of spoil or silt-laden water.

With implementation of the HDD method, final Compensatory Mitigation Plan, site-specific SWPPPs, Project-specific Plans and Procedures, the additional mitigation measures included in the EIS, and our recommendations, we conclude that impacts on water resources would be adequately minimized.

5.1.4 Wetlands

Construction of the Terminal facilities would affect 186.4 acres of wetlands. Of this total, 123.7 acres would be permanently filled and converted to upland and 17.1 acres would be excavated and converted to open water as part of the proposed berthing area and turning basin. The remaining 45.6 acres of wetland impact would be temporary impacts associated with TWS and pipeline within the property boundary. To minimize impacts on wetlands, the Terminal facilities were designed in a manner that would minimize wetland impact. To mitigate unavoidable impacts on wetlands, Venture Global would comply with its CMP/BUDM. We believe that the implementation of the final plans, as approved by the USACE and LDNR, would sufficiently offset environmental losses from unavoidable impacts on waters of the United States.

A total of 323.9 acres of wetlands would be affected by construction of the pipeline, aboveground facilities (meter stations and MLVs), ATWS areas, contractor yards, and access roads. Approximately 1.4 acres of impacted wetland would be permanently filled for MLVs, meter stations, and permanent access roads; the remaining impact would include 202.5 acres of temporary impact from Pipeline construction and 120 acres of permanently maintained ROW during operations. Following construction, disturbed areas would be restored and the permanent right-of-way maintained, in accordance with Venture Global's Project-specific Procedures. Generally, once pipelines are in place, wetland vegetation communities would transition back to a community with a function similar to that of the wetland prior to construction. Permanent wetland loss would be mitigated through the Project's CMP/BUDM (appendix E).

Section VI.A.6 of our Procedures requires that aboveground facilities be located outside wetlands, except where the location of such facilities outside of wetlands would prohibit compliance with U.S. DOT regulations. Venture Global has proposed an alternative measure to this requirement to allow the construction of an MLV and a meter station within wetlands, which we have reviewed and find acceptable.

Section VI.B.1.a of our Procedures requires that extra work areas be located at least 50 feet away from wetland boundaries except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. TransCameron Pipeline has proposed alternative measures to this requirement to place certain ATWS areas in or within 50 feet of wetlands since extensive wetlands and open waters comprise a significant portion of the Pipeline's environmental terrain. In many cases, linear waterbodies (e.g., ditches and canals) are flanked directly by wetlands and have no upland bank profile, making it infeasible to locate ATWS areas at least 50 feet away from wetland and waterbody boundaries. To minimize wetland and waterbody impacts, the Project would co-locate the pipeline with existing pipeline corridors, minimize impacts through use of construction methods such as the push method, use of timber mats, and use of specialized amphibious equipment, and use of a 50-foot setback where feasible. We agree that siting certain ATWS areas in upland areas is not feasible for this Project and use of these practices would minimize impact to the greatest extent practical.

Section VI.B.1.d of our Procedures requires 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 wetland. TransCameron Pipeline has requested a modification to this requirement to allow construction of access roads to several HDD entry and exit work sites where there are no existing roads; at these sites, a new temporary access road would be constructed across the wetland where impacts would be less than building a new access road along the construction right-of-way. We have reviewed these proposed temporary access roads and note that the only proposed improvements are the use of timber matting for stabilization and to minimize wetland impact. Therefore, we approve this requested modification.

Section VI.B.3 of our Procedures requires the use of temporary sediment barriers to prevent the flow of spoil or silt-laden water into any wetland. TransCameron Pipeline has requested an alternative approach in their Project-specific Procedures where the push method would be used. In general, we agree that the use of temporary sediment barriers across the right-of-way would not be practicable, impeding the proposed push/pull of the pipeline. However, we believe that sediment barriers should be installed along the edge of the right-of-way to minimize sediment transport off right-of-way. We conclude that sections VI.B.3.a and VI.B.3.b of this requested modification are warranted, but the requested modification to section VI.B.3.c is not justified. Therefore, we are recommending that Venture Global revise its Project-specific Procedures without the requested modification to section VI.B.3.c and file it with the Secretary for review and written approval by the Director of OEP prior to construction.

5.1.5 Vegetation

Construction and operation of the Terminal facilities would permanently impact approximately 304.8 acres of marsh, 0.2 acre of water, and 9.0 acres of non-marsh/other land. About 91.8 acres of marsh lie within the TWS for the Terminal site along with 7.5 acres of non-marsh/other land. The majority of the TWS at the Construction Support Facilities, 44.2 acres, is non-marsh/other land. Approximately 6.9 acres of marsh and 0.3 acre of water are also located within the TWS at the Construction Support Facilities. Many of the vegetation community types represented at the Terminal site are considered of low quality due to the successional nature of the communities, presence of fill, and historic use of the site for grazing and industrial purposes. Permanent conversion of habitat from non-industrial to industrial would convert existing non-industrial habitat types to an industrial status. The resulting change would have a minor impact on species in the area due to the extent of previous disturbance.

Construction of the Pipeline would affect about 346.3 acres of vegetation, of which 1.2 acres would be permanent as it would be associated with aboveground facility sites and permanent access roads. Of the remaining 345.1 acres, 329.8 acres would be temporarily affected and 15.3 acres would be avoided by HDD. To avoid and minimize impacts on vegetation associated with the Pipeline, TransCameron would implement measures described in the Project-specific Plan and Procedures, which specifically address reseeding, revegetation, and monitoring of vegetation.

Based on the amounts and types of vegetation impacted along the pipeline route, the temporary nature of the impacts, and TransCameron Pipeline's proposed impact minimization measures, we have determined that constructing and operating the Pipeline would not significantly affect vegetation.

In accordance with the Plant Protection Act of 2000 (7 USC 7701), 13 plants have been federally designated as noxious weeds that could occur in Louisiana, and the State of Louisiana has designated one plant, Chinese tallow, as a "noxious plant harmful to growth and development of other plants and pasture and may be destroyed wherever found in this state." Venture Global would construct the Project in compliance with its Project-specific Plan and Procedures. However, since the Project-specific Plan and Procedures do not include specific measures to prevent the introduction or spread of invasive species, noxious weeds, and soil pests resulting from construction and restoration activities we are recommending that Venture Global coordinate with the NRCS and LDWF to develop Project-specific noxious weed control procedures and file a revised Project-specific Plan to include these procedures.

One vegetation community of special concern (Coastal Live Oak-Hackberry Forest natural community, also known as a chenier forest) was identified in the Project area. It was observed during environmental field surveys that much of the Coastal Live Oak-Hackberry Forest areas no longer exist, as they have been heavily cleared to support cattle grazing. In addition to heavy cattle use in the area, it was observed that the habitat has been affected by storms and hurricanes, based on the presence of downed trees with intact root systems. A small area of hackberry, with no associated live oak, identified as persisting (approximately 2–3 acres) would be permanently impacted by Terminal site construction. Because this natural community has been reduced to a remnant of what is recorded by the LNHP, and current land use practices prevent natural regeneration of mature oak-hackberry forest cover, no mitigation is proposed.

Seven state-designated rare plant species are identified by the LNHP as potentially located within the project vicinity. Two occurrences are located within portions of the Terminal site that would not be impacted by construction; three locations would be unavoidable and would be impacted by construction. The LDWF has indicated that it would provide comments on rare plant impacts during the USACE and LDNR public notice periods for the Project. Venture Global would have to conduct surveys to determine the presence or absence of the identified species. Therefore, we are recommending that Venture Global file with the Secretary the results of its outstanding surveys for state-designated plant rare species, any proposed mitigation, and correspondence from the LNHP.

5.1.6 Wildlife and Aquatic Resources

Wildlife

Wildlife species inhabiting the Project area are characteristic of the habitats provided by the plant communities that occur in the Project region. Wildlife habitats associated with the Terminal site and Pipeline are dominated by vegetated wetlands, interspersed with areas of open water, herbaceous upland, scrub/shrub upland, and agricultural/pasture land. Construction of the Terminal site, Northeast Access Road, Southeast Access Road, Martin Access Road, and the Marine Facilities would permanently impact 314 acres of land, including 189.1 acres of wetland, 0.4 acre of open water, 4.3 acres of agricultural/pasture land, 61.8 acres of herbaceous land, and 33.1 acres of shrub/scrub. Construction activities for TWS, access roads, and the portion of the pipeline within Venture Global's property would temporarily impact 93.9 acres of wildlife habitat, including 71.9 acres of agriculture/pasture land, 1.9 acres of herbaceous land, 14.6 acres of wetland, and 5.5 acres of shrub/scrub. Temporarily disturbed areas would be restored in accordance with the Project-specific Plan and Procedures. Construction noise, use of construction equipment, and other human activity could impact wildlife. While these impacts would be short-term and temporary, they could cause displacement, stress, and direct mortality of some individuals.

Operation of the LNG facility would result in increased noise, lighting, and human activity that could disturb wildlife in the area. The potential disturbance to wildlife would be similar as those described for construction. However, due to the heavy ship traffic and other industrial uses along the Calcasieu River Ship Channel, most wildlife in the area are acclimated to the noise and artificial lighting associated with these activities. Therefore, we conclude that operational impacts on wildlife would be negligible.

To minimize project-related impacts on wildlife, Venture Global would implement its Project-specific Plans and Procedures, as well as an SPCC Plan for materials regulated by the EPA. In addition, the USACE New Orleans District would require compensatory mitigation for wetland impacts that cannot be avoided. Therefore, construction and operation of the proposed LNG facility would not have significant long-term impacts on wildlife species due to the degraded wildlife habitat value provided by the site and the proposed mitigation for wetland impacts.

Construction of the pipeline and associated aboveground facilities and access roads would permanently impact 132.4 acres of wildlife habitat, including 13.3 acres of agricultural/pasture land, 5.2 acres of herbaceous land, 4 acres of open water, 109.2 acres of wetland, and 0.7 acres of shrub/scrub. Approximately 99 percent (131.2 acres) of permanently impacted habitat would continue to be vegetated and periodically maintained after construction. Approximately 1 percent (1.2 acres) of the permanently impacted habitat would be the conversion of vegetation to hardscape from placement of fill materials for the aboveground facilities and access roads. The pipeline, ATWS, access roads, and contractor yards would temporarily impact 228.6 acres of wildlife habitat, including 17.6 acres of agricultural/pasture land, 26.2 acres of herbaceous land, 10.8 acres of open water, 173 acres of wetland, and 1.0 acre of shrub/scrub. Approximately 92 percent of this temporary impact is from the pipeline and ATWS. These temporarily disturbed areas would be restored in accordance with the Project-specific Plan and Procedures. No forested lands would be affected by the pipeline facilities, and some wetlands and surface waters would be avoided with HDD.

Construction noise, use of construction equipment, and other human activity could impact wildlife. While these impacts would be short-term and temporary, they could cause displacement, stress, and direct mortality of some individuals. Impacts on wildlife during Pipeline construction would generally be similar to the impacts described for the Terminal facility. These potential impacts would be short-term and temporary, lasting the duration of the construction period.

The vegetative communities in the Project area provide potential habitat for migratory bird species, including songbirds, waterbirds, and raptors. Construction of the Terminal facility and Pipeline would permanently and temporarily impact wildlife habitat areas as previously described. Much of the habitat associated with the Terminal site is 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 consists of wetlands, which provide habitat for waterfowl and other migratory birds. Because of the high importance attributed to chenier habitat for migratory birds, and because this habitat is considered to be in high decline, the FWS has requested that impacts on migratory birds be thoroughly assessed and mitigated. As previously mentioned, migratory bird habitat occurs at the Terminal site and along the Pipeline and would be permanently and temporarily impacted. However, much of the permanent habitat impacts are associated with the Terminal site, which has been previously disturbed with reduced nesting habitat value. Most of the migratory bird habitat along the Pipeline (mostly herbaceous wetlands) would be temporarily impacted and restored after construction. In addition, permanently impacted wetlands at the Terminal site or along the Pipeline would be mitigated through wetland creation/restoration at CPNWR's East Cove Unit. At the Terminal site, and where practicable along the pipeline routes, Venture Global has indicated that it would conduct clearing outside the migratory bird nesting window of March 1 to September 15. Where clearing cannot occur outside of the nesting window, Venture Global has indicated that it would conduct a walkover of the Project area prior to construction; if active nests are detected, they would be avoided until young have fledged.

The LDWF indicated that colonial waterbird nesting colonies occur within the Project area. Because nesting colonies may move from year to year, LDWF requested field surveys by a qualified biologist no more than 2 weeks prior to the commencement of construction, should construction occur during the nesting season. LDWF further has established seasonal restrictions on activity within 300 meters for colonies containing wading birds to outside the nesting season for wading birds (September 1 to February 15) and 400 meters for colonies containing gulls, turns, and/or black skimmers (700 meters for brown pelicans) to outside the nesting season for those species (September 16 to April 1). The FWS also recommended a qualified biologist inspect the proposed work areas within jurisdictional wetlands during the nesting season for the presence of undocumented rookeries, and further would require that any activity within 1,000 feet of a colony containing wading birds, anhingas, and/or cormorants be restricted to the non-nesting period. To further assure this commitment, we are recommending that Venture Global not begin construction activities until it conducts nesting bird colony surveys, utilizing appropriate survey methods, timeframes, and locations as determined in consultation with the LDWF and FWS.

With our recommendations, restoration of temporary impacts to wetlands and other habitats, mitigation of permanently impacted wetlands, and the implementation of the measures recommended by the FWS and LDWF, we conclude that impacts on migratory birds, including colonial waterbirds, would be avoided or minimized.

No managed wildlife areas would be affected by the proposed Pipeline or Terminal facilities. There are several managed wildlife areas near the Project where Venture Global has proposed wetland mitigation to compensate for the proposed Pipeline and Terminal wetland impacts. Impacts on wildlife using nearby managed wildlife areas in the region would be limited to disturbance from increased noise during construction activities. These impacts would be temporary, and sufficient suitable habitat in the region is available for wildlife displaced by noise impacts. Proposed wetland mitigation at the Cameron Prairie NWR would result in short-term and temporary noise impacts to wildlife that may be present in the area during mitigation construction. In the short term, mitigation construction would affect wetland habitat during wetland restoration activities and upland habitat for wetland creation activities, but there would be a long-term beneficial impact to the habitat and wildlife that utilize wetland habitats.

Aquatic Resources

All waterbodies within the project area support warmwater fisheries. Of the waterbodies impacted by LNG Terminal construction and operation, the Calcasieu River Ship Channel, adjacent nearshore habitats in the Gulf of Mexico and one perennial ditch within the onshore portion of the Terminal footprint are likely to provide year-round habitat for aquatic species. The remaining waterbodies (i.e., ponds/borrow pits, roadside ditch) are unlikely to provide suitable habitat for aquatic species because they are intermittent and only wetted during and after periods of rainfall. Salt and brackish marsh communities within the Terminal site may provide nursery and foraging habitats supportive of a variety of economically important marine fish species.

Potential impacts on aquatic resources during construction and operation of the facility include those associated with dredging and construction of the berthing docks and turning basin, the permanent loss of acres of wetlands and waterbodies associated with the Terminal facilities, ballast water exchanges, inadvertent spills, ship traffic, and hydrostatic testing.

Construction of the LNG berthing area and turning basin at the Terminal site would require dredging/excavation of 94.1 acres, of which approximately 83.3 acres are tidal estuarine habitat. This includes approximately 17.4 acres of shoreline tidal wetlands, of which 14 acres would be permanently converted to deepwater estuarine habitat, while approximately 3.4 acres would be permanently filled through development of the marine berm. Dredging between the shoreline and the edge of the Calcasieu River Ship Channel would permanently alter the depth profile of 65.9 acres of shallow to deepwater habitat between the shoreline and the edge of the navigation channel; the increased water depth would continue to provide deepwater habitat after dredging is completed. Approximately 1 acre of this habitat would be permanently shaded by new overwater structures.

Project construction would also produce temporary impacts that extend beyond the permanent project footprint. The piers, mooring dolphins and other in- and overwater structures associated with the Terminal would require the placement of steel piles that would be placed using a combination of vibratory and impact pile driving. Organisms within the pile-driving footprint would be killed or permanently displaced. Pile driving would also produce underwater noise sufficient to injure and/or alter the behavior of fish and other aquatic organisms a considerable distance from the point of disturbance. Construction dredging would produce a turbidity plume that extends beyond the construction footprint, with the direction and size of the plume depending on tidal currents at the time of disturbance. The impacts of project construction on fish and other aquatic organisms would vary by species, depending on the ability of the affected species or life stage to avoid affected habitats and sensitivity to each type of impact.

Dredging would also temporarily increase noise, turbidity, and suspended solids within the water column, which can adversely affect fish eggs and juvenile survival, benthic community diversity and health, foraging success, and suitability of spawning habitat. Sediments in the water column could be deposited on nearby substrates, burying aquatic macroinvertebrates. Impacts on aquatic resources due to increased turbidity and suspended solid levels would vary by species; however, the aquatic resources within the Project area are likely accustomed to regular fluctuations in noise and turbidity levels from industrial activity and regular maintenance dredging within the Calcasieu River Ship Channel. Further, Venture Global Calcasieu Pass would use a hydraulic dredge with a suction cutter head for offshore dredging, which would minimize resuspension of sediments and the resulting increases in turbidity and suspended sediment levels. 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. This indicates that fish and benthic organisms within the impact area would likely recover quickly after construction and maintenance dredging related disturbance. On this basis, we conclude that impacts on aquatic resources from dredging would be localized, temporary, and minor.

Sound waves from pile driving may result in injury or trauma to fish, sea turtles, and other animals with gas-filled cavities, such as swim bladders, lungs, sinuses, and hearing structures (Popper, 2012). The intensity of the sound pressure levels produced during pile driving depends on a variety of factors such as type and size of the pile, the substrate into which the pile is being driven, the depth of water, and the type of pile-driving equipment being used. Pile-driving noise has also been found to result in temporary displacement of fish, though multiple exposures to sound may result in habituation (Mueller-Blenkle et al., 2010). Venture Global Calcasieu Pass has indicated that it is considering 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. In combination with appropriate monitoring and construction controls, these steps can effectively avoid and minimize potential adverse effects on fish and marine mammal species. Because Venture Global Calcasieu Pass has not committed to specific mitigation measures that would be implemented to reduce the effects of pile driving noise, we are recommending that Venture Global Calcasieu Pass file a plan to mitigate the effects of noise from pile driving activities in consultation with the NMFS, the FWS, and the LDWF.

Over-water activities associated with installation of the berthing docks may cause avoidance of the area by mobile species due to noise and movement, but this impact would be minor and temporary. The berthing dock pilings would create aquatic habitat in the form of additional hard substrate areas, allowing for the growth of attached organisms. Over-water dock structures may also provide a source of refuge for some aquatic species.

Overall, we conclude that impacts on aquatic wildlife from construction and operation of the berthing docks and turning basin would result in minimal long-term impacts on aquatic organisms generally restricted to the permanent footprint of the project site.

Construction and operation of the Terminal would permanently impact 2.6 acres of waterbodies and 119.3 acres of wetland. Venture Global would provide compensatory mitigation for this wetland loss in consultation with the USACE through the section 401 and 404 permitting process. With compensatory wetland mitigation, we conclude that impacts on aquatic wildlife from construction of the LNG facilities would not be significant.

Ballast water discharge could lead to a temporary increase in salinity level, a temporary decrease in dissolved oxygen levels, and potential change in pH level in the immediate vicinity of the LNG berthing area. Resident species within the Calcasieu River Ship Channel are euryhaline and are well adapted to natural spatiotemporal variation in salinity and oxygen levels. This adaptability and the ability to move over a short distance to more suitable conditions minimizes adverse impacts on aquatic resources associated with ballast water discharges. Additionally, U.S. 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 151.2025). With the implementation of the mandatory practices required by the USCG, we conclude that the impacts on aquatic resources from ballast water discharges associated with the project would not be significant.

Aquatic resources could be adversely affected by an accidental spill or leak of hazardous materials into or near a waterbody. To minimize impacts on aquatic resources, Venture Global would implement its SPCC Plan. Should a spill or leak occur, implementation of the response measures in the SPCC Plan would reduce response time and ensure appropriate cleanup, thereby minimizing impacts on aquatic resources.

Construction of the proposed Pipeline would require crossing 21 perennial streams, five intermittent channels, and 24 permanently flooded open waterbodies that provide suitable habitat for aquatic resources. Fourteen of these waterbodies would be crossed by HDD, which 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. Should an inadvertent release occur, TransCameron would implement the measures outlined in its HDD Contingency Plan to minimize potential impacts on aquatic resources.

Use of the push and open-cut crossing method would result in temporary loss or modification of aquatic habitat, increase 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 adjacent habitats up or down stream; 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 and downstream of the crossing location. This temporary increase in suspended solids would decrease rapidly following the completion of instream activities. Because no forested lands are crossed by the pipelines, impacts to vegetative cover would be temporary and would return to preconstruction conditions within one to two growing seasons. In addition, since much of the vegetation is already maintained in a low-growing, herbaceous state and does not provide shade over the waterbodies, changes in water temperature would be minimized.

TransCameron Pipeline would implement the measures outlined in its Project-specific Procedures to minimize impacts on waterbodies and aquatic resources during Pipeline construction. Once construction is complete, streambeds and banks would be restored to their preconstruction conditions and contours to the maximum extent practicable, which would aid in preventing erosion and minimize long-term impacts on aquatic resources. With implementation of the mitigation measures described above, we anticipate that the project would have minimal and localized impacts on aquatic resources.

5.1.7 Threatened, Endangered, and Other Special Status Species

Based on input from the FWS and NMFS, sixteen federally listed threatened and endangered species and twelve state-listed threatened and endangered species may occur in the Project area. In addition, critical habitat has been designated for one species in the Project area. We are recommending that Venture Global should not begin construction of the Project facilities until FERC staff completes all necessary ESA section 7 consultations with FWS/NMFS and Venture Global has received written notification from the Director of the OEP that construction may begin.

Based on Venture Global's consultation with the FWS on potential impacts to manatees and Venture Global's commitment to implement FWS' *Standard Manatee Conditions for In-Water Work*, we conclude that the Project *may affect, but is not likely to adversely affect* the West Indian manatee. FERC's recommendation (in section 4.6.2) that Venture Global Calcasieu Pass develop a plan to mitigate noise impacts from pile driving activities could further benefit the manatee, but this recommendation would not change the effects determination for manatee.

Based on the lack of quality foraging habitat on the Terminal site, the wetland mitigation that would be provided through the requirements of the CWA, the restoration of temporary impacts from pipeline installation in accordance with the Project-specific Procedures, and the abundance of suitable wetland habitat in this region for foraging during construction, we conclude that the Project *may affect, but is not likely to adversely affect* the red knot.

The piping plover does not breed in this region, construction-related impacts on this species would primarily be limited to temporary displacement from foraging/wintering due to noise from active construction on the southern portions of the Terminal facility. This species is mobile, and would likely avoid areas of ongoing construction activity. The Project would not result in the permanent loss of suitable piping plover habitat. Operation of the LNG facility 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 Calcasieu River Ship Channel, most wildlife in the area are acclimated to the noise and artificial lighting associated with these activities. Therefore, we conclude that the Project *may affect, but is not likely to adversely affect* the piping plover.

While the presence of the Gulf sturgeon the seven federally listed whale species in the project area would be rare and incidental, the potential presence of Gulf sturgeon and whales in the project area cannot be completely ruled out. Therefore, we conclude that the Project *may affect, but would not likely adversely affect* the Gulf sturgeon and the seven federally listed whales.

Due to the specific nesting habitat requirements that are absent in the Project area, sea turtles would not likely be present onshore within the Project area; therefore, no direct impacts on sea turtles would be anticipated from land-based construction activities. Further, due to the absence of known nesting locations in the Project area for any of the listed sea turtles and the lack of suitable nesting habitat in the vicinity of the Project, indirect impacts on nesting behavior would not be anticipated from construction or operational noise or lighting. In general, sea turtles would be rare visitors to the Project area. However, they may be occasional visitors to the Calcasieu River Ship Channel. Potential impacts on sea turtles from the Project may result from dredging activities, vessel strikes, and pile driving. With adherence to the mitigation measures identified above and our recommendation, we conclude that the Project *may affect, but is not likely to adversely affect* sea turtles.

Based on consultations with the LDWF, four wildlife species of concern were identified as potentially occurring in the project area: piping plover, Wilson's plover, snowy plover, and diamondback terrapin. LDWF data identifies snowy and Wilson's plovers as occurring just south of the Terminal site. The project would not impact sandy beaches, which are the habitat preferred by these species. Construction-related impacts would primarily be limited to temporary displacement due to noise in the vicinity of active construction on the southern portions of the Terminal facility; this impact would be similar to the noise impacts described previously for wildlife and migratory birds. These species are mobile, and would likely avoid areas of ongoing construction activity. Operation of the LNG facility would result in increased noise, lighting, and human activity that could disturb wildlife in the area; these impacts would be similar to the operations impacts described previously for wildlife and migratory birds. However, due to the heavy ship traffic and other industrial uses along the Calcasieu River Ship Channel, most wildlife in the area are acclimated to the noise and artificial lighting associated with these activities, and it is anticipated that any potential impacts that would occur during operation would be negligible.

LDWF data has not identified any known occurrences of diamond back terrapin in the project area, but potential habitat occurs in the project area. Construction impacts would include permanent loss of brackish wetland habitats at the Terminal site, however, mitigation would be required to mitigate this impact under section 404 of the CWA. Construction-related noise impacts could also temporarily displace individuals that may be in project area due to active construction; this impact would be similar to the noise impacts described previously for wildlife and migratory birds. Operation of the LNG facility would result in increased noise, lighting, and human activity that could disturb wildlife in the area; these impacts would be similar to the operations impacts described previously for wildlife and migratory birds. However, due to the heavy ship traffic and other industrial uses along the Calcasieu River Ship Channel, most wildlife in the area are acclimated to the noise and artificial lighting associated with these activities, and it is anticipated that any potential impacts that would occur during operation would be negligible. Due to the potential for impacts on the diamondback terrapin, we are recommending that Venture Global consult with the LDWF on rare wildlife species and file the results of surveys conducted, and any proposed mitigation measures for our review and approval.

5.1.8 Land Use, Recreation, and Visual Resources

Construction of the Terminal facilities would affect a total of 413.2 acres of land. Of this total, about 314.0 acres would be permanently required for operation of the Terminal facilities and the remaining approximately 99.2 acres would be temporarily impacted and returned to preconstruction conditions following construction. The majority of the Terminal facilities would be located on agricultural and herbaceous land (31 percent), developed land (15 percent), and emergent wetland (44 percent) that is surrounded by open water and land that is currently occupied by or proposed for similar industrial activities. The open water along the Calcasieu Pass Ship Channel that would be utilized for the LNG berthing area would remain open water, though it would be dredged to a greater depth to maximize safety relative to ship traffic within the channel. Construction of the Terminal would result in a conversion of the existing land use to industrial use. However, due to the industrial use of adjacent land and the previously disturbed nature of the surrounding area, impacts on land use from the Terminal would be minor.

Approximately 76.2 acres of hay/pasture areas would be permanently converted to industrial land and thus, agricultural land would be removed from use. However, these impacts would be minor, and Venture Global Calcasieu Pass would compensate landowners for the use of their land and for production loss.

There are currently no existing or planned residential or commercial developments within 0.25 mile of the Terminal. There are both existing and planned industrial developments within the vicinity of the Project, which would increase the industrial setting along the Calcasieu River Ship Channel and surrounding area. This land use is consistent with planned development for the area.

All of the land that would be used for the Terminal is privately owned. No federally managed public or conservation lands, including national historic landmarks, national forests, national parks, national recreational trails, national wild and scenic rivers, NWRs, Indian Lands, or wilderness areas have been identified within 0.25 mile of the proposed Terminal. Likewise, no state-managed lands, including historic sites, natural and scenic rivers, state parks, preservation areas, or other state-recognized public areas would be located within 0.25 mile of the Terminal. In addition, no public or private conservation easements or land trusts are located within 0.25 mile of the proposed Terminal.

Numerous recreational opportunities for birding and wildlife viewing, beach use, boating, camping, hunting, and fishing are available in Cameron Parish. The Davis Road Public Boat Launch and the Cameron Jetty Fishing Pier and RV Facility are located within 0.25 mile of the proposed Terminal. The boat launch would be removed as a result of the Project; the fishing pier and RV facilities would no longer be accessible by road. The Cameron Parish Police Jury intends to relocate the public boat launch from the current location to a new location off Davis Road. The Cameron Parish Police Jury also intends to develop a new location for the RV facility, and operate and maintain a water shuttle service to the Jetty Pier from a marina to be located off Davis Road. Venture Global Calcasieu Pass is supporting the Cameron Parish Police Jury in its efforts to continue the public use of the Jetty Pier. Further, Venture Global Calcasieu Pass and TransCameron Pipeline entered into a CEA with the Cameron Parish Police Jury that contemplates the potential enhancement of recreational opportunities in the town and parish of Cameron. To further this agreement, we are recommending that Venture Global Calcasieu Pass file with the Secretary any updates for the CEA and any updated correspondence with the Cameron Parish Police Jury.

Construction associated with the Terminal may temporarily impact local recreational fishing, bird watching, trapping, hunting, and boating activities. Access to existing local boat launches, a fishing pier, RV park, playground, beaches, observation tower, and pavilion would be blocked or at least altered during the excavation and dredging activities associated with the western boundary of the proposed Terminal. Temporary impact would occur throughout the 35-month construction period. During this time, material and equipment deliveries during construction may delay or impede recreational boat traffic due to increased ship/barge traffic within the Calcasieu River Ship Channel. While there would be impacts to numerous recreational resources associated with the construction and operation of the Terminal site, Venture Global Calcasieu Pass indicates that it would mitigate for these impacts through implementation of the CEA, thus minimizing impacts on these resources. Due to the proposed mitigation measures proposed by Venture

Global, we have determined the Project would not have any adverse impacts on recreation, including boating and fishing along the Calcasieu River Ship Channel and Gulf of Mexico.

The location of the proposed Terminal would be visible to users of the Calcasieu River Ship Channel, users of the fishing pier and RV facility, and employees of the existing industrial businesses located along Davis Road. The facilities associated with the Terminal would likely also be visible to visitors to nearby beaches. However, most of the activities and structures within the Terminal site would be obscured by the perimeter berm and wall.

Increased lighting around the Terminal facility would have an influence on visual resources. The surrounding developed areas along the Calcasieu River Ship Channel, including Cameron and the facilities along the channel north of Cameron, are currently heavily lit during the night-time hours. Proper installation of lighting fixtures would keep significant light from reflecting off the water and thereby avoid any significant impacts to fish or wildlife. The proposed lighting at the Terminal site would be consistent with nearby industrial/commercial facilities and would follow all federal, state, and local ordinances per Venture Global Calcasieu Pass' project specific Facility Lighting Plan.

The remaining land surrounding the proposed Terminal is currently occupied by industrial facilities along the Calcasieu River Ship Channel as well as open marshland and pasture land. Numerous proposed industrial facilities are also planned in the immediate vicinity of the Terminal. Due to the limited recreational use of the surrounding area, the proposed mitigation measures mentioned above for the fishing pier and RV facility, as well as the existing industrial land use on adjacent areas, we have concluded that construction and operation impacts would not have a significant adverse impact on the local viewshed.

Constructing the Pipeline would impact a total of approximately 370.9 acres of land. Of this total, about 136.5 acres would be permanently required for operation of the pipeline and the remaining approximately 234.4 acres would be temporarily impacted and returned to preconstruction conditions following construction. Land use impacts associated with the pipeline facilities would include disturbance of existing land use, the creation of new easements, and the conversion of some land to a different land use type. Coastal wetlands would be the primary land use impacted by construction of the Pipeline. During pipeline construction, topsoil segregation would occur where appropriate to preserve native seed banks. Surface disturbance in wetlands and open areas would be avoided through use of the HDD construction method in some areas and minimized by use of the push method in some additional areas. With the exception of 1.3 acres of lands associated with the permanent aboveground facilities, all lands disturbed during pipeline construction would be restored to preconstruction contours and conditions.

TransCameron Pipeline would construct and maintain the Pipeline according to measures contained in its Project-Specific Plan and Procedures. Vegetation on the permanent right-of-way in non-agricultural areas would be maintained by mowing, cutting, or trimming as necessary. All lands affected by pipeline construction, with the exception of lands identified for aboveground facilities, would be restored to preconstruction contours, and would thus not result in a change in land use. The pipeline right-of-way would be allowed to revegetate. The frequency of vegetation maintenance would depend upon the vegetative growth rate; however, it would not exceed that prescribed in the Project-Specific Plan and Procedures.

There are no existing residences within 50 feet of the construction work area for the Pipeline. No planned commercial or industrial developments are located within 0.25 mile of the Pipeline. Therefore, the Pipeline would not adversely impact existing residences or planned developments.

No federal or state wildlife refuges are located within 0.25 mile of the proposed pipeline route. The Creole Nature Trail National Scenic Byway would be crossed twice by the pipeline. No other federally managed public or conservation lands, including national historic landmarks, national forests, national parks, national recreational trails, national wild and scenic rivers, NWRs, Indian Lands, or wilderness areas have been identified within 0.25 mile of the proposed Pipeline. Likewise, no state-managed lands, including historic sites, natural and scenic rivers, state parks, preservation areas, or other state-recognized public areas would be located within 0.25 mile of the Pipeline. In addition, no public or private conservation easements or land trusts are located within 0.25 mile of the proposed Pipeline. There are recreational beaches and RV parks along the coast, and outdoor activities such as fishing and hunting are offered on public and private lands within Cameron Parish; however, these sites are over half a mile from the Pipeline and are not likely to be impacted during construction or operation of the Pipeline.

Pipeline construction impacts would be short-term and confined to the period of active construction, which would be limited to several days up to several weeks in any one area. Once pipeline construction is completed, TransCameron Pipeline would restore the disturbed right-of-way to preconstruction conditions. The majority of the proposed pipeline would be collocated with other utilities; therefore minimizing the likelihood of recreational opportunities in the vicinity of the construction activities. No recreational use areas would be crossed by active pipeline construction. Due to the temporary nature of pipeline construction, the proximity of the proposed construction to known recreational areas, and the collocation of the proposed pipeline route, we agree that construction and operation of the Pipeline would not adversely impact recreation or special use areas.

Constructing and operating the Pipeline may impact visual resources by altering the terrain and vegetation patterns during construction or right-of-way maintenance and from the presence of new aboveground facilities. The majority of the proposed pipeline route would be located within marshland and/or adjacent to existing rights-of-way, which would not alter the landscape of the region. Impacts within this viewshed and other visual resources due to the pipeline would be primarily temporary and short-term, occurring during construction. The terrain over the majority of the Project area is flat; therefore, during construction, the cleared and graded right-of-way, as well as construction equipment, would be visible from nearby residences and local roads. The Project area is not forested; therefore, no visual corridor would be created as a result of the pipeline installation. Following the completion of construction activities, areas disturbed for construction would be restored and activities that previously occurred in the area would be allowed to resume. Therefore, the construction and operation of the Pipeline would not result in long-term visual impacts.

TransCameron Pipeline would also install a meter station and MLV along the pipeline right-of way. The meter station would be installed adjacent to an existing industrial facility. Since its purpose is to serve as an interconnect to other pipelines, the meter station would be located relatively close to existing aboveground pipeline facilities and previously disturbed pipeline rights-of-way. Similar to the meter station, the MLV would also be located within the permanent pipeline right-of-way and would utilize a relatively small footprint. Visual screening is not planned at the meter station or the MLV location. We agree that the visual impact of the aboveground facilities would not have a significant impact on the aesthetics of the landscape along the pipeline route.

The majority of the land impacted by the pipeline would be allowed to revert back to preconstruction conditions following completion of construction. Some areas, including those used for aboveground facilities, would be permanently converted to an industrial use. The implementation of the measures discussed above, including collocation of the majority of the pipeline, would result in minimization of impacts on land use. Most impacts on visual resources would be temporary and associated with the construction phase of the pipeline.

Construction and operation of aboveground facilities would have a minor impact on visual resources. Overall, land use, recreation, and visual resource impacts associated with the Pipeline would be minor.

The Project would be within the Louisiana Coastal Zone, which requires a federal consistency review under the National CZMP, which is delegated to the states. We are recommending that prior to construction, Venture Global file with the Secretary a copy of the determination of consistency with the Coastal Zone Management Plan issued by the LDNR.

5.1.9 Socioeconomics

Construction and operation of the LNG Terminal pipeline, and associated facilities could impact socioeconomic conditions, either adversely or positively, in the general vicinity of the proposed facilities. These potential impacts include increased population levels, increased employment opportunities, increased local and government revenue associated with payroll and sales taxes, increased demand for housing and public services, employment opportunities, increased need for public schools, services and utilities, and increased traffic on area roadways and waterways.

Venture Global Calcasieu Pass estimates that construction of the Terminal site would require an average of 1,275 workers over approximately 35 months with an estimated peak of 1,410 workers. Construction of the Pipeline would require an estimated 150 workers over approximately 10 months, peaking at 200 workers. Construction schedules for the Terminal site and Pipeline would likely overlap with the total number of workers on the Project averaging 1,425 and peaking at 1,610 workers. Assuming non-resident workers would be accompanied by family members and based on the average Cameron Parish household size, the peak construction nonresident workforce could result in an up to 1 percent temporary increase in the Cameron Parish population. During operation, Venture Global Calcasieu Pass anticipates adding approximately 130 full-time positions to operate the Terminal site facilities, resulting in a slight long-term increase in population that is consistent with growth plans for SWLA. No additional employees are anticipated for the Pipeline. Therefore, we determined the Project, as a whole, would not significantly affect local population size.

The estimated (2014) civilian labor workforce for the Project area is a combined total of 261,280. The number of unemployed persons is estimated as 18,784, which is 7.2 percent of the total civilian workforce in the Project area. Constructing the Project would positively affect employment opportunities for the state and in the surrounding counties. The Project would likely have a beneficial impact on the unemployment rate, as it would more likely decrease the unemployment rate due to hiring a predominantly local workforce where feasible, noting that the percentage of local workers would be dependent upon several factors, including the availability of local workers, timing of need for different skilled trades, and other proposed or ongoing projects in the Project area. With anticipated average salaries at the Terminal site of $70,000 per year, earnings would be well above the state average of $48,828 for construction workers but below the average of $87,152 for construction workers in Cameron Parish. The proposed salary may influence the pool of available workers during construction.

The availability of skilled workers in the Project area may also influence the available pool. Venture Global anticipates working with local education providers to increase the availability of trained local workers available for the Project. The training and hiring of a local workforce at an annual salary that is higher than the Project area per capita income would reduce unemployment and provide an economic benefit to the local economy.

Construction and operation of the Terminal site would require some closures of the channel during construction and use of exclusion zones during operation that would affect the commercial fisheries workforce in the Calcasieu River Ship Channel. It is estimated that there is a local commercial fishing fleet of 65 to 75 vessels in Cameron Parish. The commercial fishermen reportedly rotate through the different seasons of inshore/offshore shrimping and inland oyster harvesting, resulting in year-round commercial fishing. Commercial fishermen routinely share the Calcasieu River Ship Channel with industrial vessels, including the two times during the year, for approximately 2 weeks each time, when there is an excess of shrimp movement through the Calcasieu River Ship Channel. Use of the channel by barges and support vessels to deliver materials during construction of the liquefaction facility would be managed by the Port of Lake Charles in partnership with the Lake Charles Pilots Association, Furthermore, the COTP has jurisdiction over navigational safety considerations. Consequently, impacts on commercial fishing would be appropriately minimized.

The Project would boost local economies by creating jobs, purchasing construction materials locally, hiring local firms and contractors, and directly or indirectly supporting other regional suppliers in the industry. During construction, worker income would generate state income tax and worker spending would generate state sales tax. With additional spending and the employment of workers, ripple effects would perpetuate throughout the communities. The estimated 130 full-time workers hired during operation would likely spend a portion of their combined earnings in the Project area, supporting local economies by purchasing goods and services and paying rents and mortgages, all of which would generate direct and indirect socioeconomic benefits.

The Terminal site would be located in an undeveloped area surrounded by industrial and agricultural development. The nearest residential property is approximately 1 mile east of the Terminal site. There are currently no planned residential developments within 0.25 mile of the Terminal site. The Pipeline would primarily cross undeveloped and rural residential portions of Cameron Parish. There are no existing residences within 50 feet of the pipeline construction work area and no existing or planned residential developments within 0.25 mile of the Pipeline. At the aboveground pipeline facilities, the residences closest to the meter stations are approximately 0.85 mile from the pipeline. Based on the distances to the Project, we do not anticipate changes to the property values.

Due to the rural nature of Cameron and Jefferson Davis Parishes, the currently available transient housing would not likely be sufficient to accommodate the maximum peak non-resident workforce, which would result in temporary impacts on housing availability in the project area during peak construction. In recognition of a growing need for temporary worker housing, the SWLA Economic Development Alliance created a strategic plan for temporary housing for the local parishes. If all of the proposed housing projects were to be constructed, an additional 13,348 housing units would be available in the Project Study Area, which would be more than sufficient.

During operation, Venture Global Calcasieu Pass anticipates adding approximately 130 full-time positions to operate the Terminal site facilities, which would not create pressure on the local housing market. No additional employees are anticipated for the Pipeline.

The parishes and counties in the Project area have public infrastructure that provide health, police, fire, emergency, and social services near the Project site. Impacts on public services would be greatest while constructing the Project, as the greatest number of workers would be present. Cameron Parish public services would be in highest demand during construction since the Terminal site is located within this parish. The Cameron Parish Sheriff's Department anticipates that it may require up to three new positions during construction in order to maintain its current level of service, while Cameron Fire Department officials indicate that the equipment and stations already located in the parish are adequate; however, additional staffing resources would be needed. Public utility providers have also indicated that existing services are sufficient to accommodate Project needs.

Cameron Parish has four public schools serving students from pre-kindergarten through 12th grade. School enrollment is below capacity due to emigration following Hurricanes Rita and Ike. Based on existing enrollments, existing school capacity, the letter of support from the Cameron Parish School Superintendent, and the limited increase to the local population, construction and operation of the Project would not have a significant impact on local schools.

Construction of the project would result in positive impacts due to increases in construction jobs, payroll taxes, purchases made by the workforce, and expenses associated with the acquisition of material goods and equipment. No residences or businesses would be displaced as a result of construction of the Project. Operation of the project would have a positive effect on the local governments' tax revenues due to the increase in property taxes that would be collected.

There would be a temporary increase in traffic levels due to the commuting of the construction workforce to the Project area as well as the movement of construction vehicles and delivery of equipment and materials to the construction work area. Traffic is anticipated to increase substantially during construction of the Terminal facility due to the presence of worker vehicles, construction vehicles, and trucks taking materials and equipment to and from the site. To minimize the increase, Venture Global Calcasieu Pass would transport materials by barge to nearby existing aggregate storage and handling facilities prior to completion of the construction berth. Venture Global Calcasieu Pass would also address worker and material transport through off-site parking, shuttles, and infrastructure. To minimize disruption to local traffic flow and communities and to ensure that construction-related road use proceeds in a safe and efficient manner, we are recommending that Venture Global Calcasieu Pass file with the Secretary its updated Traffic Management Plan for off-site parking- and use of shuttles.

Constructing the Pipeline would result in some minor, short-term impacts on area roadways. The workforce would primarily commute during off-peak times, and would be dispersed along the 23.5-mile pipeline. Short-term impacts on traffic flow could occur where the pipeline would be installed beneath roads due to safety precautions for workers crossing and working in the vicinity of the road crossings. Major road crossings would be constructed via HDD and would have no short- or long-term impacts on traffic patterns or road conditions. If necessary, signage and traffic control personnel would be utilized to manage traffic in areas of active construction, but this would typically only be required for large trucks entering or exiting the pipeline workspaces and the traffic impacts would be of short duration. Based on these factors it would be unlikely that the workforce traffic would significantly affect local traffic.

A marine traffic study found that there was sufficient capacity in Calcasieu Channel for an increase in vessels over the current estimated number of approximately 1,100 vessels annually and projected future increase in vessels. During construction, Venture Global Calcasieu Pass estimates that major material supplies and equipment would be delivered to marine construction support facilities with existing docks located close to the Terminal facilities; during operations, approximately 150 LNG carriers would call per year. The USCG issued the LOR for the Project, which stated that the Calcasieu River Ship Channel is considered suitable for LNG marine traffic in accordance with its guidance. During operations, security zones for LNG carriers in transit would impact recreational and commercial fishing vessels within the Calcasieu River Ship Channel because they would be required to stay out of the security zone while the LNG carrier passes. After the moving security zone passes, recreational boaters and fishermen could return and continue their prior activities. Because the LNG carriers would be joining an existing convoy system, and consist of an additional four vessels a week (eight movements in total), the project would create only a slight increase in impacts to recreation and commercial fishing along the Calcasieu River Ship Channel.

We prepared an environmental justice analysis for the project in accordance with EPA guidelines to ensure proper consideration of disproportionately high and adverse impacts on minority or low-income populations in the surrounding community resulting from the Project. Overall, Cameron Parish has a much lower percentage of minority populations than the State of Louisiana (U.S. Census Bureau, 2015a). Generally, the same trends hold true at the census tract and block group levels. The single digit minority populations found within the Project area are well below the 50-percent threshold; therefore, the Project would not disproportionately affect any minority populations.

The percentage of the population living below the poverty threshold is lower in Cameron Parish than in the State of Louisiana as a whole; however, in portions of the Project area poverty levels are higher and comparable with that of the state. The Project would have an impact on low income populations; therefore, we conducted an impact analysis in accordance with the guidelines in the *Promising Practices for EJ Methodologies in NEPA Reviews*. We have determined that there would be no direct impact on residential properties and that the Project would not adversely impact the ecological, aesthetic, historic, cultural, economic, social, or health of minority populations. Consequently, the low income populations identified within the Project area would not be adversely impacted.

Construction of the project would not have a significant adverse impact on local populations, employment, provision of community services, or property values. There would not be any disproportionately high or adverse environmental and human health impacts on low-income and minority populations from construction or operation of the project.

5.1.10 Cultural Resources

Venture Global conducted a cultural resource survey for all project facilities including the Terminal, Pipeline, and berthing area. Cultural resources investigations conducted for the Terminal site facilities identified one historic period archaeology site. It was not recommended not eligible for listing on the NRHP; the Louisiana SHPO concurred with the finding that there are no historic properties within the Terminal site.

Venture Global conducted a marine archaeological survey within the LNG berthing area that included portions of the Calcasieu River Ship Channel and the eastern portion of the Calcasieu River outside the boundaries of the dredged ship channel. The Phase I marine archaeological survey identified three anomalies that were subsequently studied in a Phase II survey, which then determined that the anomalies were the result of modern debris. Venture Global recommended cultural resources clearance for the marine portion of the Project and the Louisiana SHPO concurred that no historic properties were located within the LNG berthing area.

Cultural resources surveys were conducted for the Pipeline that includes the pipeline and associated workspaces. No new cultural resources were identified within the study corridor for the Pipeline. The Louisiana SHPO concurred with the recommendation that no historic properties would be affected by construction of the Pipeline.

Compliance with section 106 of the NHPA is completed for the Project. Surveys and evaluations are also complete. The SHPO concurred that no significant archaeological or historic resources would be affected by the proposed Project and SHPO made a determination of No Effect based on survey results. Construction should not proceed for any previously unidentified facilities and/or use of staging, storage, or temporary work areas, and new or to-be-improved access roads until Venture Global Calcasieu Pass and TransCameron Pipeline files with the Secretary any additional cultural resources survey reports, avoidance/treatment plan and related consultation and comments with SHPO and affected tribes.

5.1.11 Air Quality and Noise

Air quality would be affected by construction and operation of the Project. Though air pollutant emissions would be generated by operation of equipment during construction of the Project facilities, most air emissions associated with the Project would result from the long-term operation of the Terminal site. The entire Project area is located in the Southern Louisiana-Southeast Texas Interstate AQCR. Likewise, ship transit would impact the same AQCR. Cameron Parish is designated as unclassifiable for O_3, $PM_{2.5}$, and NO_2. For all other criteria pollutants, Cameron Parish is considered to be in attainment.

The Project would be subject to the EPA NSR PSD permitting process. PSD requirements include application of BACT to minimize emissions, and a source impact analysis showing that Project-related emissions increases in excess of the relevant significance thresholds would not cause or contribute to air pollution in violation of any NAAQS. The source impact analysis also must show that the emissions increases would not cause or contribute to air pollution in violation of any applicable maximum allowable increase over the baseline concentration in any area (i.e., the "PSD increment analysis").

BACT analysis was completed for the Project to identify the maximum degree of emissions reduction for NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, VOC, and CO_2e taking into account technical feasibility, energy, environmental, and economic impacts. The results of the BACT analysis, showing the selected emission control technologies and practices, are listed in appendix I.

Federal NSPS regulations establish pollutant emission limits and monitoring, reporting, and recordkeeping requirements for various emission sources based on source type and size. The Project would comply with all NSPS requirements.

Venture Global, based on Federal guidance, determined that the Project would not lead to impacts in any Class I area. Federal Class I areas are areas of special national or regional natural, scenic, recreational, or historic value for which the PSD regulations provide special protection.

In addition to the federal requirements, the LDEQ has its own air quality regulations and is the lead air permitting authority for the Project. The LDEQ's air quality regulations incorporate the federal program requirements 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. Construction activities can result in emissions of fugitive PM or "fugitive dust" from earthmoving and exposed earth surfaces. The amount of fugitive dust for an area under construction would depend on numerous factors including: degree of vehicular traffic; size of area disturbed, amount of exposed soil, soil properties (silt and moisture content); and wind speed. Construction of the Project would also result in fuel combustion emissions from a variety of sources, including off-road sources (e.g., bulldozers, cranes, front-end loaders, pile drivers), on-road sources (e.g., construction worker vehicles), and marine vessels (e.g., tugs, barges).

Site preparation activities for the Terminal site would include grading, cutting of drainage ditches, placement of gravel surfaces (e.g., lay-down areas), and construction of access roads within the Project site boundaries. Site preparation activities would generate fugitive dust from earthmoving and movement of construction equipment over unpaved surfaces and tailpipe emissions from construction equipment and vehicle engines. We are recommending that prior to construction of the Terminal, Venture Global Calcasieu Pass file for review and written approval a Fugitive Dust Control Plan that specifies the precautions that Venture Global Calcasieu Pass would take to minimize fugitive dust emissions from construction activities at the Terminal.

The Terminal site construction equipment would include cranes, forklifts, pile drivers, welders, concrete pump trucks, and generators (for various duties such as pumping, lighting, etc.), which would result in fuel combustion and fugitive dust emissions. Construction would be supported by a concrete batch plant which would be a source of fugitive PM.

Construction of the Project would include off-shore dredging of the LNG carrier berthing area at the Terminal site. The emissions generated by these activities would be predominantly combustion emissions from the construction equipment and marine vessel engines. The construction equipment would include a dredge, tugboats, survey/workboats, crew boats, inspection vessels, and trucks.

Emissions from construction equipment would be temporary and would 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. Emissions from equipment associated with the Pipeline would be short-term and localized in the area of construction as equipment and activities move sequentially along the route, and depending on the equipment being operated at any given time.

Operation of the Project would result in long-term air pollutant emissions from stationary equipment at the Terminal site including combustion turbines, duct burners, diesel engines for backup generators, and fugitive emissions from various components. Stationary equipment that would produce emissions at the Liquefaction Facility includes liquefaction blocks; storage tanks for LNG, condensate, and refrigerant; flares; diesel engines for backup generators and firewater pumps; gas heaters; hot oil furnaces; an acid gas thermal oxidizer; and fugitive emissions from various components. The LNG Carrier Loading Facility would be a source of LNG carrier loading emissions (emission units located onshore) and fugitive emissions from various onshore components. Stationary emissions sources associated with the Pipeline would include pig launcher/receivers, meter stations, block valves, and fugitive emissions from various components.

Mobile sources of operational emissions include cars, trucks, and marine vessels. Emissions from vehicle travel would occur at all Project facilities. Marine vessels that would produce operational emissions would include LNG carriers at berth (hoteling emissions), LNG carriers underway, escort tug boats, and security vessels.

Venture Global conducted the source impact analysis as required by the PSD regulations. Venture Global used air quality dispersion modeling to estimate ambient pollutant concentrations in the vicinity of the Project. The analysis for all pollutants except O_3 used the EPA's AERMOD to predict maximum short-term and annual concentrations.

Modeled emission rates included two operating scenarios that address the two operating stages of the turbines:

1. The turbine interim operating mode which consists of three simple cycle heavy-duty frame combustion turbines and one aeroderivative combustion turbine with selective catalytic reduction (a NO_x control technology).

2. The turbine final operating mode which consists of five combined cycle heavy-duty frame combustion turbines and one aeroderivative combustion turbine with selective catalytic reduction.

The modeling for both of these scenarios includes all other emissions facility-wide, which are consistent between the two scenarios. For short-term (1-hour, 3-hour, 8-hour, and 24-hour) averaging periods, emissions were based on hourly maximum emission rates. Long-term (annual) averaging period emission rates were based on an average annual PTE.

The impact analysis includes not only the Project in the modeling, but also other large emission sources in the region. Emission sources within a distance defined by the Radius of Impact plus 12.4 miles (20 kilometers) were included in the modeling, in accordance with LDEQ guidance. Emissions data for these sources was obtained from LDEQ's ERIC. These major sources were defined as facilities with emissions greater than 250 tpy for each modeled pollutant. Meteorological data was obtained from the National Weather Service station at Lake Charles Regional Airport.

The modeling analysis showed that all predicted concentrations were less than the NAAQS except for 1-hour NO_2. To address the 1-hour NO_2 exceedance a "culpability analysis" was performed. 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 pollutant's SIL. None of the Project contributions to modeled NAAQS exceedances are greater than the SIL for 1-hour NO_2. Therefore, the Project would not significantly contribute to any of the modeled NAAQS exceedances, and is shown to be in compliance with the NAAQS.

The PSD increment assessment was performed in the same way as the NAAQS assessment. The assessment was performed for annual NO_2, 24-hour and annual $PM_{2.5}$, and 3-hour SO_2, which are the pollutants for which modeled concentrations exceeded their respective SILs and for which both NAAQS and PSD increments have been established. All predicted concentrations are less than the corresponding PSD increments. Therefore, the Project would not cause or contribute to any PSD increment violations.

Venture Global performed additional assessments of potential impacts from air emissions on Class I areas; soil, vegetation, and wildlife; and effects on development growth. The additional assessments for Class I areas and soil, vegetation, and wildlife were based on the results of the NAAQS analysis. The Project is shown not to have a significant impact on pollutant concentrations or visibility impairment in any Class I area. The Project is not expected to result in significant impacts on soil, vegetation, or wildlife as a result of air emissions.

Venture Global conducted a growth analysis to determine whether the Project could induce additional development and associated emissions that could lead to air quality impacts on the surrounding area. Raw materials, other supplies, and services to be used by the Project are currently available to serve existing oil and gas facilities. Venture Global anticipates that existing suppliers would serve the Project as well, and does not anticipate that the Project would induce new suppliers, support facilities, or other industry to locate in the Project area that were not already drawn to this coastal region.

The area surrounding the Project site contains a viable road network and available workforce. Venture Global anticipates that the majority of the permanent workforce at the Project would be local hires. As the majority of jobs would be staffed locally, 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.

Venture Global performed a second modeling analysis to quantify the potential impact of the Project on O_3 concentrations in the surrounding area, relative to the 8-hour O_3 NAAQS. The O_3 analysis was performed in accordance with current EPA and LDEQ air quality modeling guidelines and consistent with the NAAQS analysis. The potential 8-hour O_3 impact of the Project emissions was quantified using a state-of-the-science regional photochemical grid model, the CAMx in conjunction with data for an O_3 episode that occurred in the Baton Rouge region from August 17 through October 31, 2010. Background concentrations in the region were based on monitored design values in accordance with EPA guidance. The analysis determined that the addition of the modeled Project impact to these background concentrations would not exceed either the 75 ppb 2008 O_3 NAAQS or the 70 ppb 2015 O_3 NAAQS. Therefore, the Project would not cause or contribute to a violation of the O_3 NAAQS. However, Venture Global's modeling analysis for the Terminal plus LNG carrier and supporting vessel mobile emissions did not include certain pollutant concentrations for nearby inventory sources for comparison to the NAAQS. Therefore, to ensure a complete evaluation of the Project air quality impacts, we are recommending that Venture Global Calcasieu Pass file a refined air modeling analysis for the Terminal and associated mobile emissions, prior to the end of the draft EIS comment period.

During the construction phase for the Terminal, activities with such as pile driving, dredging and internal combustion engines associated with construction equipment would generate the highest levels of noise. Five potential noise receptors were identified within 7,000 feet from the Terminal noise center. Pile driving could produce peak sound levels that could be perceptible above the background sound levels at NSAs 1 and 3 during construction. Dredging activities are estimated to produce noise levels of approximately 80 dBA at a distance of 50 feet. Since pile driving and dredging activities could occur on a 24-hour per day basis, an increase in nighttime noise at NSAs 1 and 3 can be expected. As a result, we are recommending that Venture Global Calcasieu Pass file with the Secretary a pile driving and dredging noise analysis identifying the exiting and projected noise levels at NSAs 1 and 3. If noise levels are projected to exceed an L_{dn} of 55 dBA at either NSA, Venture Global Calcasieu Pass should file a mitigation plan and should monitor the noise levels during the construction phase. Most other activities are expected to occur between the hours of 7:00 a.m. and 7:00 p.m., with some nighttime construction during the first 6 to 12 months of the construction phase. A berm is proposed to be constructed on the west side of the Terminal site and a floodwall is proposed along the north, east and south sides of the Terminal site. These barriers would help minimize the short-term construction noise.

During the construction phase for the Pipeline, noise would be generated from construction equipment (excavators, bulldozers, heavy trucks, etc.), as well as from HDD activities. With the exception of the HDD activities, construction for the Pipeline would be limited to daytime hours, minimizing any impacts to nearby residences during nighttime hours. Construction noise for the Pipeline would temporary and noise would vary as the construction progresses along the corridor. TransCameron Pipeline proposes to conduct seven HDD crossings along the pipeline route, with combined entry and exit pit noise levels at 92.4 and 89.6 dBA at 50 feet from the activity, respectively. Based on a preliminary acoustical assessment, the noise levels from the HDD activities are projected to exceed FERC's criteria of 55 dBA L_{dn} at some or all of the NSAs. A number of BMPs are proposed to be implemented by TransCameron Pipeline to help reduce the amount of noise from the HDD activities. Since an acoustical assessment was not completed for all of the NSAs, we are recommending that TransCameron Pipeline file with the Secretary an HDD noise analysis identifying the existing and projected noise levels at each NSA within 0.5 mile of the HDD entry and exit pits, as well as a mitigation plan to reduce projected noise levels.

With the majority of the Pipeline and Terminal construction limited to daytime hours, Venture Global Calcasieu Pass and TransCameron Pipeline's proposed BMPs and mitigation measures, and our recommendations, we believe that nearby NSAs would not be significantly affected by construction-related noise associated with the Project.

Long-term operational noise would be primarily limited to the proposed LNG Terminal and noise-generating activities such as industrial fans for heat exchangers, electric motor units, compressor units and power plant generation units among other facilities. Some of the Terminal facilities would be elevated up to 20 feet above ground (e.g., compressor piping and air coolers) with limited intervening screening such as from the proposed berm or floodwall. The closest NSAs to the Terminal site are NSAs 1 and 3, with the exception of NSA 5 which is the Cameron Jetty Pier. During the operation phase of the Terminal, the Jetty Pier would be used for ferry shuttles only and no vehicle access or overnight camping would be permitted. NSAs 1 and 3 are located 5,000 and 3,400 feet from the Terminal center. With implementation of the mitigation measures identified in the noise analysis, the resulting noise at the NSAs would meet our criteria of an L_{dn} of 55 dBA. In order to ensure implementation of these measures, we are recommending that

Venture Global Calcasieu Pass file with the Secretary a noise survey after placing each phase of liquefaction blocks into service and after placing the entire Terminal into service to confirm that the criteria will be met.

Minimal noise impacts are expected with the operation of the Pipeline and would be limited to pipeline blowdown events during inspections or during maintenance of the system. These events typically last between 20 minutes and 2 hours. Impacts would be infrequent and of limited duration, reducing the potential for long-term impacts.

Based on the analyses conducted and our recommendations, we conclude that operation of the Terminal and TransCameron Pipeline would not result in significant noise impacts on the NSAs.

5.1.12 Safety

We evaluated the safety of the proposed Terminal facility, the related LNG carrier transit, and the Pipeline. As part of our evaluation of the facility, we performed a technical review of the preliminary engineering design to ensure sufficient layers of protection would be included in the facility designs to mitigate the potential for an incident that could impact the safety of the public. The DOT reviewed the initial data and methodology Venture Global used to determine the design spills from various leakage sources, including piping, containers, and equipment containing hazardous liquids, and stated it had no objection to Venture Global Calcasieu Pass' methodology for determining the candidate design spills used to establish the required siting for its proposed Terminal. The USCG reviewed the suitability of the Calcasieu River Ship Channel, and issued a LOR and LOR Analysis stating that the Calcasieu River Ship Channel should be considered suitable for the type and frequency of the LNG marine traffic associated with the proposed Project. In addition, Venture Global Calcasieu Pass would be required to comply with all regulations in 49 CFR 192 for its Pipeline and 33 CFR 105, 33 CFR 127, and 49 CFR 193 for its Terminal. We are recommending additional measures to ensure that concerns identified relating to the reliability, operability, and safety of the proposed design are addressed by Venture Global Calcasieu Pass, and to ensure that the Project facilities are subject to the Commission's construction and operational inspection program. Based on our engineering design analysis and recommendations presented in section 4.12 for the Terminal, the design spill methodology reviewed by DOT for the facility, the LOR issued by the USCG for the LNG marine traffic in the Calcasieu River Ship Channel, and the regulatory requirements for the Pipeline and Terminal, we conclude that the Project would not result in significant increased public safety risks.

5.1.13 Cumulative Impacts

Three types of projects (past, present, and reasonably foreseeable projects) could potentially contribute to a cumulative impact when considered with the proposed project. Such projects in the Project area include existing LNG terminals and future liquefaction projects, oil and gas facilities, other industrial facilities, utility and transportation projects, commercial and residential developments, and government facilities/activities. Our assessment considered the impacts of the proposed project combined with the impacts of the other projects on resources within all or part of the same area and time. We provide a detailed discussion about potential cumulative impacts by resource in section 4.13.

The construction period for the Project would likely coincide with at least some of the other major projects in the area of Cameron and Lake Charles. A large workforce for the simultaneously constructed projects would have a beneficial cumulative effect on revenues for the state and for Cameron, Calcasieu, and Jefferson Davis Parishes due to expenditures for services and materials for the projects, increased expenditures by local workers, and expenditures by the non-local workforce and any family members accompanying the non-local workers. The parishes would also receive a substantial increase in property taxes from the projects.

Based on the size of some of the projects and the large number of construction workers required, the qualified construction workers in the local labor force would likely be exceeded by the available jobs. Therefore, there would be an influx of non-local workers to fill the gap. This would potentially impact transient housing in Cameron, Calcasieu, Jefferson Davis Parishes, where the amount of available housing may not be sufficient if some of the other major projects are constructed at the same time. Nonlocal workers unable to find acceptable housing in Cameron, Calcasieu, and Jefferson Davis Parishes may need to find housing in adjacent Orange and Jefferson Counties, Texas.

The combined construction workforces of these projects would also potentially increase the need for some public services, such as police, medical services, and schools. Venture Global is coordinating with local officials regarding emergency services staffing to mitigate the impact by providing funding for temporarily increasing the staff and equipment of the public services affected. Emergency response time is a key aspect of public health and safety. In accordance with FERC regulations, Venture Global would prepare a comprehensive plan that identifies the cost sharing mechanisms for funding these emergency response costs. This plan would minimize the potential for a cumulative public safety impact associated with the project. Any or all of the stand-alone LNG liquefaction projects (e.g., Lake Charles LNG Project, Magnolia LNG Project), if authorized, constructed, and operated, would also have to prepare and implement a similar comprehensive plan to provide emergency services. In addition, we anticipate that the other major projects in the Lake Charles area would include emergency services within their facilities, and have emergency response plans developed with the appropriate agencies. Emergency responses at any of those facilities may temporarily stress emergency services in the area, but we would not expect them to result in a long-term significant impact on those services. In the unlikely event of major emergencies at several of the facilities at the same time, there could be a short term but substantial cumulative impact on emergency services within Cameron, Jefferson Davis, and Calcasieu Parishes. That impact could be mitigated by assistance from emergency service providers from surrounding parishes.

The percentages of minority populations in the Project area, individually and collectively, are below the 50 percent threshold and are not substantially greater than the minority percentage in the larger area of the general population. We therefore determined that the Project would not disproportionately affect any minority populations. The percentage of the population living below the poverty threshold is lower in Cameron Parish than in the State of Louisiana as a whole, though there are portions of the Project area where poverty levels are comparable with that of the state. While the Project would have an impact on low income populations, there are no direct impact on residential properties and no adverse effect on the physical environment. We therefore determined that the Project would not disproportionately affect any low income populations.

During construction of the Terminal site and other nearby potential planned projects, roadways in the area would experience a substantial increase in daily vehicle trips because of material and equipment deliveries and commuting of construction personnel to and from the project sites. Cumulative impacts on roadway transportation would occur if construction of the Project and other area projects occur at the same time.

Venture Global prepared a Traffic Management Plan in which it indicates preliminary plans for materials to be transported by barge and delivered to nearby existing aggregate storage and handling facilities, which will alleviate material delivery traffic on roadways. The Traffic Management Plan also addresses worker and material transport through off-site parking, shuttles, and infrastructure. These measures, in addition to other potential measures such as controlled shift times and coordination among the other projects to reduce peak hour vehicular trips, traffic signal coordination/timing, intersection and road improvements, and use of law enforcement to control traffic, would help mitigate for and alleviate cumulative impacts from the other area projects, if needed. Pipeline crossings of major roads would be constructed via HDD and would have no short- or long-term impacts on traffic patterns or road conditions.

If necessary, signage and traffic control personnel would be utilized to manage traffic in areas of active pipeline construction, but this would typically only be required for large trucks entering or exiting the pipeline workspaces and the traffic impacts would be of short duration. Vehicles and equipment associated with construction would be required to operate from, or be parked on, the Project right-of-way or authorized contractor equipment yards. With these mitigation options available, we believe that cumulative impacts on land transportation would not be significant. Additionally, we have recommended that Venture Global file its updated Traffic Management Plan for off-site parking- and use of shuttles prior to construction of the Terminal.

Vessel traffic would not be negatively impacted based on the marine traffic study prepared for the Port of Lake Charles (Ausenco, 2014). The study found that there was sufficient capacity in Calcasieu Channel for an increase in vessels over the current estimated number of approximately 1,100 vessels annually and projected future increase in vessels. Additionally, since the LNG carriers would be joining an existing convoy system, and consist of an additional four vessels a week (eight movements in total), the project would create only a slight increase in impacts to recreation and commercial fishing along the Calcasieu River Ship Channel.

The geographic scope of potential impact for air quality during construction of the Project is the area adjacent to and near the boundary of the Terminal site and along the Pipeline. The cumulative impact area for air quality during operation of the Project was established as the Project's PSD Area of Impact, described in section 4.13.2.11.

Construction of the Project and many of the past, present, or future projects listed in table 4.13.1.1-1 would involve the use of construction equipment that generates air pollution, including fugitive dust. The construction activities for the Project and other projects in the region would result in short-term emissions that would be localized to each project area; emissions including fugitive dust would be minimized through typical controls and practices. Therefore, construction emissions are not expected to have a significant cumulative impact on regional air quality.

Operation of the Project, including LNG carriers and associated support vessels in the vicinity of the Terminal site, would contribute cumulatively to air pollutant levels in combination with some of the other projects identified as part of the cumulative impact analysis. As discussed in section 4.11, Venture Global conducted detailed air quality impact analyses to quantitatively evaluate the combined impacts from operation of the Project and other emission sources in the region, including pollutant background concentrations. Those combined impacts were compared to the NAAQS, which are designed to be protective of human health and the environment. The results of the NAAQS analyses demonstrated that there would be no significant impact on regional air quality from operation of the Project.

Like the Project, the cumulative projects are required to demonstrate that they meet the federal and state emissions standards and that they will not cause or contribute to a violation of the NAAQS, either individually or in combination with other existing and permitted sources. Thus, while the Project would incrementally contribute to regional emissions, it is not anticipated to contribute to a significant cumulative air quality impact.

Climate change is the change in climate over an extended period of time, whether due to natural variability, human activities, or a combination of both. Climate change 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 an indication of climate change, while a series of severe droughts or hot summers that statistically alter the trend in average precipitation or temperature over decades may indicate climate change.

The Intergovernmental Panel on Climate Change (IPCC) and U.S. Global Change Research Program (USGCRP) have recognized that:

- globally, GHGs have been accumulating in the atmosphere since the beginning of the industrial era (circa 1750);
- combustion of fossil fuels (coal, petroleum, and natural gas), combined with agriculture and clearing of forests, is primarily responsible for the accumulation of GHG;
- anthropogenic GHG emissions are the primary contributing factor to climate change; and
- impacts extend beyond atmospheric climate change alone, and include changes to water resources, transportation, agriculture, ecosystems, and human health.

The USGCRP's 2009 report, *Global Climate Change Impacts in the United States*, summarizes a number of environmental impacts that may be attributed to climate change in the Southeast region. These impacts are discussed in section 4.13.2.12.

Climate change in the Project region would have two effects that may cause increased storm surges: increased temperatures of Gulf Waters which would increase storm intensity, and a rising sea level. The Project will raise the ground elevation at the site and will construct a levee or perimeter berm that would provide sufficient protection for the facility up to the 500-year storm event.

Venture Global assessed the feasibility of a CCS system to minimize net GHG emissions. 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, any CCS system would require water and energy for system operation, with the associated energy and environmental impacts.

Currently, there is no standard methodology to determine how the Project's incremental contribution to GHGs would result in physical effects on the environment, either locally or globally. However, estimated emissions associated with the Project would incrementally increase the atmospheric concentrations of GHGs, in combination with GHG emissions from other sources identified in the cumulative impact analysis. Because we cannot determine the Project's incremental physical impacts due to climate change on the environment, we cannot determine whether or not the Project's contribution to cumulative impacts on climate change would be significant.

The only potential cumulative project located within proximity to the Terminal site that could contribute to cumulative operational noise impacts is the Commonwealth LNG project. No projects fall within the geographic scope of cumulative construction impacts. The Commonwealth LNG project has not completed the FERC approval process and is in the pre-filing phase and recently initiated the EIS process. For the Project, the FERC would require that noise at the NSAs generated during operation would not exceed the 55 decibel limit established by the EPA for protection of public health and welfare. The combined operation of the Commonwealth LNG project with the Project could result in the raising of the average ambient noise level at the nearest NSAs but not by a significant measure and would not exceed the EPA threshold. Cumulative operational noise may be audible at the NSAs, but should not be significantly greater than current measured ambient noise due to noise attenuation.

No projects are located within the geographic scope of potential cumulative construction noise impacts. There are no NSAs within 0.5 mile of construction activities at the Terminal site, and noise associated with the Pipeline construction (where 14 NSAs are located within 0.5 mile of HDD operations), would be short-term, temporary, and mitigated appropriately. Therefore, cumulative noise impacts associated with construction would be unlikely to be noticeable, unless one or more of the projects were constructed concurrently at the same location which is not anticipated.

The greatest Project-related impact on natural resources would occur within areas permanently occupied by the proposed new aboveground facilities that would be paved, graveled, or covered with other fill material and that would not be restored to preconstruction condition. The cumulative impact to local geology and soils would be negligible. Impacts to wetlands and waters would be minimized and mitigated through implementation of FERC's Plan and Procedures and other project erosion and sediment control plans, and project-specific BMPs.

Impacts on wildlife could include displacement, stress, and direct mortality of some individuals. Potentially suitable cover, nesting, and foraging habitat for some wildlife species would be reduced due to clearing of vegetation. The greatest contribution to cumulative impacts on wildlife and habitat would result from the permanent loss of approximately 304.7 acres of marsh within the Terminal site, Terminal support facilities, access roads, and marine facility area. This effect would be partially offset by Venture Global's implementation of compensatory wetland Project-specific mitigation, as well as other beneficial projects such as marsh habitat restoration and creation.

Operation of the facilities would result in increased noise, lighting, and human activity that could disturb wildlife in the area. However, local wildlife is acclimated to the present industrial conditions, which would be similar to the proposed condition. Additionally, Venture Global Calcasieu Pass has developed a Facility Lighting Plan that includes mitigation measures for light pollution. Therefore, we expect cumulative impacts due to noise, light, and human activity during operation of the facilities to be negligible.

Impacts to aquatic resources would occur within an industrial ship channel that is maintained to support shipping for industrial activity. Proposed project impacts are consistent with this use. Impacts on estuarine fisheries, including those related to changes in benthic forage, should be temporary with habitat use reverting to normal conditions following completion of construction. Therefore, we conclude that cumulative impacts on aquatic resources affected by construction and operation of the Terminal site would be minimal.

Hydroacoustic impacts on fish, sea turtles, and other animals with gas-filled cavities as a result of pile driving may include injury, trauma, or displacement of these aquatic resources. Venture Global Calcasieu Pass has indicated that it is considering noise attenuation measures to reduce underwater sound pressure levels produced by pile driving and implementation of suitable noise attenuation measures. It is expected that other proposed LNG projects and the Port Cameron Project that are in the vicinity of the proposed Project may also generate hydroacoustic impacts on aquatic resources during their construction phase. Should these project schedules overlap and noise and vibration impacts occur within the same impact zones, cumulative impacts on aquatic resources may be expected, but are likely to be minimal with implementation of noise attenuation measures.

We have determined that with implementation of the appropriate mitigation measures, designed in consultation with the FWS, NMFS and LDWF, construction and operation of the Project *may affect but is not likely to adversely affect* the federally and state-listed endangered species. No mitigation is proposed and cumulative impacts are not expected on avian species. ESA section 7 consultation with NMFS is not yet complete for the Gulf sturgeon, five sea turtles, or seven whales, so we have recommended that Venture Global not begin construction until consultation is complete. The Project is unlikely to the impact the sturgeon, sea turtles, or whales, so the cumulative impact on these resources is expected to be limited as a result of this Project and the other cumulative projects proposed along the Calcasieu River Ship Channel. We have determined that, with implementation of the appropriate mitigation measures, there would not be cumulative impacts on threatened or endangered species due to construction and operation of the Project.

The Terminal site would impact primarily open, barren wetland land use areas, and to a lesser extent hay/pasture, herbaceous, developed, open water, and scrub/shrub land uses. Most of the area would be permanently converted to industrial use for long-term operation of the Terminal facility. In addition, construction of Commonwealth LNG, if constructed, as well as the Port Cameron Project would result in a cumulative increase in the conversion of a variety of land uses to industrial/commercial use in the cumulative impact area. Because there are many areas of wetlands, forest, and open water that would remain unaffected by the Project and other area projects, and because impacted wetlands would be mitigated in accordance with USACE and LDEQ permit conditions, we believe that the Venture Global Calcasieu Pass Project would contribute to cumulative land use changes in the area but would not result in a significant cumulative impact.

Construction of the Pipeline would impact primarily coastal wetlands, and to a lesser extent hay/pasture, developed, and herbaceous land uses. Because the majority of land use impacts would be temporary, and permanent and long-term wetland impacts would be mitigated for per USACE and LDEQ regulations, the cumulative impact of the Pipeline on land use would not be significant.

There are no federally or state-managed recreational areas or lands located within 0.25 mile of the Project; however, the Davis Road Public Boat Launch and the Cameron Jetty Fishing Pier and RV Facility are located within 0.25 mile of the Terminal site. Access to these facilities would be removed to allow for construction and operation of the Terminal site. Venture Global Calcasieu Pass is supporting Cameron Parish in its efforts to continue the public use of the Jetty Pier and is coordinating with the Parish in review of plans to develop alternate access to these facilities (e.g., a water shuttle service), and to potentially relocate the RV Facility to another location north of the Terminal site. This particular impact is considered a direct effect and would not have cumulative impacts from other projects.

Construction of the Project and other planned area projects would temporarily impact local recreational fishing and boating activities. However, the cumulative impact of these projects would be mitigated somewhat by the fact that recreational boating and fishing occurs more often on weekends and holidays, and construction activities would likely be reduced during these peak times. Moreover, the cumulative impact of project vessel traffic during construction would be short-term. As a result, we do not believe that the Venture Global Calcasieu Pass Project would result in a significant cumulative impact on recreational fishing and boating.

The visual character of the Terminal site would be similar to and consistent with the ongoing industrial facilities and activities along the Calcasieu River Ship Channel, as well as the many oil and gas facilities in the area. Construction of the other planned area LNG projects would involve constructing similar facilities that would contribute to cumulative visual impacts. Therefore, we do not believe the Terminal site would result in significant cumulative impacts on visual resources.

Construction of the Pipeline may impact visual resources by altering the terrain and vegetation patterns during construction or right-of-way maintenance. Impacts during construction would be short-term and temporary; following construction activities, areas disturbed for construction would be restored and activities that previously occurred in the area would be allowed to resume. The Pipeline would not be in close proximity to other planned area projects and as such, impacts resulting from the construction of these facilities would not contribute significantly to cumulative visual impacts. No additional impacts would occur during operation of the Pipeline. Aboveground facilities associated with the pipeline (i.e., MLVs, meter stations) would have additional visual impacts. However, the facilities would be installed at locations with similar topography to that of the pipeline, and close to existing aboveground facilities. These structures would be located within TransCameron Pipeline's permanent right-of-way and utilize a relatively small footprint. As mentioned above, the Pipeline is not near other planned projects. For these reasons, the aboveground facilities would not contribute significantly to the cumulative impact on visual resources.

We conclude that, for most resources, the Project's contribution to cumulative impacts on resources affected by the Project would not be significant, and that the potential cumulative impacts of the Venture Global LNG Project and the other projects considered would be minor or insignificant.

5.1.14 Alternatives

As alternatives to the proposed action, we evaluated the No-Action Alternative, system alternatives for the proposed LNG facility and Pipeline, alternative configurations for the liquefaction facility, alternative pipeline routes, alternative aboveground facility sites for the pipeline facilities, and alternative power sources for the liquefaction facility. 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 reviewed system alternatives to evaluate the ability of other existing, modified, approved, planned, or proposed facilities to meet the stated objectives of the Project and to determine if a system alternative exists that would have less significant adverse environmental impacts than those associated with the Project. We identified six operating LNG terminal sites along the Gulf Coast in the southeastern United States with approved, proposed, and/or planned expansion(s) to export to FTA countries (nine expansion plans total), and 13 new LNG terminals approved, proposed, and/or planned on greenfield sites. Although it might be theoretically possible to locate Venture Global Calcasieu Pass' proposed liquefaction facilities at any of the project locations by building additional infrastructure alongside previously announced facilities, the commercial, technical, environmental, and schedule impediments to such an undertaking preclude further analysis. Each proposed project is authorized or has applied from DOE to export to FTA countries, which is pre-determined to be in the public interest; therefore, we cannot speculate or conclude that excess capacity would be available to accommodate this Project's purpose and need. Consequently, the proposed export capacity at any other existing or proposed LNG facility would require an expansion or new facility similar to the proposed facilities, resulting in environmental impacts similar to the proposed Project. These systems alternatives therefore offer no significant environmental advantage or disadvantage over the proposed Project.

Facility design and configuration within the Terminal site is subject to the siting requirements of 49 CFR 193 and other industry or engineering standards. Regulatory requirements stipulate that potential thermal exclusion and vapor dispersion zones remain on site, limiting the potential locations for specific pieces of equipment. Similarly, thermal radiation zones for flares require that the flare be set back a minimum distance from other equipment and property lines. The selected location of each of the components of the Terminal was based on the relevant regulations, codes, and guidelines. Venture Global Calcasieu Pass' original September 4, 2015 application included a larger project footprint that was subsequently reduced to accommodate a smaller, more efficient facility design, in response to feedback from permitting agencies regarding environmental impacts. We evaluated the proposed configuration and project specification changes in supplemental and addendum filings 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 proposed Terminal configuration.

Two pipeline routes were considered to transport feed gas from the interconnect location to the Terminal site: the Alternative Lateral pipeline route and the proposed Pipeline. The alternative route would be approximately 20.6 miles long and would trend due east between the Terminal site and the interconnect location. Although the route would approximate the shortest land distance between the two locations and run along the coast in a relatively unpopulated area, it has some significant disadvantages, including proximity to the upper beach line, nesting shorebirds and turtles, greater extent of wetland impact, crossing of a major waterbody, and lesser extent of collocation. The proposed Pipeline offers significant environmental advantages compared to the Alternative Lateral Pipeline Route, despite its greater length. Based on the regional setting of TransCameron Pipeline's proposed Pipeline, we have determined that a different route between other points of interconnection to the ANR and Bridgeline pipeline systems would not offer any environmental advantage, irrespective of engineering feasibility or cost.

As part of the original September 24, 2015 application, TransCameron Pipeline included a West Lateral pipeline that was subsequently removed from the Project. Venture Global determined that the proposed pipeline lateral to the east of the Terminal site would provide sufficient flexibility and access to feed gas from the U.S. natural gas pipeline grid. The removal of the West Lateral pipeline reduced the project footprint by 372 acres, including a 46 percent and 52 percent reduction in temporary and permanent impacts on wetlands, respectively. There is no significant advantage to the West Lateral Pipeline as an alternative to the proposed Pipeline.

Venture Global investigated several liquefaction technologies and process alternatives currently available on the market to determine which is best suited to the Project and region. Each LNG train for the proposed Project would have a capacity of 1.0 MTPA, and would be developed based on a staged approach of smaller gas volumes. Based on its improved efficiencies and modular nature, Venture Global selected the IPSMR® process as the most suited for this project. We have determined that none of the alternative processes offered any significant environmental advantages over the proposed process.

5.2 FERC STAFF'S RECOMMENDED MITIGATION

If the Commission authorizes the proposed Calcasieu Pass 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 proposed Project. We have included several recommendations that require Venture Global Calcasieu Pass to provide updated information and/or documents prior to the end of the draft EIS comment period. While some of the documents may not be available until the end of the comment period, FERC will continue to accept and consider comments on these documents, as well as those on the draft EIS, as the final EIS is prepared. We do not expect that Venture Global Calcasieu Pass's responses would materially change any of the conclusions presented in this draft EIS; instead, the information requested is primarily related to ensuring that our final EIS is complete and to provide up-to-date information on Venture Global Calcasieu Pass's ongoing efforts to minimize the impacts of the Project and comply with FERC regulations.

1. Venture Global Calcasieu Pass and TransCameron Pipeline shall follow the construction procedures and mitigation measures described in their application and supplements (including responses to staff data requests) and as identified in the EIS, unless modified by the Order. Venture Global Calcasieu Pass and TransCameron Pipeline 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 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, 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 Calcasieu Pass and TransCameron Pipeline each 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 Calcasieu Pass and TransCameron Pipeline 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.

   TransCameron Pipeline's exercise of eminent domain authority granted under Natural Gas Act (NGA) section 7(h) in any condemnation proceedings related to the Order must be consistent with these authorized facilities and locations. TransCameron 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 Calcasieu Pass and TransCameron Pipeline 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 *Upland Erosion Control, Revegetation, and Maintenance 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. **At least 60 days before construction begins,** Venture Global Calcasieu Pass and TransCameron Pipeline shall each file an Implementation Plan with the Secretary for review and written approval by the Director of OEP. Venture Global Calcasieu Pass and TransCameron Pipeline must file revisions to the plan as schedules change. The plan(s) shall identify:

a. how Venture Global Calcasieu Pass and TransCameron Pipeline 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 Calcasieu Pass and TransCameron Pipeline 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 onsite construction and inspection personnel;

c. the number of EIs assigned per spread, and how Venture Global Calcasieu Pass 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 Calcasieu Pass and TransCameron Pipeline will give to all personnel involved in 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. Venture Global Calcasieu Pass personnel (if known) and specific portion of Venture Global Calcasieu Pass and TransCameron Pipeline's organization having responsibility for compliance;

g. the procedures (including use of contract penalties) Venture Global Calcasieu Pass and TransCameron Pipeline will follow if noncompliance occurs; and

h. for each discrete facility, a Gantt or PERT chart (or similar project scheduling diagram), and dates for:

   i. the completion of all required surveys and reports;

   ii. the environmental compliance training of onsite personnel;

   iii. the start of construction; and

   iv. the start and completion of restoration.

8. Venture Global Calcasieu Pass and TransCameron Pipeline shall employ at least one EI for the Terminal and one EI per pipeline construction spread, or as may be established 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 7 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 Calcasieu Pass and TransCameron Pipeline shall file updated status reports with the Secretary on a **monthly** basis for the Terminal, and a **biweekly** basis for the Pipeline, until all construction and restoration activities are complete. Problems of a significant magnitude shall be reported to the FERC **within 24 hours**. 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 Calcasieu Pass and TransCameron Pipeline's efforts to obtain the necessary federal authorizations;

b. Project schedule including the current construction status, 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 and remedial actions implemented in response to all instances of noncompliance, nonconformance, or deficiency;

e. the effectiveness of all corrective and remedial 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 Calcasieu Pass and TransCameron Pipeline from other federal, state, or local permitting agencies concerning instances of noncompliance, and Venture Global Calcasieu Pass and TransCameron Pipeline's response.

10. Venture Global Calcasieu Pass and TransCameron Pipeline must receive written authorization from the Director of OEP **before commencing construction of any Project facilities**. To obtain such authorization, Venture Global Calcasieu Pass and TransCameron Pipeline must file with the Secretary documentation that each has received all applicable authorizations required under federal law (or evidence of waiver thereof).

11. Venture Global Calcasieu Pass 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. Venture Global Calcasieu Pass must receive written authorization from the Director of OEP **before placing the Terminal facilities into service**. Such authorization will only be granted following a determination that the facilities have been constructed in accordance with the FERC approval, can be expected to operate safely as designed, and the rehabilitation and restoration of the areas affected by the Terminal are proceeding satisfactorily.

13. TransCameron Pipeline must receive written authorization from the Director of OEP **before placing the Pipeline into service**. Such authorization will only be granted following a determination that rehabilitation and restoration of the right-of-way and other areas affected by the Pipeline are proceeding satisfactorily.

14. **Within 30 days of placing the authorized facilities in service**, Venture Global Calcasieu Pass and TransCameron Pipeline shall each 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. identifying which of the conditions in the Order Venture Global Calcasieu Pass and TransCameron Pipeline have 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. **Prior to the end of the draft EIS comment period**, Venture Global Calcasieu Pass shall file with the Secretary the results of the planned aquifer test well, including the aquifer pumping test results and analysis of potential long-term impacts, and identify the source(s) for the Terminal's long-term freshwater supply. In addition, Venture Global Calcasieu Pass shall file with the Secretary documentation of consultation with the LDEQ regarding adequate groundwater supply for both construction and long-term operations. (section 4.3.1.4)

16. **Prior to construction of the Pipeline**, TransCameron Pipeline shall file with the Secretary the results of site-specific geotechnical investigations conducted for each proposed HDD. Describe the subsurface lithology along the drill path, standard penetration test results, and soil mechanic properties. Depict this data on each HDD profile. Utilizing this data also file an HDD feasibility study conducted by a qualified contractor. Discuss the potential for hydrofracture and an inadvertent release of drilling fluids using the USACE methodology for the installation of pipelines using HDD. (section 4.3.2.2)

17. **Prior to construction**, Venture Global shall file with the Secretary written concurrence from LDWF for the proposed instream construction windows. (section 4.3.2.3)

18. **Prior to construction**, Venture Global shall revise its Project-specific Procedures without the requested modification to section VI.B.3.c and file it with the Secretary for review and written approval by the Director of OEP. (section 4.4.3.6)

19. **Prior to construction**, Venture Global shall coordinate with the NRCS and LDWF to develop Project-specific noxious weed control procedures. Venture Global shall file its Project-specific noxious weed control procedures with the Secretary, including documentation of its consultation with the NRCS and LDWF, for review and written approval by the Director of OEP. (section 4.5.2)

20. **Prior to the end of the draft EIS comment period**, Venture Global shall file with the Secretary its plan to conduct outstanding surveys for state-designated rare plant species, correspondence with the LNHP, and any mitigation measures Venture Global would implement. (section 4.5.4.2)

21. **Prior to construction**, Venture Global shall conduct nesting bird colony surveys within the appropriate buffer area. Before the initiation of surveys, Venture Global shall consult with the LDWF and FWS for appropriate survey methods, timeframes, and locations. The survey reports, any LDWF or FWS comments on the surveys, and Venture Global's proposed mitigation measures shall be filed with the Secretary. Venture Global must receive written approval from the Director of OEP before construction or implementation of any mitigation measures may proceed. (section 4.6.1.3)

22. **Prior to the end of the draft EIS comment period**, Venture Global shall file with the Secretary its plan to conduct surveys for state-designated rare wildlife species, including the diamondback terrapin, correspondence with the LDWF, and any mitigation measures Venture Global would implement. (section 4.6.1.3)

23. **Prior to the end of the draft EIS comment period**, Venture Global Calcasieu Pass shall file with the Secretary a plan to mitigate the effects of noise from pile driving activities in consultation with the NMFS, the FWS, and the LDWF. (section 4.6.2.1)

24. Venture Global shall **not begin construction of the Project facilities until**:

    a. the FERC staff receives comments from the FWS/NMFS regarding the proposed action;

    b. the FERC staff completes any necessary ESA section 7 consultation with FWS/NMFS; and

    c. Venture Global has received written notification from the Director of the OEP that construction and/or use of mitigation may begin. (section 4.7.1.5)

25. **Prior to the end of the draft EIS comment period**, Venture Global Calcasieu Pass shall file with the Secretary any updates to the Cooperative Endeavor Agreement and any updated correspondence with the Cameron Parish Police Jury, regarding its plans to enhance and/or maintain recreation opportunities in the project area. (section 4.8.1.3)

26. **Prior to construction of the Project**, Venture Global shall file with the Secretary a copy of the determination of consistency with the Coastal Zone Management Plan issued by the LDNR. (section 4.8.1.5)

27. **Prior to construction of the Terminal**, Venture Global Calcasieu Pass shall file with the Secretary, for review and written approval by the Director of OEP, a Final Traffic Management Plan that includes information relative to off-site parking and the use of shuttles. (section 4.9.12.1)

28. **Prior to construction of the Terminal**, Venture Global Calcasieu Pass shall file with the Secretary, for review and written approval by the Director of OEP, a Fugitive Dust Control Plan that specifies the precautions that Venture Global Calcasieu Pass will take to minimize fugitive dust emissions from construction activities, including additional mitigation measures recommended by the EPA to control PM_{10} and $PM_{2.5}$. The plan shall clearly explain how Venture Global Calcasieu Pass will implement such measures as:

    a. watering the construction workspace and access roads;

    b. providing measures to limit track-out onto the roads;

    c. identifying the speed limit that Venture Global Calcasieu Pass would enforce on unsurfaced roads;

    d. covering open-bodied haul trucks, as appropriate;

    e. clarifying that the EI has the authority to determine if/when water or an alternative dust suppressant needs to be used for dust control; and

    f. clarifying the individuals with the authority to stop work if the contractor does not comply with dust control measures. (section 4.11.1.4)

29. **Prior to the end of the draft EIS comment period**, Venture Global Calcasieu Pass shall file with the Secretary a refined air modeling analysis for the Terminal and the associated mobile emissions, during LNG vessel hoteling and maneuvering activities, that includes the nearby inventory sources

for the pollutants that exceeded the significant impact levels and for comparison to the NAAQS. Venture Global Calcasieu Pass shall perform the modeling analysis using the same protocol used for the PSD permitting modeling analysis with justification for the basis of any assumptions. (section 4.11.1.6)

30. **Prior to the end of the draft EIS comment period**, Venture Global Calcasieu Pass shall file with the Secretary a pile driving and dredging noise analysis identifying the existing and projected noise levels at NSAs 1 and 3. If noise attributable to the pile driving and dredging activities are projected to exceed an Ldn of 55 dBA at either NSA, Venture Global Calcasieu Pass shall file the noise analysis and a mitigation plan to reduce the projected noise levels. (section 4.11.2.4)

31. **Prior to construction of the HDDs identified in table 4.11.2-3 of the EIS**, TransCameron Pipeline shall file with the Secretary an HDD noise analysis identifying the existing and projected noise levels at each NSA identified within 0.5 mile of each HDD entry and exit site. If noise attributable to the HDD is projected to exceed an Ldn of 55 dBA at any NSA, TransCameron Pipeline shall file with the noise analysis a mitigation plan to reduce the projected noise levels for the review and written approval by the Director of OEP. **During drilling operations**, TransCameron 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 Ldn of 55 dBA at the NSAs. (section 4.11.2.4)

32. Venture Global Calcasieu Pass shall file with the Secretary a full power load noise survey for the Terminal **no later than 60 days** after each phase of liquefaction blocks are placed into service. If the noise attributable to operation of the equipment at the Terminal exceeds an Ldn of 55 dBA at the nearest NSA, Venture Global Calcasieu Pass shall reduce operation of the liquefaction facilities or install additional noise controls until a noise level below an Ldn of 55 dBA at the NSA is achieved. Venture Global Calcasieu Pass 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. (section 4.11.2.4)

33. Venture Global Calcasieu Pass shall file a noise survey with the Secretary **no later than 60 days** after placing the entire Terminal into service. If a full load condition noise survey is not possible, Venture Global Calcasieu Pass shall provide an interim survey at the maximum possible horsepower load **within 60 days** of placing the Terminal into service and provide the full load survey **within 6 months**. If the noise attributable to operation of the equipment at the Terminal exceeds an Ldn of 55 dBA at the nearest NSA under interim or full horsepower load conditions, Venture Global Calcasieu Pass 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. Venture Global Calcasieu Pass 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. (section 4.11.2.4)

34. **Prior to the end of the draft EIS comment period**, Venture Global shall demonstrate how they comply with 49 CFR 193.2155(b). (section 4.12.5)

35. **Prior to initial site preparation**, Venture Global Calcasieu Pass shall file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in Louisiana:

    a. quality assurance and quality control procedures to be used for civil/structural design and construction;

b. site preparation drawing and specifications; and

c. seismic specifications for procured equipment prior to the issuing of requests for quotations. (section 4.12.5)

36. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in Louisiana:

a. pile installation drawings and specifications;

b. LNG storage tank and foundation design drawings and calculations;

c. LNG facility structures and foundation design drawings and calculations (including prefabricated and field-constructed structures as applicable); and

d. perimeter berm and floodwall design drawings and calculations based upon the design recommendations provided in the Project Levee and Floodwall Overtopping Analysis report (Moffat and Nichol, 2016) and the Project Geotechnical Study report (Fugro, 2015). (section 4.12.5)

37. **Prior to commencement of service**, Venture Global Calcasieu Pass shall file with the Secretary a surface maintenance plan, stamped and sealed by the professional engineer-of-record registered in Louisiana, for the perimeter berm 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. (section 4.12.5)

Conditions 38 through 118 shall apply to the Calcasieu Pass Project LNG Terminal facilities. 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.

38. **Prior to initial site preparation,** Venture Global Calcasieu Pass shall file an overall Terminal schedule, which includes the proposed stages of the commissioning plan.

39. **Prior to initial site preparation,** Venture Global Calcasieu Pass shall file quality assurance and quality control procedures for construction activities.

40. **Prior to initial site preparation,** Venture Global Calcasieu Pass shall file procedures for controlling access during construction.

41. **Prior to initial site preparation,** Venture Global Calcasieu Pass shall develop an Emergency Response Plan (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 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 including, but not limited to, the calculated AEGL dispersion zones;

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 carrier to activate sirens and other warning devices.

Venture Global Calcasieu Pass shall notify FERC staff of all planning meetings in advance and shall report progress on the development of its Emergency Response Plan at **3-month intervals**.

42. **Prior to initial site preparation,** Venture Global Calcasieu Pass 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. Venture Global Calcasieu Pass 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**.

43. **Prior to initial site preparation,** Venture Global Calcasieu Pass shall file a complete specification of the proposed LNG tank design and installation.

44. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file information/revisions pertaining to Venture Global Calcasieu Pass's response numbers 64, 68, 69, 73, 74, 77, 80, 83, and 88 of its February 3, 2017 filing, which indicated features to be included or considered in the final design.

45. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file information/revisions pertaining to the response numbers 1, 3, 4, 5, 8, 10, 11, 12, 13, and 14 of its December 13, 2017 filing, which indicated features to be included or considered in the final design.

46. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file information/revisions pertaining to the response numbers 1(a), 3(b), 6(b), 7, 9(a) leakage source table changes, 13, and 15 of its March 7 and 13, 2018 filings, which indicated features to be included or considered in the final design.

47. **Prior to construction of the final design**, Venture Global Calcasieu Pass shall provide details of its foundation heating system of the LNG storage tanks or details of an alternative system that demonstrates cold temperatures will be prevented from causing frost heave underneath the tank. If an elevated pile cap design is selected, Venture Global Calcasieu Pass shall consider preventing

the migration and ignition of vapor clouds underneath the LNG storage tank or demonstrating the tank will be able to withstand such a scenario.

48. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file change logs that list and explain any changes made from the FEED provided in its application and filings. A list of all changes with an explanation for the design alteration shall be filed and all changes shall be clearly indicated on all diagrams and drawings.

49. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file a plot plan of the final design showing all major equipment, structures, buildings, and impoundment systems.

50. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file an up-to-date complete equipment list, process and mechanical data sheets, and specifications.

51. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file three-dimensional plant drawings to confirm plant layout for maintenance, access, egress, and congestion.

52. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file up-to-date Process Flow Diagrams with heat and material balances and a complete set of Piping and Instrumentation Diagrams (P&IDs), which include the following information:

    a. equipment tag number, name, size, duty, capacity, and design conditions;

    b. equipment insulation type and thickness;

    c. 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.

53. **Prior to construction of the final design**, Venture Global Calcasieu Pass shall revise P&IDs to be consistent and include the full tag numbering system for valves and instrumentation to prevent operator errors.

54. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file a car seal philosophy and a list of all car-sealed and locked valves consistent with the P&IDs.

55. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file a hazard and operability review of the completed design prior to issuing the P&IDs for construction. The review shall include a list of recommendations and actions taken on the recommendations.

56. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall provide 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.

57. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall include provisions in the facility plot plan for the possible future installment of a mercury removal system.

58. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall include space for possible future installment of LNG drain pumps for the BOG Compressor Drain Drum (110-V0003).

59. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall include an antisurge and control system on the recycling gas compressor (103-K1001).

60. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall include a vent valve on the drain line 3”-BO-126-040002-1K0A1-PH from the Warm Flare Knockout Drum (126-V0001).

61. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall include a flow meter on the discharge of the LNG Loading Pumps to verify the pump’s performance.

62. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall include an antisurge and control system on the molecular sieve dehydration system.

63. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall include double isolation valves on the Cold Flare Scrubber (00A-V-1110).

64. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file the cause-and-effect matrices for the process instrumentation and emergency shutdown system. The cause-and-effect matrices shall include alarms and shutdown functions, details of the voting and shutdown logic, and set points.

65. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall specify that all emergency shutdown valves are to be equipped with open and closed position switches connected to the Distributed Control System/Safety Instrumented System.

66. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file the procedures for pressure/leak tests which address the requirements of ASME VIII and ASME B31.3, as required by 49 CFR Part 193.

67. **Prior to construction of the final design**, Venture Global Calcasieu Pass 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 required by 49 CFR Part 193, and shall provide justification if not using an inert or non-flammable gas for clean-out, dry-out, purging, and tightness testing.

68. **Prior to construction of the final design,** Venture Global Calcasieu Pass 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.

69. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall specify that piping specifications for stainless steel piping capable of operating at cryogenic temperatures shall require the inner and outer ring of spiral wound gaskets to be stainless steel.

70. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall include dual relief valves on the ethylene, propane, and pentane storage drums.

71. **Prior to construction of the final design,** Venture Global Calcasieu Pass 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.

72. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file an updated fire protection evaluation of the proposed facilities carried out in accordance with the requirements of NFPA 59A (2001 edition), Chapter 9.1.2 as required by 49 CFR Part 193. The evaluation shall include a list of recommendations and supporting justifications, and actions taken on the recommendations. Clarification shall be provided on the use of high expansion foam or foam glass blocks for LNG spill impoundments and specific consideration shall be given to the use of other foam systems or automatic fire protection measures in the hazardous fluid storage areas, including the diesel storage area.

73. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file spill containment system drawings with dimensions and slopes of curbing, trenches, impoundments, and capacity calculations for trenches and impoundments considering any foundations and equipment within impoundments, the sizing and design of the down-comer that would transfer LNG tank top spills to the ground-level impoundment system, and demonstration that the piping spill trays at the base of the LNG tanks would withstand the force and shock of a sudden cryogenic release.

74. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file revised dimensions for Discharge Holding Basins 127-M0011, 127-M0021, and 127-M0041 to contain the liquid volume associated with the high liquid level in the hot oil surge drum or shall demonstrate that sizing liquid volumes greater than those already considered could not occur.

75. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file detailed calculations to confirm that the final fire water volumes would be vaporized or accounted for when evaluating the capacity of the impoundment system during a spill and fire scenario.

76. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file documentation of the PHAST model suitability for predicting the rainout from a catastrophic failure of the liquid nitrogen storage tank, including any validation against experimental data for similar scenarios. Alternatively, Venture Global Calcasieu Pass shall revise the liquid nitrogen containment design to take into account for the non-flashing portion of the vessel liquid volume in the PHAST modeling results or to account for the liquid fraction indicated by experimental data for similar scenarios of a similar scale.

77. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall provide containment for the liquid from a failure of a feed gas booster compressor knock out drum, as well as any other significant liquid vessels outside of containment areas, or shall provide a detailed

explanation of how this liquid would be safely collected, including calculations for the liquid volume considered.

78. **Prior to construction of the final design**, Venture Global Calcasieu Pass shall provide a detailed analysis to demonstrate that liquid from an LNG storage tank failure would not be expected to reach the metal storm surge wall and gate or shall demonstrate that the storm surge wall, up to a necessary height, would be designed or protected to withstand the potential spill conditions, including sudden cryogenic temperatures.

79. **Prior to construction of the final design,** Venture Global Calcasieu Pass 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).

80. **Prior to construction of the final design,** Venture Global Calcasieu Pass 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.

81. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file electrical area classification drawings.

82. **Prior to construction of the final design,** Venture Global Calcasieu Pass 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. The list shall include the instrument tag number, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment.

83. **Prior to construction of the final design**, Venture Global Calcasieu Pass shall file a technical review of its proposed facility design that:

    a. identifies all combustion/ventilation air intake for equipment and buildings and the distances to any possible hazardous fluid release (LNG, flammable refrigerants, flammable liquids and flammable gases); 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 ventilation equipment whose continued operation could add to or sustain an emergency.

84. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas when determining the lower flammability limit set points for methane, propane, and ethylene, pentane, and condensate.

85. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas when determining the toxic concentration set points for condensates, ammonia, and hydrogen sulfide.

86. **Prior to construction of the final design,** Venture Global Calcasieu Pass 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.

87. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file the cause-and-effect matrices for the fire and gas detection system and emergency shutdown system. The cause-and-effect matrices shall include alarms and shutdown functions, details of the voting and shutdown logic, and set points.

88. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file complete plan drawings and a list of the fixed and wheeled, dry-chemical, and hand-held fire extinguishers, and other hazard control equipment. Drawings shall clearly show the location by tag number of all fixed, wheeled, and hand-held extinguishers. The list shall include the equipment tag number, type, capacity, equipment covered, discharge rate, and automatic and manual remote signals initiating discharge of the units. The spacing of portable fire extinguishers shall be demonstrated to meet NFPA 10 spacing requirements.

89. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall include clean agent systems in the electrical switchgear and instrumentation buildings.

90. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file facility plans and drawings that show the location of the firewater and foam systems. Drawings shall clearly show: firewater and foam piping; post indicator valves; and the location, and area covered by, each monitor, hydrant, deluge system, foam system, water-mist system, and sprinkler. The drawings shall also include piping and instrumentation diagrams of the firewater and foam system.

91. **Prior to construction of the final design**, Venture Global Calcasieu Pass shall install firewater hydrants or monitors that cover the LNG storage tanks for exposure cooling.

92. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall specify that the firewater flow test meter is 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. The firewater main header pressure transmitter shall also be connected to the DCS and recorded.

93. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file the structural analysis of the LNG storage tank and outer containment demonstrating they are designed to withstand all loads and combinations. The analysis shall include thermal loads on the outer containment of the full containment storage tanks when exposed to a roof tank top fire or adjacent tank top fire and overpressure and projectile loads from wind borne projectiles and ignition of design spills.

94. **Prior to construction of final design,** Venture Global Calcasieu Pass shall include 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.

95. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file plans to equip the LNG storage tank and adjacent piping and supports with permanent settlement monitors to allow personnel to observe and record the absolute and relative settlement of the LNG storage tank and adjacent piping.

96. **Prior to construction of final design,** Venture Global Calcasieu Pass shall provide complete plan drawings of lighting, camera coverage, security fencing, including facility access and egress for the entire facility. The lighting shall include all lighting, including the process and storage tank areas, and shall be supported by a photometric analysis. The camera coverage shall include all camera coverage within the site and delineate operator and security camera coverage. The fencing shall surround the entire facility, including along the entire shoreline, and shall evaluate the mesh size proposed and shall show access/egress points and vehicle barriers at those locations and other locations throughout the plant.

97. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall certify that the final design is consistent with the information provided to the DOT as described in the design spill determination letter dated October 4, 2017 (Accession Number 20171005-3053). In the event that any modification to the design alters the candidate design spills on which the 49 CFR Part 193 siting analysis was based, Venture Global Calcasieu Pass shall consult with the DOT on any actions necessary to comply with Part 193.

98. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file plant geometry models or drawings that verify the confinement and congestion represented in the front-end engineering design or provide revised overpressure calculations indicating that a 1 psi overpressure would not impact the public.

99. **Prior to construction of the final design,** Venture Global Calcasieu Pass shall file a detailed quantitative analysis to demonstrate that adequate thermal mitigation would be provided for each significant component that could fail from an impoundment fire. The analysis shall consider 4,000 BTU/ft^2-hr or a more detailed analysis of the degradation of strength and pressure rise from the radiant heat exposures. Trucks at the truck transfer station shall be included in the analysis. A combination of passive and active protection shall be provided and demonstrate the effectiveness and reliability. Passive mitigation shall be supported by calculations for the thickness limiting temperature rise and active mitigation shall be justified with calculations demonstrating flow rates and durations of any cooling water would mitigate the heat absorbed by the vessel.

100. **Prior to commissioning,** Venture Global Calcasieu Pass 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. Venture Global Calcasieu Pass shall 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.

101. **Prior to commissioning,** Venture Global Calcasieu Pass shall file results of the LNG storage tank hydrostatic test and foundation settlement results along with adjacent piping. At a minimum, foundation settlement results shall be provided thereafter annually via a semi-annual operational report.

102. **Prior to commissioning,** Venture Global Calcasieu Pass shall file plans and detailed procedures for testing the integrity of onsite mechanical installation, functional tests, introduction of hazardous fluids, operational tests, and placing the equipment into service.

103. **Prior to commissioning,** Venture Global Calcasieu Pass shall tag all equipment, instrumentation, and valves in the field, including drain valves, vent valves, main valves, and car-sealed or locked valves.

104. **Prior to commissioning,** Venture Global Calcasieu Pass shall file a tabulated list and drawings of the proposed hand-held fire extinguishers. The list shall include the equipment tag number, extinguishing agent type, capacity, number, and location. The drawings shall show the extinguishing agent type, capacity, and tag number of all hand-held fire extinguishers.

105. **Prior to commissioning,** Venture Global Calcasieu Pass shall file the operation and maintenance procedures and manuals, as well as safety procedures, hot work procedures and permits, abnormal operating conditions reporting procedures, and management of change procedures and forms.

106. **Prior to commissioning,** Venture Global Calcasieu Pass shall provide a detailed training log that demonstrates that operating staff has completed required training.

107. **Prior to introduction of hazardous fluids,** Venture Global Calcasieu Pass shall complete all pertinent tests (Factory Acceptance Tests, Site Acceptance Tests, Site Integration Tests) associated with the Distributed Control System and the Safety Instrumented System that demonstrates full functionality and operability of the system.

108. **Prior to introduction of hazardous fluids,** Venture Global Calcasieu Pass 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).

109. **Prior to unloading the first LNG import commissioning cargo and prior to loading the first LNG export commissioning cargo,** Venture Global Calcasieu Pass shall receive written authorization from the Director of OEP. After first production of LNG, Venture Global Calcasieu Pass 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 block, 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**.

110. **Prior to commencement of service,** Venture Global Calcasieu Pass shall specify an alarm management program to ensure effectiveness of process alarms.

111. **Prior to commencement of service,** Venture Global Calcasieu Pass shall develop procedures for offsite contractors' responsibilities, restrictions, and limitations and for supervision of these contractors by Venture Global Calcasieu Pass staff.

112. **Prior to commencement of service,** Venture Global Calcasieu Pass 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).

113. **Prior to commencement of service,** Venture Global Calcasieu Pass shall notify the FERC staff of any proposed revisions to the security plan and physical security of the plant.

114. **Prior to commencement of service,** Venture Global Calcasieu Pass shall file documentation confirming a determination by the USCG, under its authorities under the Ports and Waterways Safety Act, the Magnuson Act, the Maritime Transportation Security Act, and the Safety and

Accountability For Every Port Act, that Venture Global Calcasieu Pass has installed appropriate measures to ensure the safety and security of the facility and the waterway.

In addition, the following measures shall apply **throughout the life** of the LNG Terminal facilities:

115. 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, Venture Global Calcasieu Pass 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 piping and instrumentation diagrams reflecting facility modifications and provision of other pertinent information not included in the semi-annual reports described below, including facility events that have taken place since the previously submitted semi-annual report, shall be submitted.

116. **Semi-annual** operational reports shall be filed with the Secretary to identify changes in facility design and operating conditions, abnormal operating experiences, activities (e.g., ship arrivals, quantity and composition of imported and exported LNG, liquefied and vaporized quantities, boil-off/flash gas, number and volume of trucking, etc.), 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 to provide FERC staff with early notice of anticipated future construction/maintenance projects at the LNG facility.

117. 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.

118. 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 FERC staff. In the event an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification 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 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 five minutes or more;

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

g. any crack or other material defect that impairs the structural integrity or reliability of an LNG 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 LNG facilities) plus the build-up allowed for operation of pressure limiting or control devices;

i. a leak in an LNG facility that contains or processes 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 an LNG facility that contains or processes hazardous fluids;

l. safety-related incidents to 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 facility's incident management plan.

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

APPENDIX A

EIS DISTRIBUTION LIST

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Federal Government Agencies

U.S. Advisory Council on Historic Preservation, Office of Federal Programs, Assistant Director for Federal Program Development, Charlene D Vaughn, DC

U.S. Army Corps of Engineers, New Orleans District, Ms. Brenda Archer, LA

U.S. Army Corps of Engineers, New Orleans District, Chief, Western Evaluation Section, Mr. Darrell Barbara, LA

U.S. Army Corps of Engineers, New Orleans District, Environmental Resources Specialist, Mr. James Little, LA

U.S. Army Corps of Engineers, New Orleans District, Regulatory Branch Chief, Mr. Martin Mayer, LA

U.S. Army Corps of Engineers, Planning and Policy Division, Senior Policy Advisor, John Furry, DC

U.S. Coast Guard, Michael S. Oyler

U.S. Coast Guard, Commanding Officer, Captain Jackie Twomey, TX

U.S. Coast Guard, Deepwater Ports Standards Division, Commandant (CG-OES-4) Chief (Acting) Attorney/Advisor, Curtis E. Borland, DC

U.S. Coast Guard, MSU Lake Charles Chief, Prevention Department, LT Peter Bizzaro, LA

U.S. Coast Guard, MSU Lake Charles, Commanding Officer, Commander Daniel H. Cost, LA

U.S. Coast Guard, MSU Port Arthur, Commander, Loan O'Brien, TX

U.S. Coast Guard, MSU Port Arthur, Commanding Officer, Jacqueline Twomey, TX

U.S. Department of Agriculture, Farm Service Agency, Conservation and Environmental Program Division, National Environmental Compliance Manager, Nell Fuller, DC

U.S. Department of Agriculture, Forest Service-Ecosystem Management Coordination, Assistant Director, NEPA, Joe Carbone, DC

U.S. Department of Agriculture, Natural Resources Conservation Service, National Environmental Coordinator, Andree DuVarney, DC

U.S. Department of Agriculture, Natural Resources Conservation Service, State Conservationist, Mr. Kevin D. Norton, LA

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Assistant Regional Administrator for Fishery Resources, Mr. Dave Bernhart, FL

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Assistant Regional Administrator, Mr. Miles Croom, FL

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Fishery Biologist/Team Leader, Mr. Richard Hartman, LA

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, NOAA NEPA Coordinator, NOAA National Marine Fisheries Service, MD

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Regional Administrator, Dr. Roy Crabtree, FL

U.S. Department of Defense, Office of the Deputy Under Secretary of Defense (Installations & Environment), DOD Siting Clearinghouse, ATTN: Chief, Mission Evaluation Branch, DC

U.S. Department of Defense, Siting Clearinghouse, Steve Sample, DC

U.S. Department of Energy, Director, Division of Natural Gas Regulatory Activities, John Anderson, DC

Federal Government Agencies (cont'd)

U.S. Department of Energy, Office of Environmental Management, Principal Deputy Assistant Secretary, Mark Whitney, DC

U.S. Department of Energy, Office of Fossil Energy, Mr. Kyle Moorman, DC

U.S. Department of Energy, Office of NEPA Policy and Compliance, Acting Director, OGC, Brian Costner, DC

U.S. Department of Health and Human Services, Center for Disease Control, National Center for Environmental Health, Director, Division of Emergency and Environmental Health Services, Sharunda Buchanan, GA

U.S. Department of Health and Human Services, Chief Environmental Officer, Mr. Everett Bole, CHMM, DC

U.S. Department of Homeland Security, Customs and Border Protection Department, Branch Chief, Christopher Oh, DC

U.S. Department of Housing and Urban Development, Office of Environment and Energy, Community Planner, Danielle Schopp, DC

U.S. Department of Interior, Bureau of Indian Affairs, BJ Howerton, VA

U.S. Department of Interior, Bureau of Indian Affairs, NEPA Coordinator, Terry L McClung, DC

U.S. Department of Interior, Bureau of Land Management, FERC Contact, U.S. Department of Interior, DC

U.S. Department of Interior, Bureau of Land Management, NEPA Specialist, U.S. Department of Interior, DC

U.S. Department of Interior, Bureau of Ocean Energy Management, Chief, Division of Environmental Assessment, Dr. Jill Lewandowski, VA

U.S. Department of Interior, Bureau of Safety and Environmental Enforcement, Chief, Environmental Compliance Division, David Fish, VA

U.S. Department of Interior, National Park Service, Chief, Environmental Planning and Compliance Branch, Patrick Walsh, CO

U.S. Department of Justice, Environment and Natural Resources Division, NEPA Coordinator, U.S. Department of Justice, DC

U.S. Department of State, Bureau of Oceans & International Environmental & Scientific Affairs, Foreign Affairs Officer, Alexander Yuan, DC

U.S. Department of the Air Force, Office of the Deputy Assistant Secretary of the Air Force (Installations), SAF/IEI, ATTN: Liaison, DoD Siting Clearinghouse, DC

U.S. Department of the Army, Office of the Assistant Secretary of the Army for Civil Works, Assistant for Environment, Tribal & Regulatory Affairs, DC

U.S. Department of the Army, Office of the Deputy Assistant Secretary of the Army (Energy & Sustainability), ATTN: Liaison, DoD Siting Clearinghouse, DC

U.S. Department of the Navy, Office of the Assistant Secretary of the Navy (Energy, Installations and Environment), DC

U.S. Department of Transportation, Office of Assistant Secretary for Transportation Policy, Environmental Policy Team Coordinator, Camille Mittelholtz, DC

U.S. Department of Transportation, Office of Assistant Secretary for Transportation Policy, Senior Environmental Attorney Advisor, Helen Serassio, DC

U.S. Department of Transportation, Office of the Chief Information Officer, Deputy CIO, Kristin Baldwin, DC

U.S. Department of Transportation, Pipeline & Hazardous Materials Safety Administration, Associate Administrator for Hazardous Materials Safety, William Schoonover, DC

Federal Government Agencies (cont'd)

U.S. Department of Transportation, Pipeline & Hazardous Materials Safety Administration, Associate Administrator for Pipeline Safety, Alan Mayberry, DC

U.S. Department of Transportation, Pipeline & Hazardous Materials Safety Administration, Attorney Advisor, Ahuva Battams, DC

U.S. Department of Transportation, Pipeline & Hazardous Materials Safety Administration, Attorney Advisor, Melanie Stevens, DC

U.S. Department of Transportation, Pipeline & Hazardous Materials Safety Administration, Community Assistance and Technical Services, Mr. Bill Lowry, TX

U.S. Department of Transportation, Pipeline & Hazardous Materials Safety Administration, Community Liaison Services Program Manager, Karen Lynch, DC

U.S. Department of Transportation, Pipeline & Hazardous Materials Safety Administration, Director, Engineering and Research Division, Kenneth Y Lee, DC

U.S. Department of Transportation, Pipeline & Hazardous Materials Safety Administration, Engineering and Research, Sentho White, DC

U.S. Department of Transportation, Surface Transportation Board, Chief, Section of Environmental Analysis, Victoria Rutson, DC

U.S. Environmental Protection Agency, Gabriel Gruta, TX

U.S. Environmental Protection Agency, Air Permits Section Chief, Mr. Jeffrey Robinson, TX

U.S. Environmental Protection Agency, Assistant Administrator, Office of Enforcement and Compliance Assurance, Lawrence Starfield, DC

U.S. Environmental Protection Agency, Chief, Special Projects Section, Mr. Robert Houston, TX

U.S. Environmental Protection Agency, Director, Office of Federal Activities, Susan E Bromm, DC

U.S. Environmental Protection Agency, Natural Gas STAR, Jerome Blackman, DC

U.S. Environmental Protection Agency, Regional Administrator, Anne Isdal, TX

U.S. Environmental Protection Agency, Wetlands Section, Dr. Raul Gutierrez, TX

U.S. Fish & Wildlife Service, Conservation Planning Assistance, Mr. Joshua Marceaux, LA

U.S. Fish & Wildlife Service, Deputy Regional Director, Mike Oetker, GA

U.S. Fish & Wildlife Service, Fish and Wildlife Biologist, Mr. Joshua Marceaux, LA

U.S. Fish & Wildlife Service, Refuge Manager, Mr. Glenn Harris, LA

U.S. Fish & Wildlife Service, T&E Species Biologist, Mr. David Castellanos, LA

U.S. Geological Survey, Chief, Environmental Management Branch, Esther Eng, VA

U.S. Senate Committee on Energy and Natural Resources Committee, Chairman, Lisa Murkowski, DC

U.S. White House Council on Environmental Quality, Associate Director for NEPA Oversight, Edward Boling, DC

U.S. White House Council on Environmental Quality, Deputy General Counsel, Marna McDermott, DC

Federal Senators and Representatives

Office of Senator Bill Cassidy, Southwest Regional Director, Lauren Casanova, LA

Office of U.S. Senator John Kennedy, Regional Representative, Emily Stine, LA

Office of Representative Clay Higgings, Field Representative, Jerod Prunty, LA

APPENDIX A
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Federal Senators and Representatives (cont'd)

Staff to Representative Boustany, Staff to Representative Boustany, Mr. Charles Dalgleish, LA

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U.S. House of Representatives, U.S. Representative, The Honorable Clay Higgins, LA

U.S. House of Representatives, U.S. Representative, The Honorable Steve Scalise, DC

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U.S. Senate, U.S. Senator, The Honorable Bill Cassidy, DC

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U.S. Senate, U.S. Senator, The Honorable John Kennedy, DC

U.S. Senate, U.S. Senator, The Honorable John Kennedy, LA

State Senators and Representatives

Louisiana House of Representatives, State Representative, District 47, The Honorable Bob Hensgens, LA

Louisiana State Senate, State Senator, District 25, The Honorable Dan "Blade" Morrish, LA

State Government Agencies

Coastal Protection and Restoration Authority of Louisiana, Executive Director, Michael G. Ellis, LA

Governor's Office of Homeland Security and Emergency Preparedness, Regional Director, Dick Gremillion, LA

Louisiana Department of Agriculture and Forestry, Commissioner, Mr. Mike Strain, LA

Louisiana Department of Environmental Quality, Air Permits Administrator, Bryan Johnston, LA

Louisiana Department of Environmental Quality, Air Quality Dispersion Modeling Coordinator, Ms. Yvette Olmos, LA

Louisiana Department of Environmental Quality, Assistant Secretary, Mr. Elliott Vega, LA

Louisiana Department of Environmental Quality, Environmental Services Manager, Qingming Zhang, LA

Louisiana Department of Environmental Quality, Permit Writer, Mei Wu, LA

Louisiana Department of Environmental Quality, Sec. 401 Water Quality Certification, Ms. Elizabeth Johnson, LA

Louisiana Department of Environmental Quality, Secretary, Dr. Chuck Carr Brown, LA

Louisiana Department of Environmental Quality, Water Permits Administrator, Mr. Scott Guilliams, LA

Louisiana Department of Natural Resources, Administrator, Permits and Mitigation Division, Mr. Karl Morgan, LA

Louisiana Department of Natural Resources, Assistant Secretary, Office of Coastal Management, Mr. Keith Lovell, LA

Louisiana Department of Natural Resources, Coastal Resources Scientist, Andi Zachary, LA

Louisiana Department of Natural Resources, Manager – Permits, Ms. Christine Charrier, LA

Louisiana Department of Natural Resources, Secretary, Mr. Stephen Chustz, LA

Louisiana Department of Transportation and Development, Secretary, Ms. Sherri LeBas, LA

Louisiana Department of Wildlife and Fisheries, Biologist Program Manager, Mr. Kyle Balkum, LA

State Government Agencies (cont'd)

Louisiana Department of Wildlife and Fisheries, Non-game Ornithologist, Mr. Michael Seymour, LA

Louisiana Department of Wildlife and Fisheries, Permits Coordinator, Mr. Dave Butler, LA

Louisiana Department of Wildlife and Fisheries, Secretary, LA

Louisiana Economic Development, Assistant Secretary, Ms. Mandi Mitchelle, LA

Louisiana Economic Development, Secretary of Economic Development, Mr. Donald Pierson Jr., LA

Louisiana Office of Cultural Development, State Archaeologist and Director, Dr. Charles "Chip" McGimsey, LA

Louisiana State Fire Marshal's Office, State Fire Marshal, Chief Butch Browning, LA

Louisiana State Police, Command Inspector, Region II, Major Becket Breaux, LA

Louisiana State Police, Troop D Commander, Benny Broussard, LA

State of Louisiana, Attorney General, The Honorable Jeffrey Landry, LA

State of Louisiana, Governor, The Honorable John Bel Edwards, LA

State of Louisiana, Lieutenant Governor, The Honorable Billy Nungesser, LA

State of Louisiana, Secretary of State, Secretary Tom Schedler, LA

Local Government Agencies

Cameron Parish, Parish Administrator, Mr. Ryan Bourriaque, LA

Cameron Parish Police Jury, President, Mr. Curtis Fountain, LA

Cameron Parish Police Jury, Police Juror, Mr. Anthony "Dino" Hicks, LA

Cameron Parish Police Jury, Police Juror, Mr. Kirk Quinn, LA

Cameron Parish Police Jury, Police Juror, Mr. Terry Beard, LA

Cameron Parish Police Jury, Police Juror, Mr. Dave Doxey, LA

Cameron Parish Police Jury, Vice President, Mr. Joe Dupont, LA

Cameron Parish Police Jury, Police Juror, Mr. Lawrence "Lee" Faulk, LA

Cameron Parish Public Works, Public Works Supervisor, Mr. Lee Faulk, LA

Cameron Parish Permitting Office, Permit Technician, Ms. Robin Morales, LA

Cameron Parish Parks & Recreation, Director, Mr. Dwayne Sanner, LA

Cameron Parish School Board, Superintendent, Mr. Charles Adkins, LA

Cameron Parish School Board, President, Mr. Joseph Delcambre, LA

Cameron Parish School Board, Board Member, Ms. Christi Labove, LA

Cameron Parish School Board, Board Member, Ms. Rhonda Bourdreaux, LA

Cameron Parish School Board, Vice President, Ms. Sheila Miller, LA

Cameron Parish School Board, Board Member, Mr. John Canik, LA

Cameron Parish School Board, Board Member, Ms. Sharon Picou, LA

Cameron Parish School Board, Board Member, Ms. Paula Smythe, LA

Cameron Parish, District Attorney, The Honorable Jennifer Jones, LA

Cameron Parish, Assistant District Attorney, The Honorable Tom Barrett, LA

West Cameron Port Commission, Port Director, Ms. Clair Hebert Marceaux, LA

Local Government Agencies (cont'd)

West Cameron Port Commission, Chairman, Mr. Clifton Cabell, LA

West Cameron Port Commission, Port Vice President, Mr. Jimmy Brown, LA

West Cameron Port Commission, Port Commissioner, Mr. Tim Dupont, LA

West Cameron Port Commission, Port Commissioner, Mr. Ricky Poole, LA

West Cameron Port Commission, Port Commissioner, Mr. Howard Romero, LA

West Cameron Port Commission, Port Commissioner, Mr. Dwight Savoie, LA

West Cameron Port Commission, Port Commissioner, Mr. Carroll Trahan, LA

West Cameron Port Commission, Port Commissioner, Mr. Wendell Wilkerson, LA

West Cameron Port Commission, Port Commissioner, Ms. Sheila Miller, LA

West Cameron Port Commission, Port Commissioner, Mr. Chris Foundation, LA

West Cameron Port Commission, Port Commissioner, Kay Picou, LA

Port of Lake Charles, Executive Director, Mr. William J. Rase, LA

Port of Lake Charles, President, Dudley R. Dixon, LA

Port of Lake Charles, Commissioner, Mr. Thomas L. Lorenzi, LA

Port of Lake Charles, Commissioner, Mr. Elcie Guillory, LA

Port of Lake Charles, Vice President, Mr. Michael G. Eason, LA

Port of Lake Charles, Secretary/Treasurer, John L. LeBlanc, LA

Port of Lake Charles, Commissioner, Mr. David Darbone, LA

Port of Lake Charles, Assistant Secretary/Treasurer, Mr. Carl Krielow, LA

Cameron Parish, Sheriff, Sheriff Ron Johnson, LA

Cameron Parish Fire Department, Fire Chief, Chief Paul Sellers, LA

Lake Charles Fire Department, Fire Chief, Chief Keith Murray, LA

Cameron Parish, Director of Emergency Preparedness, Mr. Danny Lavergne, LA

Cameron Parish Ambulance District 1, Director, Mr. Bryon Broussard, LA

Cameron Parish Ambulance District 2, Director, Ms. Rhonda Coleman, LA

Cameron Parish Police Jury, LA

Cameron Parish Sewerage, District #1, LA

Gravity Drainage District No. 4, Attn: Steven Landry, LA

Sewerage District No 1 of the Parish of Cameron, LA

West Cameron Port Commission, LA

Lower Cameron Hospital Service District, LA

Native American Groups

Alabama Coushatta Tribe of Texas, Mikko Colable III, Clem Sylestine, TX

Choctaw Nation of Oklahoma, Chief, Gary Batton, OK

Jena Band of Choctaw Indians, Chief, Chief B. Cheryl Smith, LA

Coushatta Tribe of Louisiana, Chairman, David Sickey, LA

Tunica-Biloxi Indians of Louisiana, Tribal Chairman, Mr. Earl J. Barbry Sr., LA

Mississippi Band of Choctaw, Chief, Chief Phyllis Anderson, MS

APPENDIX A
DISTRIBUTION LIST (cont'd)

Libraries

Cameron Main Library, Branch Manager, Angel Baccigalopi, LA

Media

American Press, Lake Charles, LA

Cameron Pilot, DeQuincy, LA

Southwest Daily News, Sulphur, LA

Port Arthur News, TX

Companies and Organizations

4K Services, Inc., LA

A. M. Cox Properties, L.L.C., Attn: Althea M. Cox, LA

Abear-Nunez Farms, L.L.C., Attn: Carl Hebert, Registered Agent & Principal Member, LA

Avavia Investments LLC, Attn: Chad E Mudd, LA

C. F. Henry Properties, LLC, Attn: Ell Ray Henry, LA

C.F. Henry Properties, LLC, LA

Calcasieu Kiwanis Club, Mr. Russell Ham, LA

Cameron Commercial Property LLC, Attn: Chad E Mudd, LA

Cameron Lions Club, President, LA

Cameron Main Library, Branch Manager, Angel Baccigalopi, LA

Cameron Masonic Club, Inc., LA

Cameron Parish Chamber of Commerce, President, Mr. Greg Wicke, LA

Cameron Parish Farm Bureau, Parish President, Mr. James Cox, LA

Cameron Parish School Board, LA

Cameron Rental Properties, LA

Cameron Water Works, Secretary and Treasurer, Kim Murphy, LA

Can AM LA Properties LLC, OR

Carter-Butler Properties, LA

Catholic Society of Religious & Literary Education, LA

CEM Properties LLC, LA

Chenier, L.L.C., Attn: Dallas Lionel Brasseaux, LA

Coastal Cans LLC, Brent and Amanda Morales, LA

DAN3177, LLC, Attn: Robert Quigley, Jr., TX

Davis Lands, L.L.C., Attn: E. Scott Henry, LA

Graham Royalty, LTD, LA

Greater Lake Charles Rotary Club, President, Mr. Ryan Abell, LA

Henry Venture, LLC, Attn: EllRay Henry, LA

Henry, Henry, & Martin LLC, Attn: Ellray Henry, LA

Imperial Calcasieu Human Resource Management Association, President, Janell Johnson, LA

Imperial Calcasieu Regional Planning and Development Commission, Director, Cheri Soileau, LA

JA Davis Furman, LLC, Attn: Scott Henry, LA

JADP Venture, LLC, Attn: E Scott Henry, LA

John W Stone Oil Distributor LLC, LA

Lake Area Industry Alliance, Executive Director, Mr. Larry DeRoussel, LA

Lake Charles Pilots, President, Captain Brett Palmer, LA

LeBoeuf Land & Investments, L.L.C., OK

Louisiana Oil and Gas Association, Assistant to the President, Cece Richter, LA

Louisiana Oil and Gas Association, President, Mr. Don Briggs, LA

APPENDIX A
DISTRIBUTION LIST (cont'd)

Companies and Organizations (cont'd)

LSU Center for Energy Studies, Executive Director, Dr. David Dismukes, LA

Margie Nunez Dimas Family, L.L.C., LA

Mermentau Mineral and Land Company, Inc., LA

Millrich Properties L.L.C., Attn: Kirk Sanner, LA

Mudd Land Company LLC, LA

Punk's Properites, L.L.C., Attn: Ester Liggio, LA

R & D Resources LTD, c/o Gloria Connors, Canada

Rotary Club of Lake Charles, President, Mr. Brian Abshire, LA

S. E. Carter Properties, L.L.C., Attn: Jenny Carter, LA

Safety Management Systems, Regional Manager, Mr. Todd LaPorte, LA

SM Ingram LLC, Attn: Scott McCoy Ingram, TX

South Cameron Memorial Hospital, LA

Southwest Louisiana Association of Realtors, CEO, Cynde Pettie, LA

Southwest Louisiana Economic Development Alliance, President/CEO, Mr. George Swift, LA

SOWELA Technical Community College, Chancellor, Dr. Neil Aspinwall, LA

St. John M. B. Vianney Catholic Church, LA

The Ardoin Limited Partnership, LA

The EEL & PDL, LLC, TX

The Flying F, LLC, Attn: Arthur L. French and Susan W. French, TX

The John W. Rutherford, Jr. Family L.L.C., Attn: John W. Rutherford, III, TX

Wilma Davis Bride Family, LLC, Attn: E Scott Henry, LA

Individuals

A P Higgins, EST, Attn: Lionel Ortego, Jr, LA

Aaliyah Noel LaBove, Attn: Lisa LaBove Guidry, LA

Aaron LaSalle, LA

Aaron Paul Pinch, LA

Adam Thibodeaux, Attn: Jo Ann Camp, TX

Agnes Marie Pradia, LA

Alana Savoy, LA

Alberta Marie Bartie, LA

Alcie Gerard Nunez, LA

Allen B. Andrus, OR

Allen Brent Nunez, LA

Allen Fred Stapleton, TX

Allie Lee Jones Carter, LA

Allie Mae Theriot, LA

Allison C. Griffith, OK

Althea Mae Cox, LA

Alvin Kenneth Smith, II, GA

Alvin R. Mudd, LA

Amanda Drost, FL

Amanda Weatherly, FL

Andre Mitchell, FL

Angela D. Bartie Adams, MA

Angela F. Nunez, LA

Angela Khoury Blanchette, LA

Angela M. LeBoeuf, AK

Angela Price LaBove, LA

Angela Rutherford, TX

Angela Theriot, LA

Anita Granger, LA

Individuals (cont'd)

Ann Lisa Theriot, LA

Ann Savoy, LA

Ann Van Geffen Meaux, LA

Anna Carol Levy Plaisance, LA

Anthony Drew Dorsett, Sr., TX

Anthony Harmon, LA

Anthony Lee Bartie, LA

Anthony Seals, TX

Arain Abshire, LA

Arieal Jerreal Green, TX

Arlene Macilda-Miller Crochet, LA

Arvel James Holland, LA

Ashley Pinch, LA

Ashley Robinson Welch, LA

Astrid Gulindo, LA

Audrey Rutherford Vaughan, LA

B Vernon Cooley, et al, c/o: Dorothy Bennett, LA

Barbara J. George, LA

Barbara J. Marsh, OR

Barbara Nunez Primeaux, LA

Becky Bennett Carter, GA

Belinda K. Dockins, LA

Ben Templeton, TX

Benjamin Carl Welch, Sr., LA

Benjamin Franklin Rutherford c/o John W Rutherford, III, TX

Bennett Revocable Living Trust, c/o: Eleanor Bennett, CA

Bennie Savoy Reon, LA

Bernard Freeland Levy, Jr., LA

Bertha Sturlese Brown, LA

Bessie Jean Ruley Kearns, CO

Betsy Ann Bennett Ireland, LA

Betty LeBoeuf Walters, LA

Beverly Mudd Miller, LA

Beverly Mudd, LA

Billy DeLaney, LA

Billy Drost, LA

Billy Greig Nicholson, TX

Billy Shane Cooley, Attn: Herman Primeaux, MO

Blaine Kermit Quinn, LA

Blair C. Belanger Taylor, LA

Bobby Hession, LA

Bobby Pearce, LA

Bonnie Donahue Theriot, LA

Bonnye Beth Savoie, LA

Boymah Bartie, PA

Brandon Bishop Smith, TX

Brandon Jerome Carter, Jr., LA

Brandon P. Butler, LA

Brenda Andrew LeBoeuf, LA

Brenda M. Van Atten, LA

Brenda Storm Quinn, LA

Bronwen Freeman, Attn: Cynthia Marie Nunez, LA

Bryan Scott Courville, TX

Burnell James Nunez, Jr., LA

Burnell Nunez, LA

Burt Vincent, LA

C. Jerome Rutherford, LA

Individuals(cont'd)

Candance Chenelle Sturlese, LA

Carbet J. Boudreaux, LA

Carl Lee Trahan, LA

Carl Theriot, c/o: Tiffany Ellis, TX

Carlin Dale LeBoeuf, LA

Carlotta Ann Savoie, LA

Carlotta Boudoin, LA

Carlton L. Jones, LA

Carmen M. Dimas, LA

Carol Ann Hockey Nunez, LA

Carol DeRouen, LA

Carol Duhon Mack, et al, LA

Carolyn Ann Benoit, LA

Carolyn Braud Smith, GA

Carolyn Herpin Carter, LA

Carolyn Kay Canik, LA

Carolyn M. Miller, LA

Catherine U. Savoie, LA

Cecelia Bartie, LA

Cecile Savoie, Attn: Phillis Tarkington, LA

Chad Dwayne Arceneaux, LA

Chad Ellis & Michelle Mudd, LA

Chadwick S. Miller, LA

Charlene Constance, LA

Charles Cruthirds, GA

Charles Dwight Reed, LA

Charles Edward Bradley, Jr., LA

Charles Evans LaBove, LA

Charles Francis Savoy, III, LA

Charles Glen Theriot, LA

Charles Larry Conner, LA

Charles O. Styron, III, LA

Charles Perry, LA

Charles R. Fontenot, c/o: Camille M. Whittington, TX

Charles Randall Broussard, LA

Charles Randall DeRouen, LA

Charles Randall Nicholson, TX

Charlotte Ann Trosclair, LA

Cherie Griffith Giblin, LA

Cheryl Ann Hutchins, LA

Cheryl Ann Miller Murphy, TX

Cheryl Ann Miller, LA

Cheryl Savoy, LA

Chris E. Landry, LA

Christina Catherine LaFleur, TX

Christine S. Leonard, LA

Christopher Allen Percle, LA

Christopher Kyle Pedersen, LA

Cindy Helms Pedersen, LA

Clara Joan Phillips, TX

Clarence A. Miller, Jr., LA

Clarice Ann Richard Jones, LA

Claude Jack Herpin, II, TX

Claudette Boudoin Dinger, LA

Claudette Fawvor Regan, LA

Clayton A. Richard, LA

Clifford Fontenot, Sr., LA

Clinton Nunez, LA

Constance Celeste Margaret Carter McKelvy, PA

Corliss Monceaux, LA

APPENDIX A
DISTRIBUTION LIST (cont'd)

Individuals (cont'd)

Cornelia Dunwoody, GA

Cornellia Marie Bartie Dunaway, LA

Craig A. Rutherford, LA

Crystal Boudreaux Savoie, LA

Crystal Mudd Wilson, LA

Cynthia Jean Quinn Mansco, LA

Dale Boudreaux, LA

Dale Hendrix Beam, LA

Dale LaFleur, TX

Dallas C. Pichnic, Jr., TX

Dallas Clyde Pichnic, Sr. Trust, TX

Dallas Lionel Brasseaux, Sr., LA

Damon Granger, LA

Dan H. Pradia, Sr., LA

Dana A. Courville, LA

Dana Michelle White Granger, LA

Daniel Davis, TX

Daniel Gordon Nunez, LA

Daniel Kenneth Drost, FL

Daniel Lynn Savoie, LA

Daniel Young, LA

Darla Ann Boudreaux DeSonier, LA

Darlene Boudreaux Higgins, LA

Darren J. Miller, LA

David A. Savoie, LA

David Brent Sturlese, LA

David Conner, LA

David Davis, Attn: Cynthia Marie Nunez, LA

David Dimas, LA

David G. Culpepper, LA

David George, LA

David Kent Savoie, LA

David L. Browne, et al, LA

David L. Ingram, TX

David Michael Richard, LA

Deann Shores LaBove, LA

Debbie Ann Hendrix, LA

Debbie Theriot, LA

Debbie Williamson, TX

Deborah Andrus, OR

Deborah Delee Nicholson, TX

Deborah Drost, NC

Deborah LeBoeuf, LA

Deborah Savoie, LA

Debra Broussard, LA

Debra Lynne Miller, LA

Debra Primeaux, LA

Debra Rutherford, LA

Della Gossen Vaughan, LA

Delmer Mansco, LA

Denise Charity Roberts Gullett, LA

Denise R. DeLaney, LA

Dennis Keith Savoie, LA

Derek W. Hardie, LA

Desmond Kearns, CO

Devin McComb, LA

Dewey George Boudreaux, Jr., Attn: Linda Dianne Boudreaux, LA

Dewitt Poole, LA

Diane Jane Pedersen, LA

Diane Smith Bradley, LA

Individuals (cont'd)

Diane Theriot, LA

Donald James Swire, LA

Donald Maurice Drost, NC

Donald W. Kahl, Sr., LA

Donna Faye Duhon Nunez, LA

Donna Jean Koppie Chaisson, AR

Donna Kaye Sturlese, LA

Donna Marie Savoie, LA

Donna Primeaux, LA

Donna Rae Ducote, LA

Donna Sturlese McDonald, LA

Dora Mae Pinch, LA

Dorothy Ann Landry, TX

Dorothy Arrington Hassell, TX

Dorothy Mae French Arrington, TX

Douglas Claude Jones, TX

Dwight Belone Erbelding, LA

Earl Ervan Guidry, LA

Earline Marie Mudd, LA

Eddie D. Dunwoody, GA

Eddie J. Conner, LA

Eddie Mudd Nunez, LA

Edward A. Frank, Jr., LA

Edward Alcee Freeland, Jr., LA

Edward LeBoeuf, LA

Edward Russell Smith, LA

Edwin Joseph Granger, Jr., LA

Eleanor Roselle Welch, TX

Eleesa N. Andrus, OR

Elias Burton Swire, LA

Elisabeth Richard, LA

Elizabeth Authement Mudd, LA

Elizabeth B. Richard, LA

Elizabeth Elaine DeRouen Todd, LA

Elizabeth Jean Mudd, LA

Elizabeth Marion Ruley, TX

Elizabeth S. Richard, LA

Elizabeth W. Brasseaux, LA

Ella Mae Nunez Little, LA

Elma Jones Bishop, LA

Elsie Richard Theriot, LA

Emma Jean Boudreaux Miller, LA

Eric Christopher Smith, LA

Eric Dinger, LA

Eric R. LeBoeuf, AK

Erik Brandt Pedersen, Jr., LA

Ernest Joseph Savoie, LA

Ernest R. Horn, LA

Ernestine T. Horn, LA

Ethel Theriot, LA

Eva Sandra Mount Webber, CA

Eve LeBlanc Andrews, LA

Evelyn Alford Smith, LA

Evelyn F. Landry, LA

Fann Family Living Trust, Attn: Brian Joseph Haven, TX

Faye Cormier, TX

Ferdinand Bishop, LA

Floyd January, LA

Floyd Lee Benoit, LA

APPENDIX A
DISTRIBUTION LIST (cont'd)

Individuals (cont'd)

Frances C. Savoy Living Trust, c/o: Frances Savoy, WA

Frances Khoury Freedlund, LA

Frances Murphy DeVall, LA

Frances Piner Mudd, LA

Frances Welch Perry, LA

Francis Brent Little, LA

Francis Hector Guilbeau, Jr., LA

Francis Romain Theriot, LA

Francis W Haymark, et al, LA

Frank Murray, LA

Fred A. Johnson, LA

Fred W. Schenk, TX

Frederick Carter, LA

Frederick James Nunez Granger, LA

Fredrick B. Boudoin, LA

Gabe LaLande, LA

Gail Kovach Bonsall, LA

Gary M. Billedeaux, LA

Gary Wayne LeBoeuf, LA

Gemi Blake, TX

Genelle Conner Crochet, LA

George Allen Savoy, LA

George C. Quinn, Jr., LA

George Houston Miller, LA

George LaBove, LA

George Saikin, TX

George Simpson, TX

Georgia Herpin Baker, TX

Gerald Elvis Ruley, TX

Geraldine Oresile Boudreaux Richard, LA

Geraldine Savoie McDaniel, LA

Geraldine Savoy January, c/o Gertrude Savoy, LA

Geri Ann Jones, TX

Gertrude Amelia Nunez Holland, Attn: A.J. Holland, LA

Gertrude Ann Savoy, LA

Gilbert S. Mudd, LA

Glada Labove Guidry, LA

Gladis Savoy Hardin, LA

Glinda LaBove Boudreaux, LA

Gloria Savoie Kelley, LA

Gregory Delane Boudreaux, LA

Gregory Keith Trahan, TX

Greta Maureen Kahl, LA

Guy Murphy, Jr., LA

Gwendlynn Faith Roberts Broussard, LA

Gwendolyn Boudreaux Hebert, LA

Gwendolyn Lou Savoy, LA

Hans Edward Petersen, LA

Hargie Faye Savoy, TX

Harold Hardie, LA

Heidi Welch, Attn: James R. Welch, II, CA

Helen Marie DeRouen Culpepper, LA

Henry James Company, LA

Henry Richard Woodgett, LA

Herman Meredith Primeaux, LA

Hilda Miller Crain, c/o: Rachel Corley, LA

Holly Meaux, LA

Hugh O. Bourque, Jr., GA

Individuals (cont'd)

Hugh Pravate Miller, Attn: Arlene Crochet, LA

Hunter LeBoeuf, LA

Ina Wicke, Attn: Richard & Wendy Wicke, LA

India A. Bartie-Thomas, MA

Irene Corley, LA

Iris Vinson, LA

Ivory Dugas, LA

Ivy LeBoeuf, LA

J.C. Reina, LA

Jack Jaynes, TX

Jack S. Compton, GA

Jackie Reon LaBove, LA

Jacqueline Beam, LA

Jacqueline R. Savoie, LA

Jacquelyn Ann Simoneaux, LA

Jaime Beth Guidry Goos, LA

James Austin Guthrie, LA

James Breaux, LA

James Carroll Beam, LA

James Curtis Richard, LA

James Dale Sells, LA

James David Perry, Jr., LA

James E. Breaux and Betty R. Breaux Revocable Living Trust, LA

James Fitch, LA

James G. Sutton, LA

James Jamar Bishop, OK

James Jeffrey Campbell, LA

James Keith Stanley, TX

James Lee Savoy, LA

James M Jennings Jr, et al, LA

James M. Forsberg, TX

James Oscar Savoie, LA

James Patrick Giblin, LA

James R. Rutherford, TX

James Ralph Welch, II, CA

James Rudolph Savoie, LA

James Scott Granger, LA

Jamie L. Styron, LA

Jamie Leigh Pinch, LA

Jan Allyce Stanley, TX

Jana Lee DeChau, FL

Janelle Hebert Boudoin, LA

Janet Marie Dorsett, TX

Janet S. LeBoeuf Benson, LA

Janetta Agnes Theriot LaLande, LA

Janice Landry, LA

Janice LeBoeuf, LA

Janith Savoie Lockwood, LA

Jared LaBove, LA

Jared LeBoeuf, LA

Jason Moore, LA

Jason Taylor, LA

Jason Travis Neal, TX

Jaynee Smith-Wood, NC

Jeanette R. Benoit, LA

Jeanette Savoie, Attn: Kevin Savoie, LA

Jeannet R. Mudd, LA

Jeff Freeman, Attn: Cynthia Marie Nunez, LA

Jeffery Roberts, LA

Jeffery Rome Larke, LA

Individuals (cont'd)

Jeffrey W. Beam, LA

Jennifer Carter Sutton, LA

Jennifer Khoury Vincent, LA

Jenny Theriot Peterman, LA

Jerome Malcolm Primeaux, LA

Jerry A & Gwendolyn F Mouton, LA

Jerry L. Canik, LA

Jerry Wayne Furs, LA

Jesse Dwayne Trahan, LA

Jim Hassell, TX

Jim Traweek, LA

Jimmie Ann Meaux McLean, LA

Jimmie Ann Rutherford Moriarty, LA

Jimmie D. & Barbara Pelloquin, LA

Jimmy L. Kelley, LA

Jo Ann D. Beam, LA

Joan Alice Carter Liebert, LA

JoAnn Miller, TX

Jodi Kelley Williams, LA

Jodi Mudd Young, LA

Jodi Nunez-Landry, TX

Joe Landry, LA

Joel Roberts, TX

John Brent Meaux, LA

John D. Stevenson, KS

John E. Liebert, LA

John Edward Khoury, II, LA

John Elie Savoie, LA

John F. Boudreaux, LA

John Galton Boudreaux, LA

John Guidry, LA

John Hebert, LA

John Huey Theriot, LA

John Marcus Clark, TX

John Ronald Theriot, TX

John Strom, TX

John W. Rutherford, III, TX

John Whitney Stine III, TX

Jolyn English Stanley, TX

Jonas T. Primeaux, LA

Jonathan Lazzara, CA

Jordon Matthew Sturlese, LA

Joseph Chalmus Roberts, Jr., LA

Joseph Edward Addison, III, LA

Joseph Everette Roy, LA

Joseph Godfrey Miller, LA

Joseph John Higgins, III, LA

Joseph Kelan McCall, LA

Joseph Kirk Rutherford, LA

Joseph Ovey Herpin, III, LA

Joseph Trahan, LA

Joseph W. Dockins, LA

Joseph Watson Hutchins, Jr., LA

Joshua K. Nunez Testamentary Trust, LA

Joshua K. Nunez, LA

Josie Ann Richard Boudreaux, LA

Joyce Agnes Savoie, LA

Joyce T. Freeland, LA

Jude Savoie, LA

Judie Katherine Patterson, TX

Judith Faye Boudoin Trahan Guidry, LA

Individuals (cont'd)

Judith Gail Mudd, LA

Judith Lynette Savoie, LA

Judy Ann Erbelding, LA

Judy Marie Nunez Trahan, LA

Judy Wyers, TX

Julia Courville, LA

Julie Ann Burris Stanley, TX

Justin Kyle LeBoeuf, LA

Kala Sue Billedeaux, LA

Karen Dee Guillory, LA

Karen Elizabeth Savoie McCall, LA

Karen Kay Savoie Clayton, LA

Karen Melancon, LA

Karen Renee Theriot, LA

Karl J. Styron, LA

Karlton H. Styron, LA

Katherine Jane Stanley McCabe, TX

Katherine L Spurlock, TX

Katherine Louise Levy Strom, TX

Katherine Louise Schuehle, Attn: Cynthia Huff, POA, TX

Katheryn Nunez Bednarz, LA

Kathleen L. Guthrie, LA

Kathleen Miller Roberts, LA

Kathryn Carter McBride, LA

Kathryn Lunnell Bourque Fitch, LA

Kathryn Savoy Guilbeau, LA

Kathryn Sturlese Dupuis, TX

Kathy Christian Smith, GA

Kathy Smith Skipper, TX

Keith Joseph Kovach, LA

Kelly C. Smith, TX

Kelly Wescott Khoury, LA

Kelvin Troy Mudd, LA

Kempa Inez Savoie, LA

Ken Joseph Nunez, LA

Ken Thomas Mudd, Attn: Thomas E. Mudd, Jr., LA

Kendall J. Nunez Testamentary Trust, LA

Kenneth Drost, est, Attn: Betty Lou Drost, FL

Kenneth Dupont, LA

Kenneth James LeDano, TX

Kenneth Jude Theriot, LA

Kenneth Larry Landry, LA

Kenneth Paul Nunez, Jr., LA

Kenneth Simpson, TX

Kenneth Theriot, LA

Kenny Jules Sturlese, LA

Kent Crochet, LA

Kent Ray Bennett, TX

Kenzie LeBoeuf, LA

Kevin A. Savoie, LA

Kim B. Murphy, LA

Kimberly Aplin Nunez, LA

Kirk D. Tiller, TX

Kirk H. Landry, LA

Kirk Randolph Quinn, LA

Krissi Jo Savoie Moore, LA

Kristine Stoma Carter, LA

Krystal Dawn Varnado, LA

LaBove Family Limited Partnership, LA

Individuals (cont'd)

Lakeisha Doucet, LA

Lana Nunez, LA

Larre G. Butler, LA

Larry C. Simoneaux, LA

Latricia George, LA

Lauren Davis, Attn: Cynthia Marie Nunez, LA

Laurie Ann Rutherford, c/o: John W. Rutherford, III, TX

Lawrence Carter, LA

Lawrence William LeBoeuf, LA

Layton Gerard Miller, LA

Lela Roy Guidry, LA

Leland Crochet, LA

Lelia Jene Quinn, LA

Lena M. Peloquin, LA

Leon Quentin LeDoux, LA

Leonard C. Harmon, LA

Leonard Vinson, LA

Leslie C. Bishop, TX

Leslie Douglas Griffith, LA

Leslie Russell Welch, LA

Leslie W. Mudd, LA

Lessie Irene Swire, LA

Lester J. Richard, LA

Levy Family Irrevocable Trust, Attn: Martha Levy, LA

Lidian Fae Theriot-Richard, LA

Lillian Cecile Morris, LA

Lillie Green Jones, TX

Lilly Baccigalopi Guillory: Lela Guidry Kershaw and Joseph Everett Roy, LA

Linda Bennett, TX

Linda Diane Ash, TX

Linda Dianna Boudreaux, LA

Linda Gale Welch, LA

Linda Grisham, TX

Linda Mae Swire Aguirre, LA

Linda Marie Miller Conner, LA

Linda Sturlese, LA

Linda Verret Nunez, LA

Linden Marsh, OR

Linford Joseph Miller, LA

Lionel Paul Savoy, LA

Lisa Ann Levy Menard, LA

Lisa Beam Pigno, LA

Lisa Carroll Miller, LA

Lisa Cecchetti, AB

Lisa LaBove Guidry, LA

Lloyd Edward Gullett, LA

Lois Ann Stanley Stapleton, TX

Lola Quinn, LA

Lonnie Davis, Jr, FL

Lorendia Kay Savoy, LA

Lori Lynn Nicholson, LA

Lori Nunez, LA

Louis F. Dupuis, TX

Lovenia Theriot, Attn: Kevin Theriot, LA

Lucas Tod Miller, LA

Lucille Miller Hebert, LA

Lula Granger, LA

Lula Mae LeBlanc, LA

Lynette Reed, LA

Individuals (cont'd)

Lynn Thompson "Thomp" McCall, LA

Mable Thibodeaux, Attn: Jo Ann Camp, TX

Madeline Savoie, LA

Madge Meaux Reina, LA

Margaret Ann Richard Little, LA

Margaret Benoit Mims, LA

Margaret Charlane Compton, LA

Marguerite A. Nunez Kramer, LA

Marguerite McVeaugh LeDoux, LA

Marie Annette Maneille, LA

Marie Johnston, TX

Marion Elizabeth Levy Larke, LA

Marion Glynn Portie, LA

Marjorie Pichnic Rorex, TX

Mark Blaine Boudoin, LA

Mark Carl Pedersen, LA

Mark Domingues, LA

Mark Dwayne LeBoeuf, LA

Mark James Pelloquin Revocable Trust, CO

Marleen M. Theriot, TX

Marlon Coy Mudd, LA

Martha D. Andersen, TX

Martha Johnson, LA

Martha Lou Boudreaux LeBleu, LA

Mary A. LeDano, LA

Mary Angie S. Vincent, LA

Mary Ann Didelot, LA

Mary Ann Richard-Jaynes, TX

Mary Davis & W.F. Henry, Jr., LLC, Attn: E. Scott Henry, LA

Mary Frances Templeton, TX

Mary Gay Mier Richard, LA

Mary Katherine Khoury Campbell, LA

Mary Kathryn Roberts, LA

Mary Nykole LaBove, LA

Mary Savoy George, LA

Mason Graham Lindsay, et al, LA

Maureen Freeman Miller, LA

Maureen Johnson Kahl, LA

Maureen Miller, LA

Maureen Savoie Cruthirds, GA

MCD Trust, Attn: Dolores T. Carter, Trustee, LA

Meceal Ann Nunez Stear, LA

Medina Miller Percle, LA

Melanie Ann Savoie, LA

Melba June Stine, LA

Melissa J. Dupont, LA

Melvin Eugene Bennett, OR

Melvin Fruge, FL

Meredith Montie, LA

Michael Brien Theriot, LA

Michael Glen Bartie, LA

Michael Glen Bartie, LA

Michael Henry Carter, NY

Michael McBride, Attn: Dolores T. Carter, LA

Michael Paul Plaisance, Jr., LA

Michael Richard Pedersen, LA

Michael T. Bertrand, TN

Micheal Dennis Andrus, OR

Michelle Boudoin Trahan, LA

Michelle Renee Mier, LA

Individuals (cont'd)

Mike Devall, LA

Mildred S. Sturlese, LA

Millard Scott Quinn, LA

Milton Collins, LA

Milton Mims, LA

Mirinda L. Morales, LA

Missy LeBoeuf, LA

Mitchell K. Savoie, LA

Mitzi Dean Savoie Garry, LA

Mona Batts, LA

Mona Ray LeBoeuf Pearce, LA

Mona Sturlese Turner, TX

Monica DeRouen, LA

Monty W. Savoy, LA

Muriel Ruth Theriot, LA

Mymae Duhon Savoie, Attn: James Savoie, LA

Myra Rutherford, LA

Myron Kent Little, LA

Nancy R. Fruge, FL

Natalie Abshire, LA

Ned Wilson, LA

Neil S. Carter, LA

Nell Buckley, MS

Nicole Pederson Mudd, Attn: Thomas E. Mudd, Jr., LA

Nicole Roy, LA

Norma Gail Savoie, LA

Novella Sheree Boddie, CA

Olga Vincent Mudd, LA

Osa Cox, Jr., KS

Pamela B. Beam Dionne, LA

Pamela D. Savoy, LA

Pamela DuBois, TX

Pamela George Kelley, LA

Pamela Jeanne Trahan, LA

Pamela Kovach, LA

Pamela Mudd, LA

Pat Jerome Nunez, LA

Patricia Ann Bartie Dugas, LA

Patricia Ann D. Roberie, MD

Patricia Ann Little, LA

Patricia Anne Savoie, LA

Patricia Conner, LA

Patricia Corine Addison, LA

Patricia Lynne Duhon, LA

Patricia W. Kelly Living Trust, Attn: Patricia W. Kelly, FL

Patrick McDonald, LA

Patrick Williams, LA

Patsy Claudette Sells, LA

Paul Doyle, Attn: Cynthia Marie Nunez, LA

Paul Evans Miller, LA

Paul J. Brown, TX

Paul Pigno, LA

Paula Diane Savoie, LA

Paula McPherson McCall, LA

Pauline S. Vandre, FL

PDR Testamentary Trust, Attn: Kala Billedeaux, LA

Peggy Ann Griffith, LA

Penny Trahan, TX

Individuals (cont'd)

Peter Raymond Savoie, LA

Philip Bryan Nunez, LA

Phillip Andrews, LA

Phillip Michael Maneille, LA

Phyllis Doreen Johnston, LA

Phyllis Tarkington, LA

Priscilla Collins, LA

Randall James Boudoin, LA

Randall K. Guillory, LA

Randy James Nunez, LA

Randy Wright, LA

Raymond Bednarz, LA

Raymond George, LA

Raymond J. LeBlanc, LA

Raymond LaBlanc, Jr., LA

Raymond LeBlanc, Jr., LA

Raynaldo Patrick Jones, TX

Rebecca Griffith Kendall, CO

Rebecca Jones LaSalle, Attn: Tiffany LaSalle, LA

Rebecca Melicia Theriot-Trahan, LA

Reggie Murphy, LA

Rene Ingram, TX

Renee Tims, Attn: Arthur Tims, Jr., CA

Richard D. Griffith, Jr., OK

Richard Dean LeBoeuf, LA

Richard Freeman Buckley, TX

Richard Gregory Wicke, LA

Richard Jerome LeDoux, LA

Richard M. Thomas, MA

Richard Martin Sturlese, LA

Richard Michael Savoie, LA

Richard Montgomery, AZ

Richard Ray Richard, LA

Richard Thomas Moriarty, LA

Richard W. Miller, LA

Ricky Tims, Attn: Arthur Tims, Jr., CA

Rita Savoy, LA

Robert D. Savoie, LA

Robert E. Mudd, LA

Robert Harmon, LA

Robert L & Kelly Mudd, LA

Robert L. Benson, LA

Robert Mitchell Kelley, LA

Robert V. Landry, LA

Robert W. Heflin, LA

Robin Davis Courville, TX

Robin Nunez, LA

Robley Menard, LA

Roderick L. Primeaux, LA

Rodger C. Theriot, LA

Rodney F. McLean, V, LA

Roger Dale Broussard, LA

Romona Brasseaux Kelley, LA

Ronald Byron Stear, LA

Ronald D. Andrus, OR

Ronald David Smith, GA

Ronald Doucet, Jr., LA

Ronald G. Nunez, Jr., LA

Ronald Paul Savoie, OK

Ronnie D. LaFosse, TX

Individuals (cont'd)

Rosalie Primeaux Nunez, LA

Rosetta Bartie, TX

Ross Dexter Peloquin, Sr., LA

Roxanne Boudoin, LA

Roy Garry, LA

Ruben Morales, LA

Ruby Swire Nunez, LA

Rudolph Bartie, Jr., VA

Russell Bennett, Jr, LA

Russell C. Savoie, LA

Russell Eugene Bennett, CA

Russell G. Corley, TX

Sadie Mae Trahan William, LA

Samantha Joyce LaBove, c/o: Lisa LaBove Guidry, LA

Samuel Mark DeRouen, LA

Sandra Drost, FL

Sandra Hession, LA

Sandra Tims, Attn: Arthur Tims, Jr., CA

Sara G. Doyle, Attn: Cynthia Marie Nunez, TX

Sarah Dale Granger Hebert, LA

Sarah Frances Kendall, CO

Savoy Jan Granger, LA

Scott Bennett Nunez, LA

Scott David Levy, TX

Scott Trahan, LA

Selma Frank, LA

Shantelle L. Richard, LA

Shareen Louise Buckley, TX

Sharon Ann LeBoeuf Allen, TX

Sharon Faulk, LA

Sharon Kalb Moore, KY

Sharon Kay Boudreaux, LA

Sharon Mae Mount, AL

Sharon Sturlese, LA

Sharrie Theriot, LA

Sheree Boddie, Attn: Nona Boddie, CA

Sherry Ann Veazy Rogers, LA

Shirley Nunez, LA

Shirley Reon Dupont, LA

Shirley Ruth Stine Marshall, LA

Sikica Crosby, TX

SilverBow, TX

Smith Family Trust, Attn: Jaynee Smith-Wood, NC

Solomon Saul Savoy, LA

Sonya Savoy Roberts Ballard, LA

Stacey Darlene Miller, LA

State of Louisiana, LA

Stephanie Ellen Bartie, LA

Stephen B. Butler, CO

Stephen Butler Stanley, TX

Stephen Edward Levy, TX

Stephen L. Carter, II, LA

Sterling Constance, LA

Sterling Vaughan, LA

Steve Landry, LA

Steven Walter Nicholson, TX

Stewart Vandre, FL

Sue Wright, AL

Suella Nunez McCardle, LA

Individuals (cont'd)

Susan Brown, TX

Susan C. Johnson, LA

Susan L. Montgomery, AZ

Susan Saikin, TX

Sylvia Savoy, LA

Tamara Cryer Pedersen, LA

Tammi A. Schenk, TX

Tammy Aldridge Lazarra, CA

Tammy Jo Miller, LA

Tammy Sue Pedersen, LA

Tara LaVonne Moore, TX

Tara Poole, LA

Tara Seals, AL

Taten Peterman, LA

Taylor A. Brown, TX

Telicia LaSalle, LA

Terence Lee Savoie, LA

Teresa L. Beam Doucet, LA

Teresa Sells, TX

Terry A. Rutherford, LA

Terry Dean Murphy, LA

Terry Elizabeth Savoie, OK

Terry Hendrix, LA

Terry Roberie, MD

Thania Savoie Elliott, LA

Thaunia Rae Savoie Hardie, LA

The Adam Hebert, Jr. and Elma R. Hebert Revocable Living Trust, LA

The Butch and Linda Smith Family Trust, TX

The Charles William Morris & Barbara Pizanie Morris, Revocable Living Trust, LA

The Estate of Absie Mitchel LeBoeuf, TX

The Estate of Annette Marie Simpson, TX

The Estate of Harold Rupert Buckley, MS

The Estate of Olevia Bartie Seals, Attn: Rosetta Bartie, TX

The Estate of Ralph A. Hebert, Attn: Jim Traweek, LA

The Estate of Walter L. Rogers, Jr., LA

The Estate of Willie P. Miller, c/o: Sandra Hession, LA

The Succession of Alford Clooney Savoie, Attn: Una Savoie, LA

The Succession of Eugene Carter, LA

The Succession of Grace Mary Virginia Savoie, Attn: David Kent Savoie, LA

The Succession of James Calvin Vallette, Attn: Candace Little, LA

The Succession of Joyce Virginia Nunez Sturlese, Attn: Tony Sturlese, LA

The Succession of Walton L. Crosby and Lucille Doxey Crosby, TX

The Successsion of Beverly Butler Domingues, LA

Theo Richard Mier, LA

Theodore Ardly Broussard, LA

Theresa Ann Theriot Bertrand, TN

Theresa Theriot Welch, LA

Thomas David Theriot, LA

Thomas Dude Savoy, LA

Thomas E. Mudd, Jr., LA

Thomas H. Courville, LA

Individuals (cont'd)

Thomas Kramer, LA

Thomas Nunez, LA

Thyria LeDoux, LA

Tiffany Smith Neal, TX

Timothy J. Dupont, LA

Tina Granger, LA

Tommy Bonsall, LA

Tommy Todd, LA

Toni Brown, TX

Townsend Patricia LaFosse, TX

Tracey Quinn, LA

Tracy Carter, LA

Triassic Investment Partners, LA

Troy Anthony Miller, LA

Truda D. James-Daughtry, MA

Trudy Sturlese Heflin, LA

Twilla Savoie, LA

Tyrella Montgomery Harmon, LA

Vanessa Kelley Mudd, LA

Velma LeBoeuf Hebert, LA

Vicki Elaine Koppie Laughlin, LA

Vicki Lynn Veronie Little, LA

Vickie Pichnic, TX

Vicky Mier, LA

Victoria Ann Savoie Manuel, LA

Victoria LeDano Conner, LA

Vida Marie Nunez Landry, LA

Viola Savoy Ball, LA

Virginia Carol Bourque, GA

Virginia Celeste Landry, LA

W. G. Williams, LA

Walter Turner, TX

Wanda Rae Sells Ray, LA

Warren Douglas Jones, III, TX

Warren Douglas Jones, Jr., TX

Warren E. Adams, MA

Warren Hanson Sells, TX

Wendell Joseph Broussard, LA

Wendy Wicke, LA

Wesley Paul LeBoeuf, LA

Willard J. Savoie, LA

Willard Joseph Little, LA

William Cody Wyers, III, TX

William Daniel Blake, TX

William David Drost, FL

William Earl Guthrie, Jr, LA

William Earl Guthrie, Jr., LA

William Edwin Van Atten, LA

William Elliott, LA

William H. Smith, III, TX

William Johnston, LA

William L. Welch, TX

William P. Welch, Jr., TX

William Pinch, Sr., LA

William Ray Little, Sr., LA

Willie B. Conner, LA

Willie Harmon, LA

Willie Patrick Nunez, LA

Wilson Adaway, Jr., TX

Wynita M. Nunez, Attn: Thomas Nunez, LA

Yancy William Welch, LA

Individuals (cont'd)

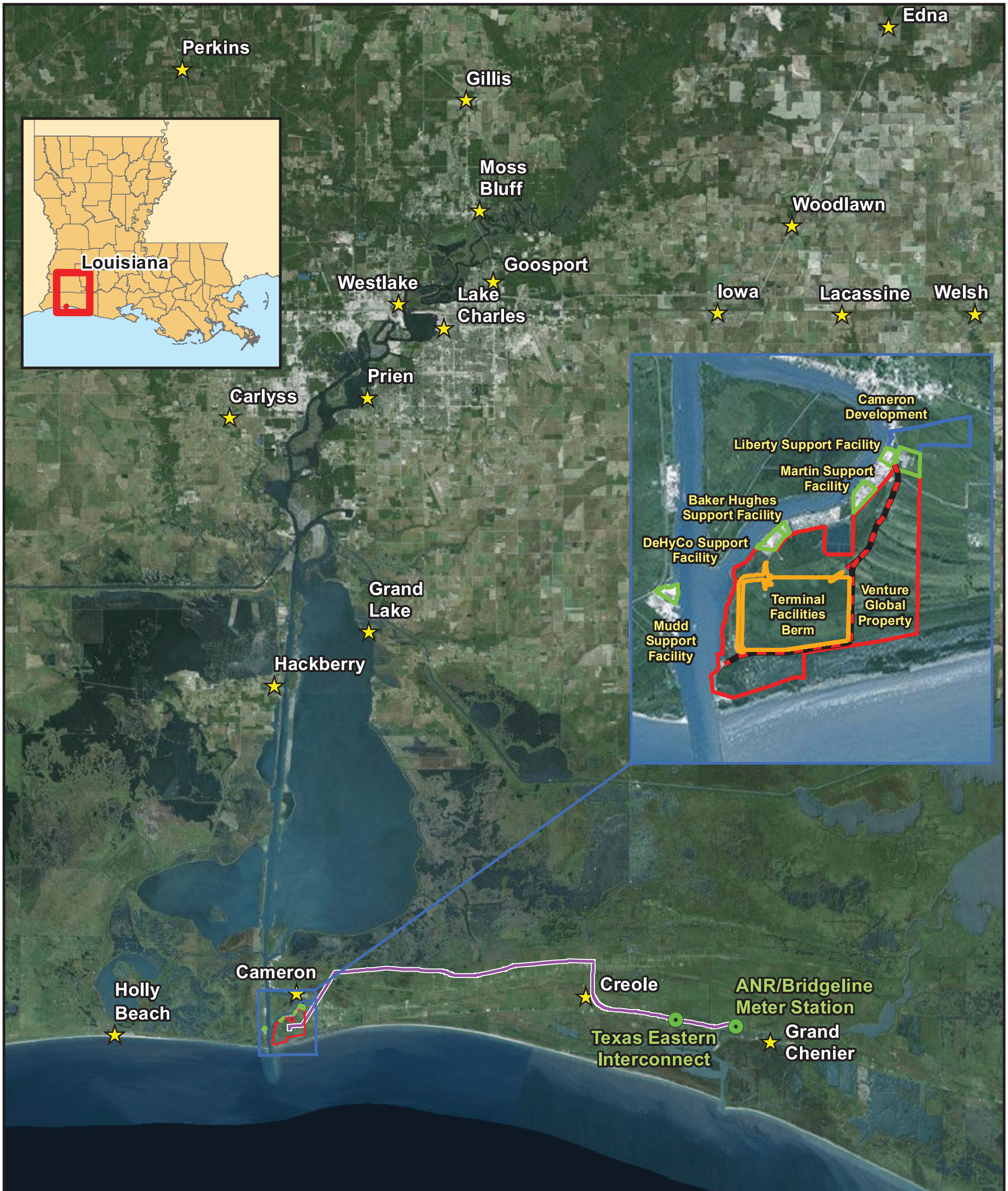
Yvette Winona Boddie, CA

Yvonne Carol Broussard, LA

Yvonne Nunez, LA

APPENDIX B-1

PROJECT OVERVIEW MAP



Venture Global Property
Cameron Development
Construction Support Facility
Proposed East Lateral Pipeline
Meter Station

1:380,160

0 3 6 Miles

N

Figure 1.1-1

Proposed Project Facilities - Regional Location (Aerial Map)

Calcasieu Pass Terminal and TransCameron Pipeline Project

Cameron Parish, Louisiana

CALCASIEU PASS

TransCameron PIPELINE

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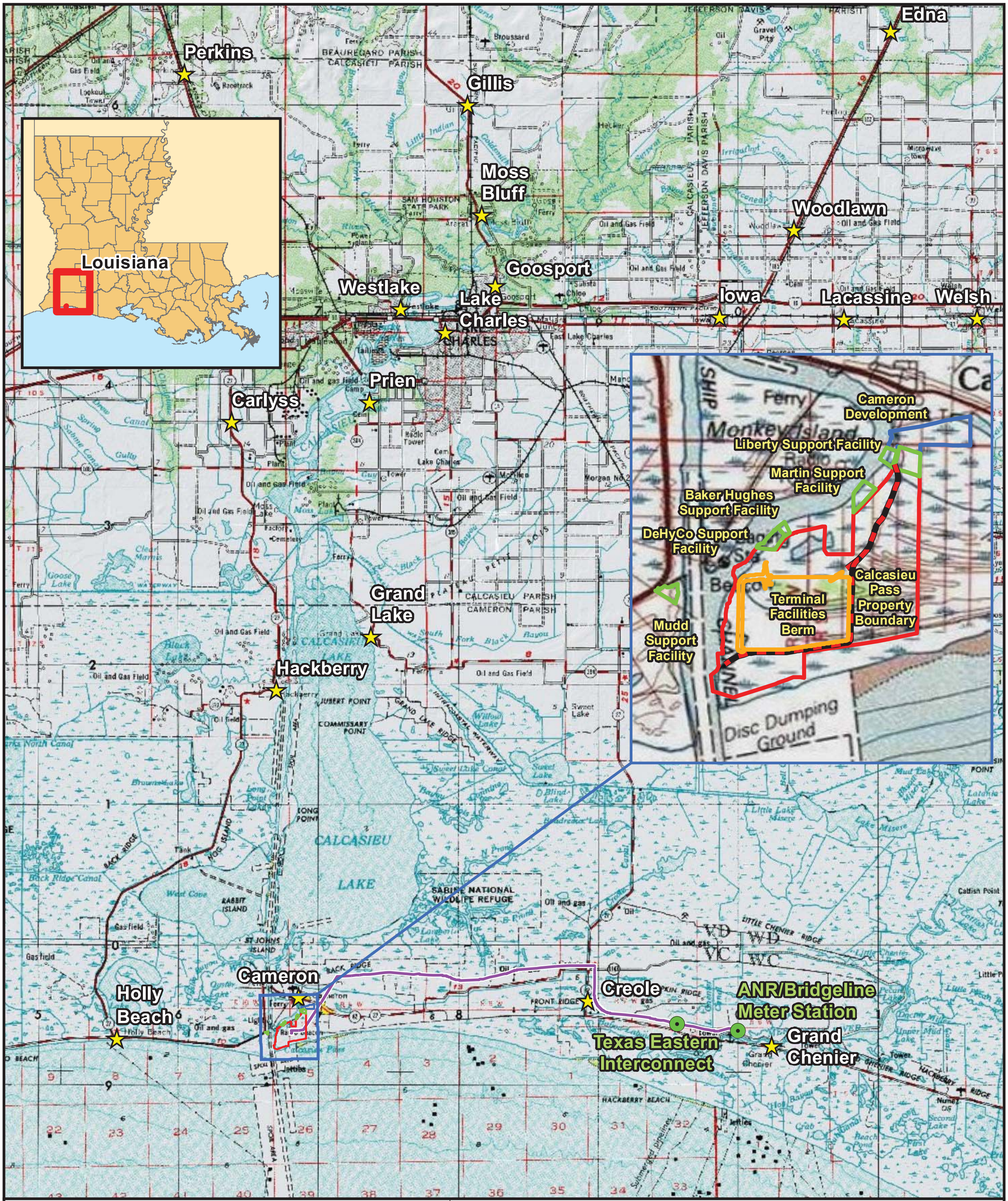

Figure 1.1-2

Proposed Project Facilities - Regional Location (Topographic Map)

Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana

CALCASIEU PASS

TransCameron PIPELINE

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APPENDIX B-2

PIPELINE MAPS

Sheet ID	Start MP	End MP
1	0	1.1
2	1	2.5
3	2.5	4
4	3.9	5.5
5	5.4	6.8
6	6.8	7.6
7	7.6	8.8
8	8.4	9.9
9	9.8	11.3
10	11.2	12.8
11	12.6	14.2
12	14.1	15.6
13	15.6	17.1
14	16.3	17.9
15	17	18.5
16	18.5	20.2
17	20	21
18	21	22
19	18.7	23.3
20	18.8	23.4

Louisiana

Proposed East Lateral Pipeline
Meter Station
Venture Global Property
Permanent Access Road
Temporary Access Road

1:95,040

0 0.75 1.5 Miles

Gulf of Mexico

Figure 1.3-3
Proposed Pipeline System – Aerial Routing Overview
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana

CALCASIEU PASS

TransCameron PIPELINE

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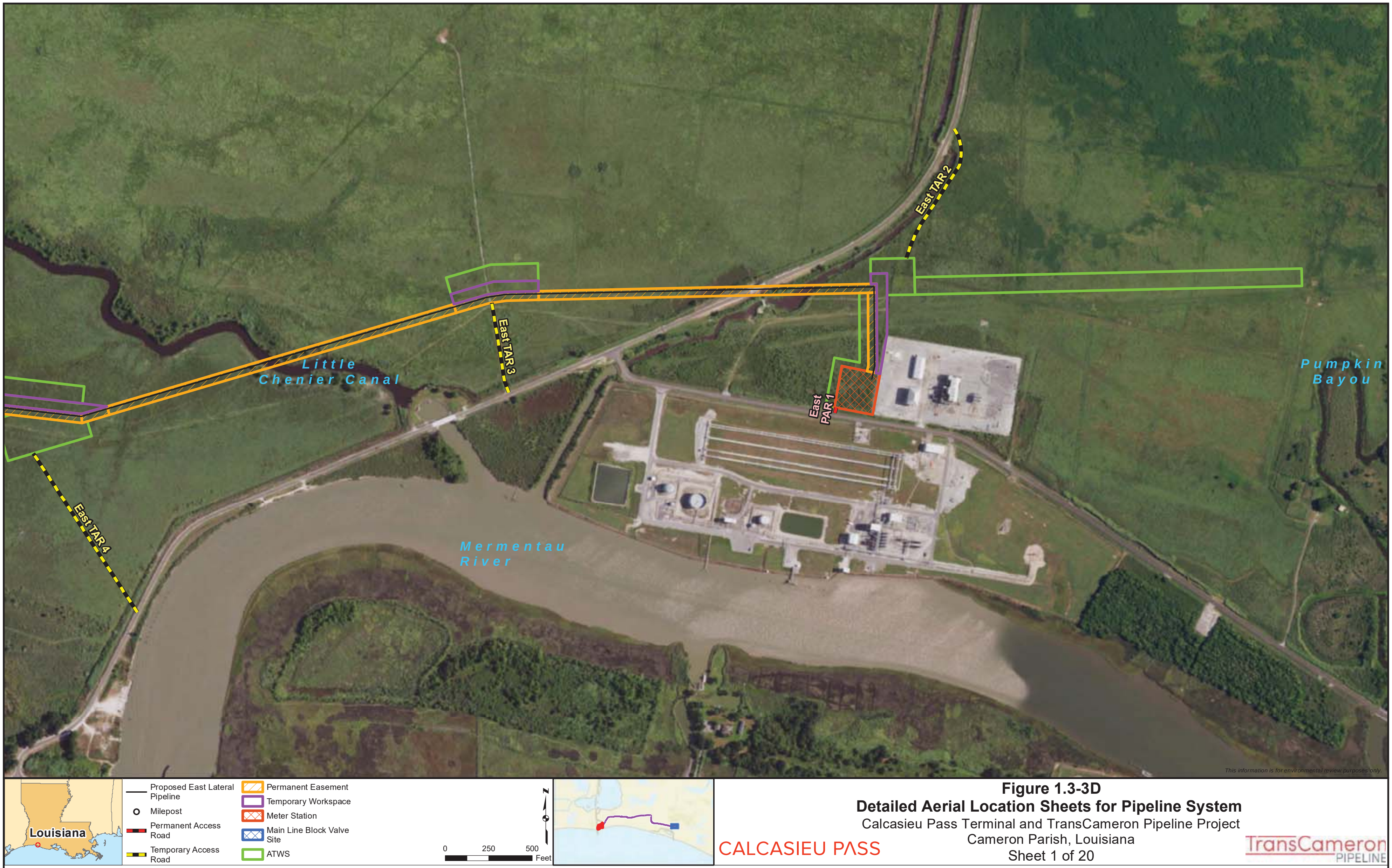

Figure 1.3-3D
Detailed Aerial Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 1 of 20

CALCASIEU PASS
TransCameron PIPELINE

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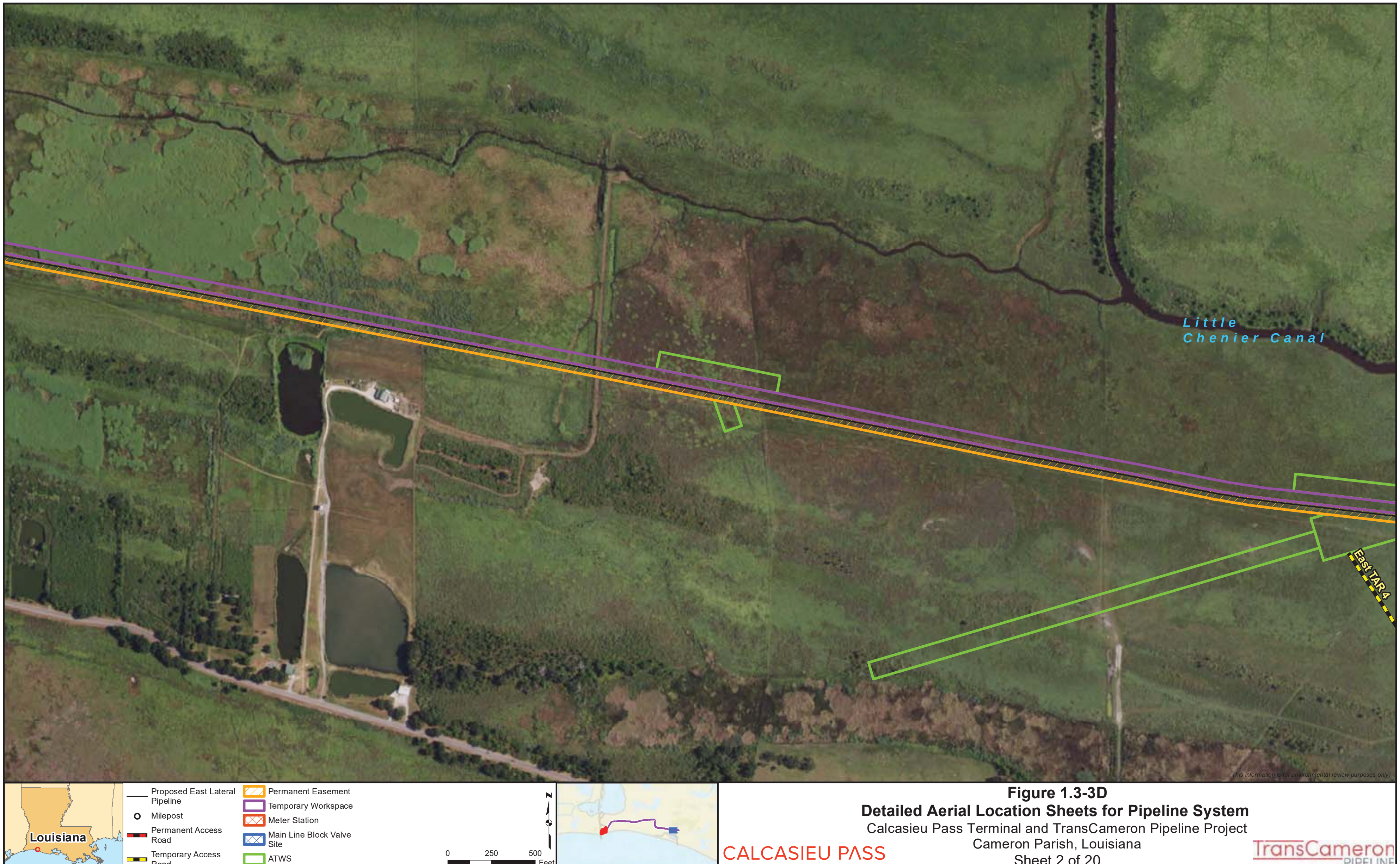

Figure 1.3-3D
Detailed Aerial Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 2 of 20

CALCASIEU PASS

TransCameron PIPELINE

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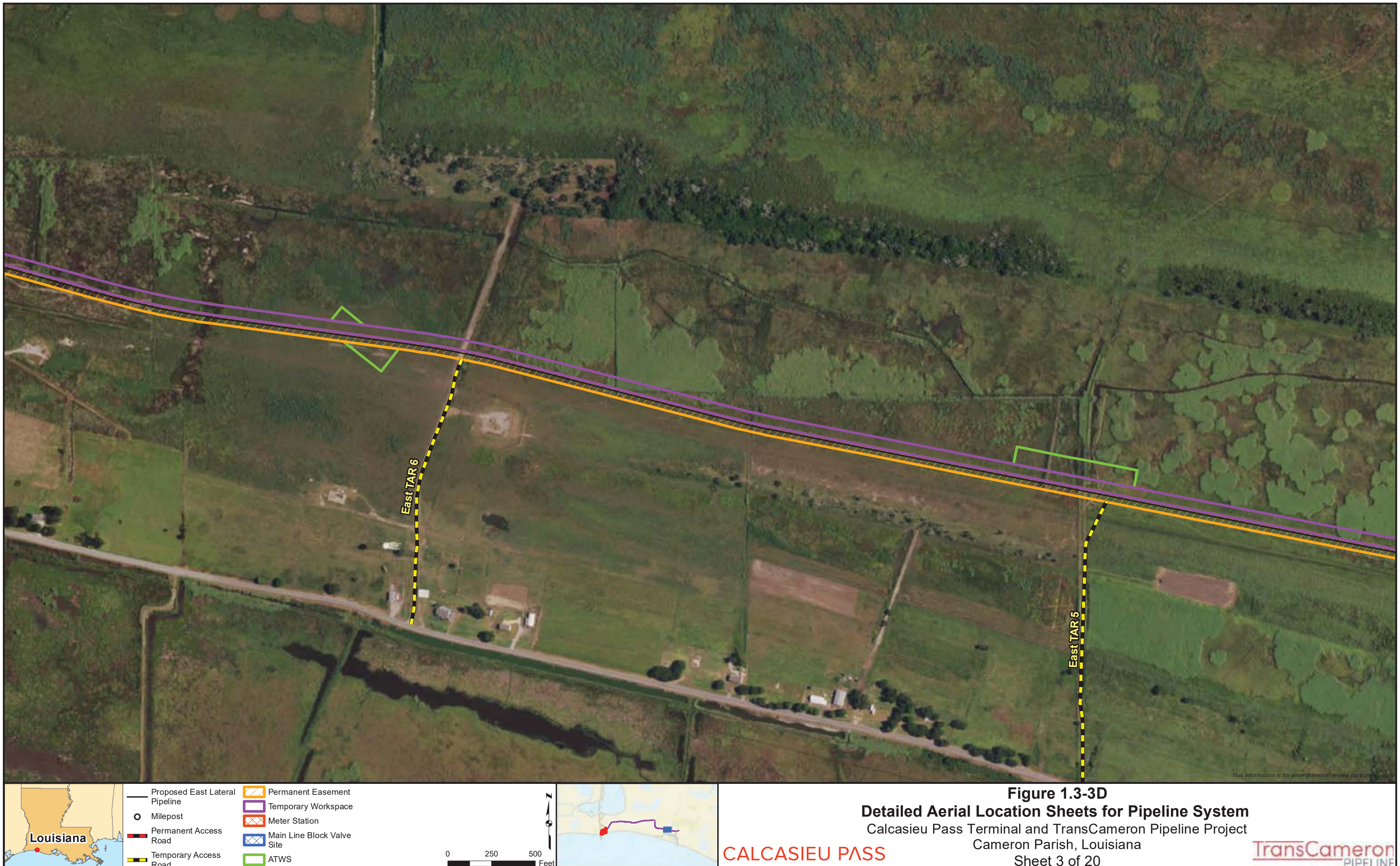

Figure 1.3-3D

Detailed Aerial Location Sheets for Pipeline System

Calcasieu Pass Terminal and TransCameron Pipeline Project

Cameron Parish, Louisiana

Sheet 3 of 20

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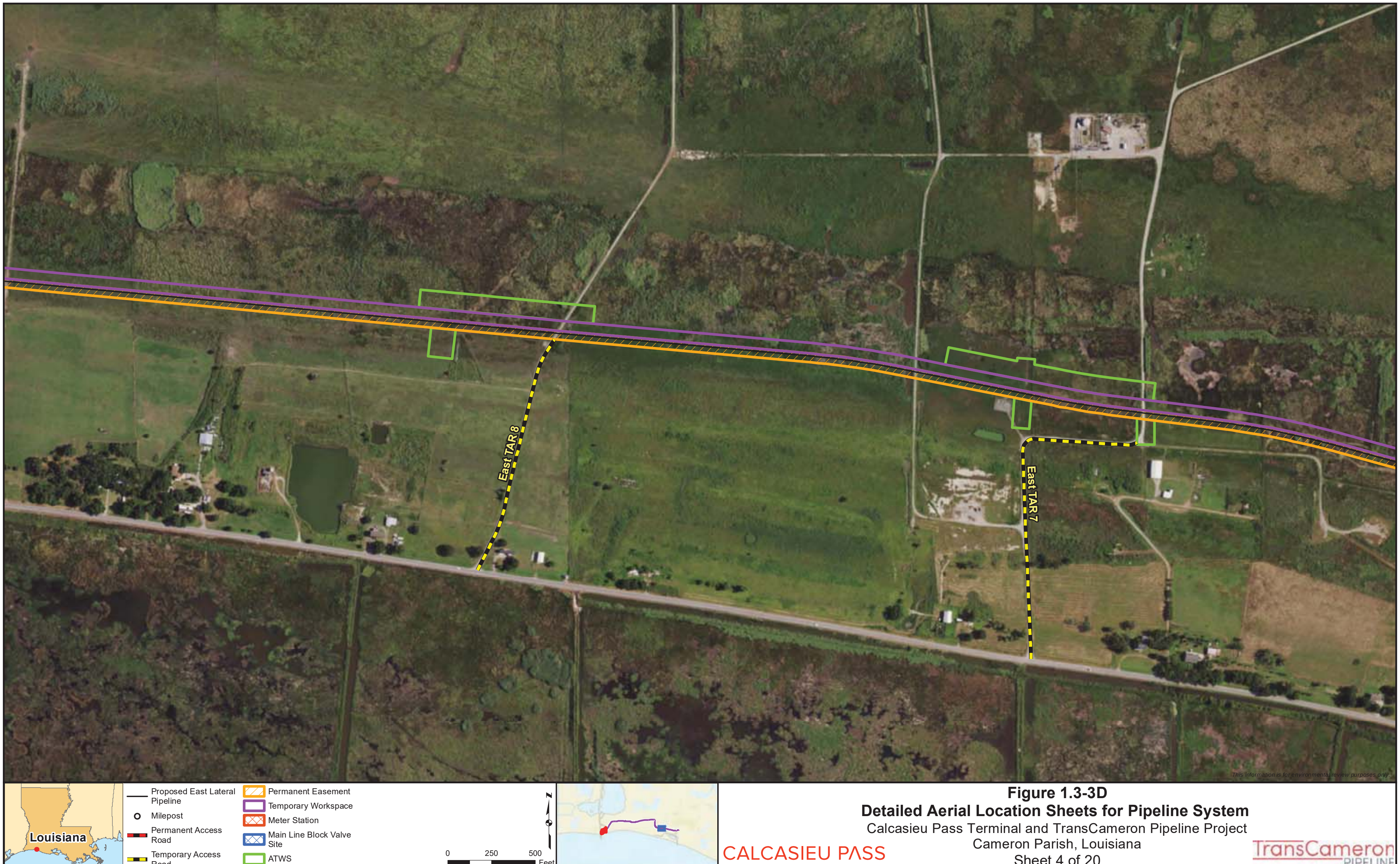

Figure 1.3-3D
Detailed Aerial Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 4 of 20

CALCASIEU PASS
TransCameron PIPELINE

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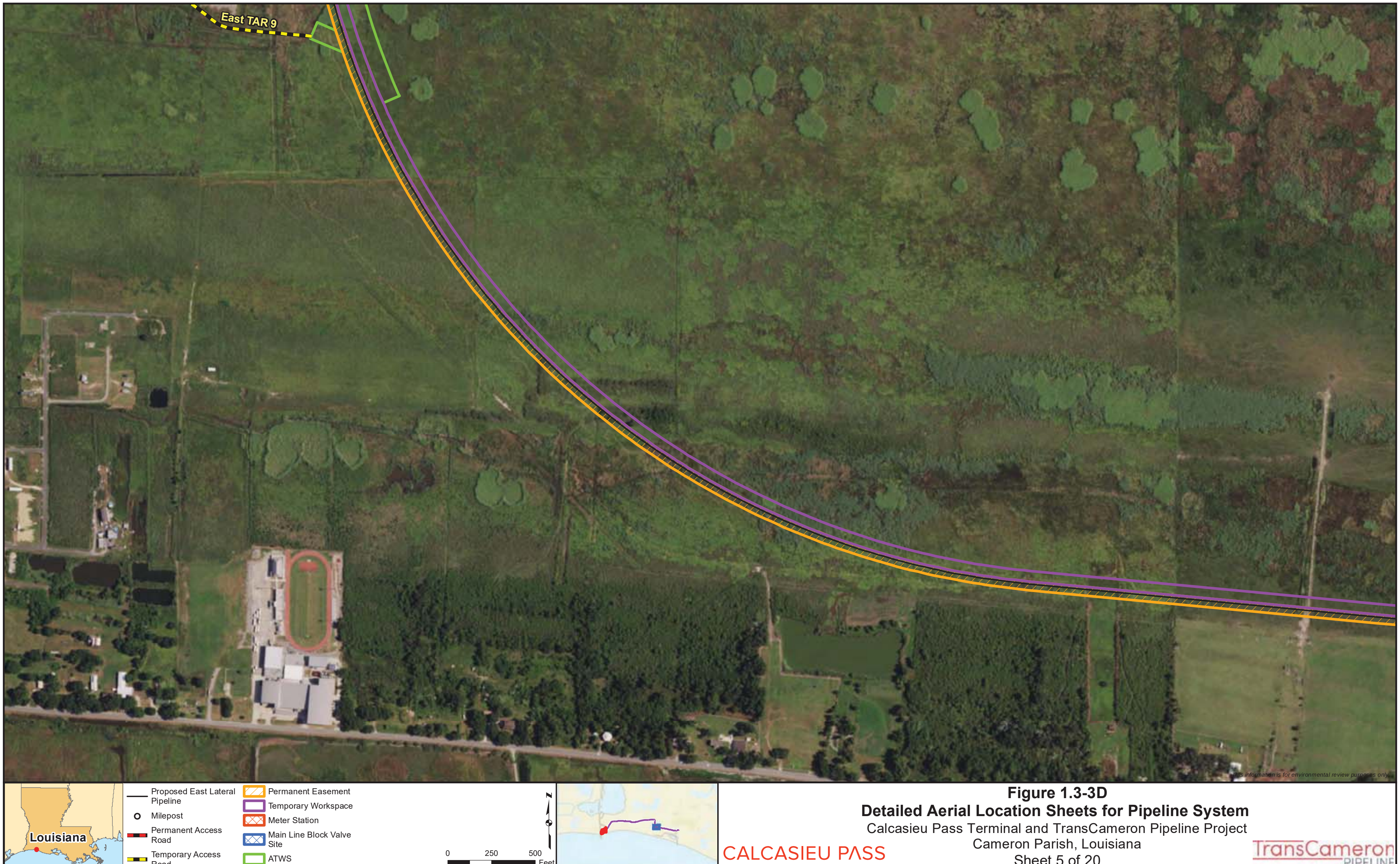

Figure 1.3-3D
Detailed Aerial Location Sheets for Pipeline System

Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 5 of 20

CALCASIEU PASS

TransCameron PIPELINE

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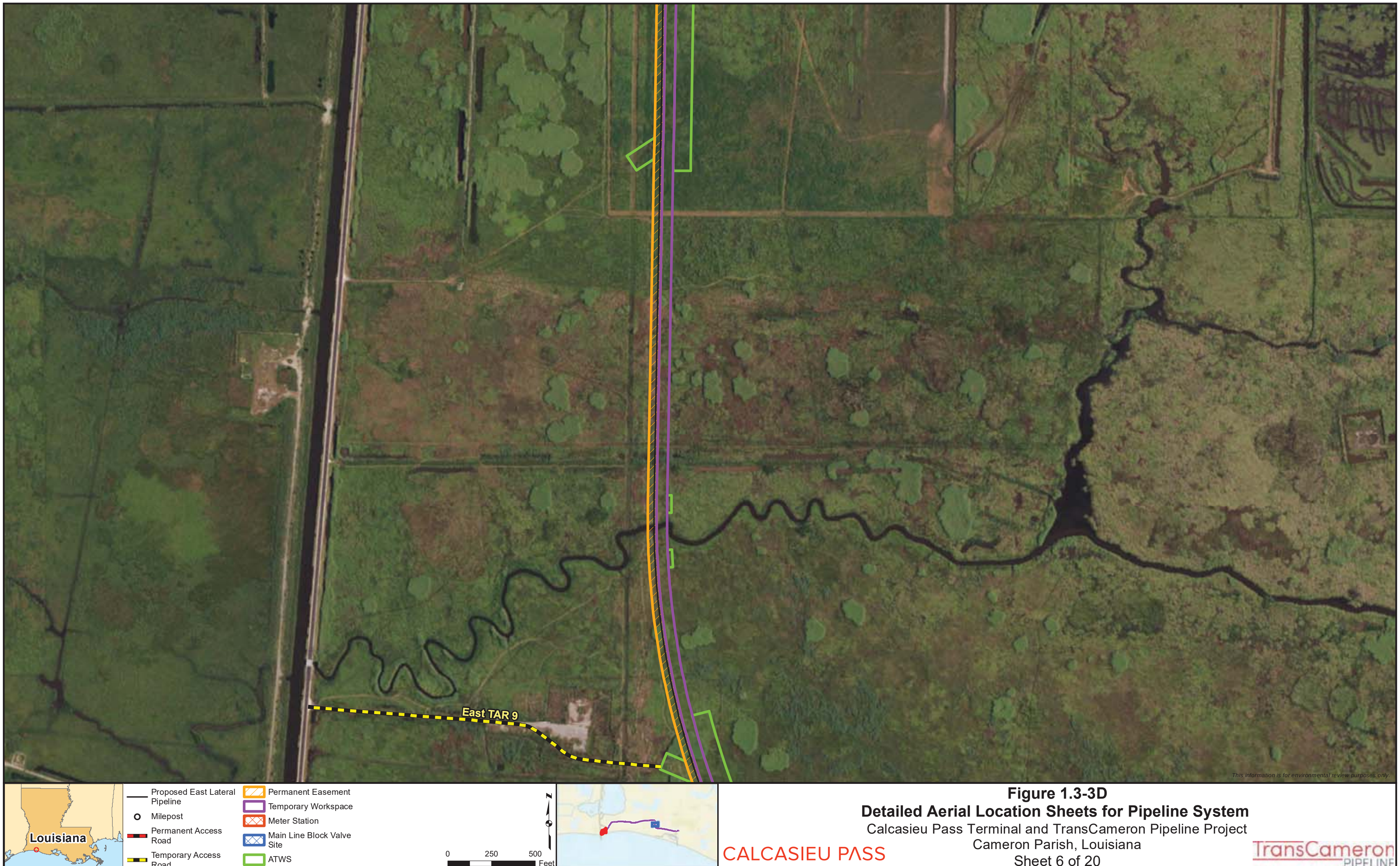

Figure 1.3-3D

Detailed Aerial Location Sheets for Pipeline System

Calcasieu Pass Terminal and TransCameron Pipeline Project

Cameron Parish, Louisiana

Sheet 6 of 20

CALCASIEU PASS

TransCameron PIPELINE

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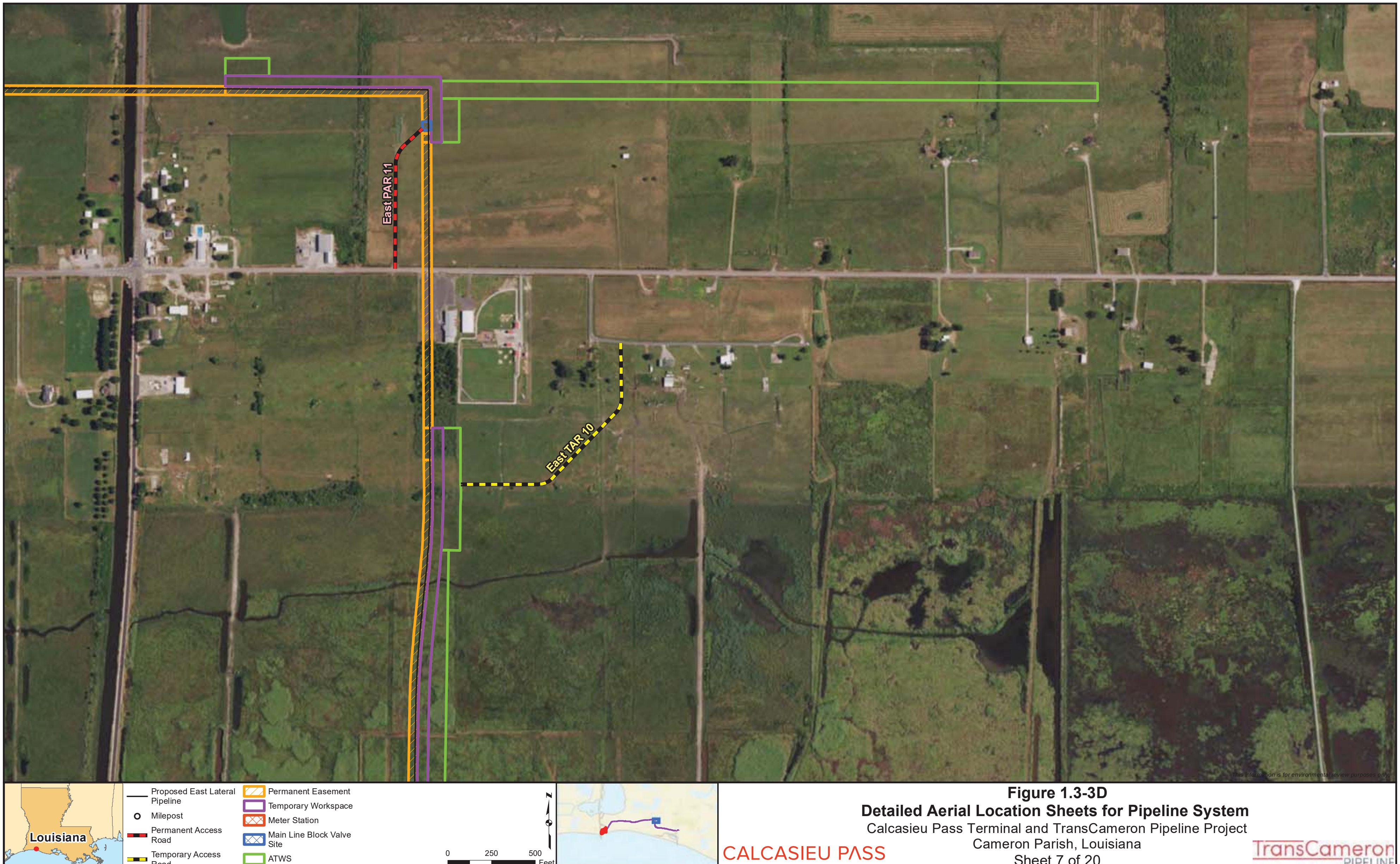

Figure 1.3-3D
Detailed Aerial Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 7 of 20

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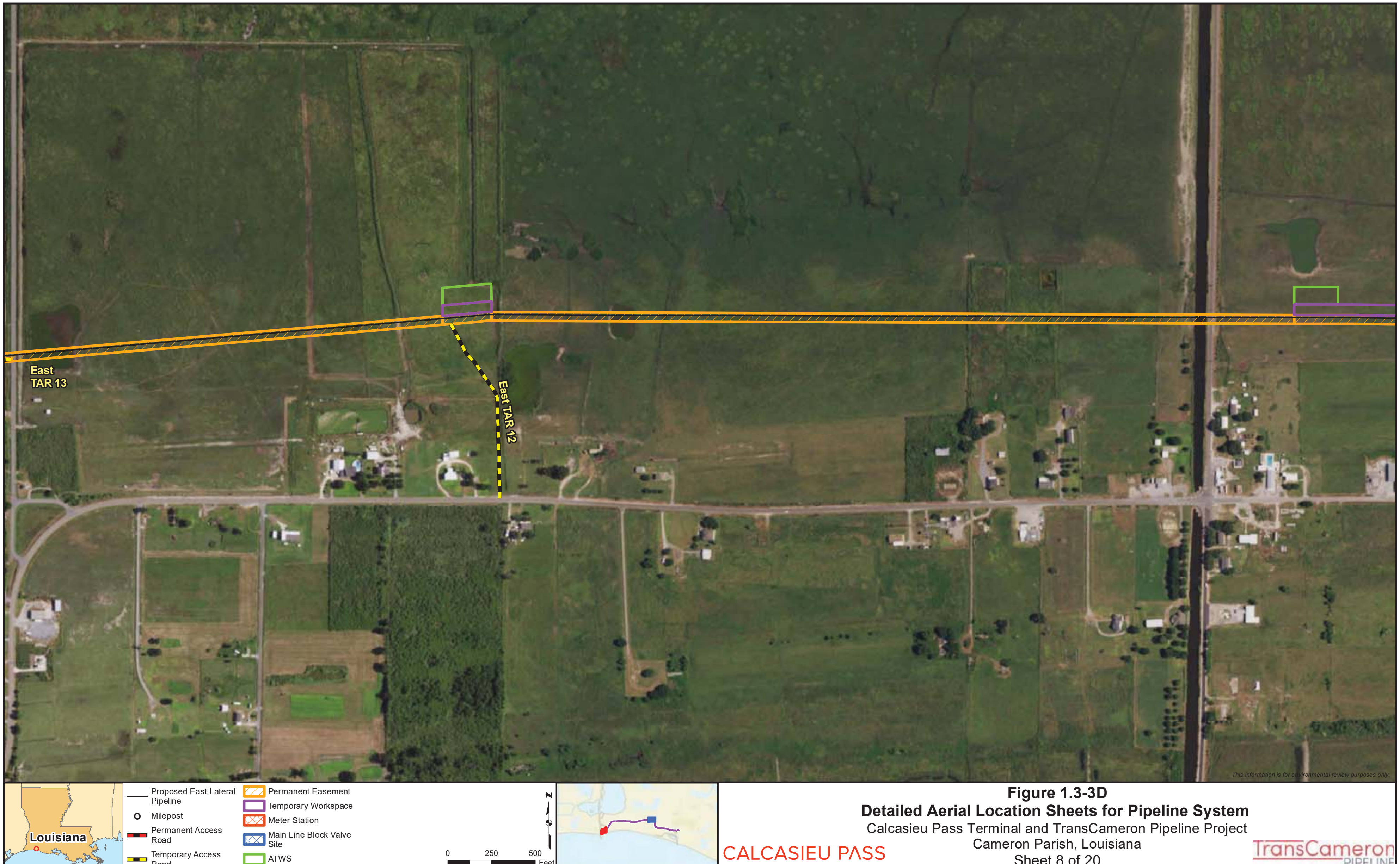

Figure 1.3-3D
Detailed Aerial Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 8 of 20

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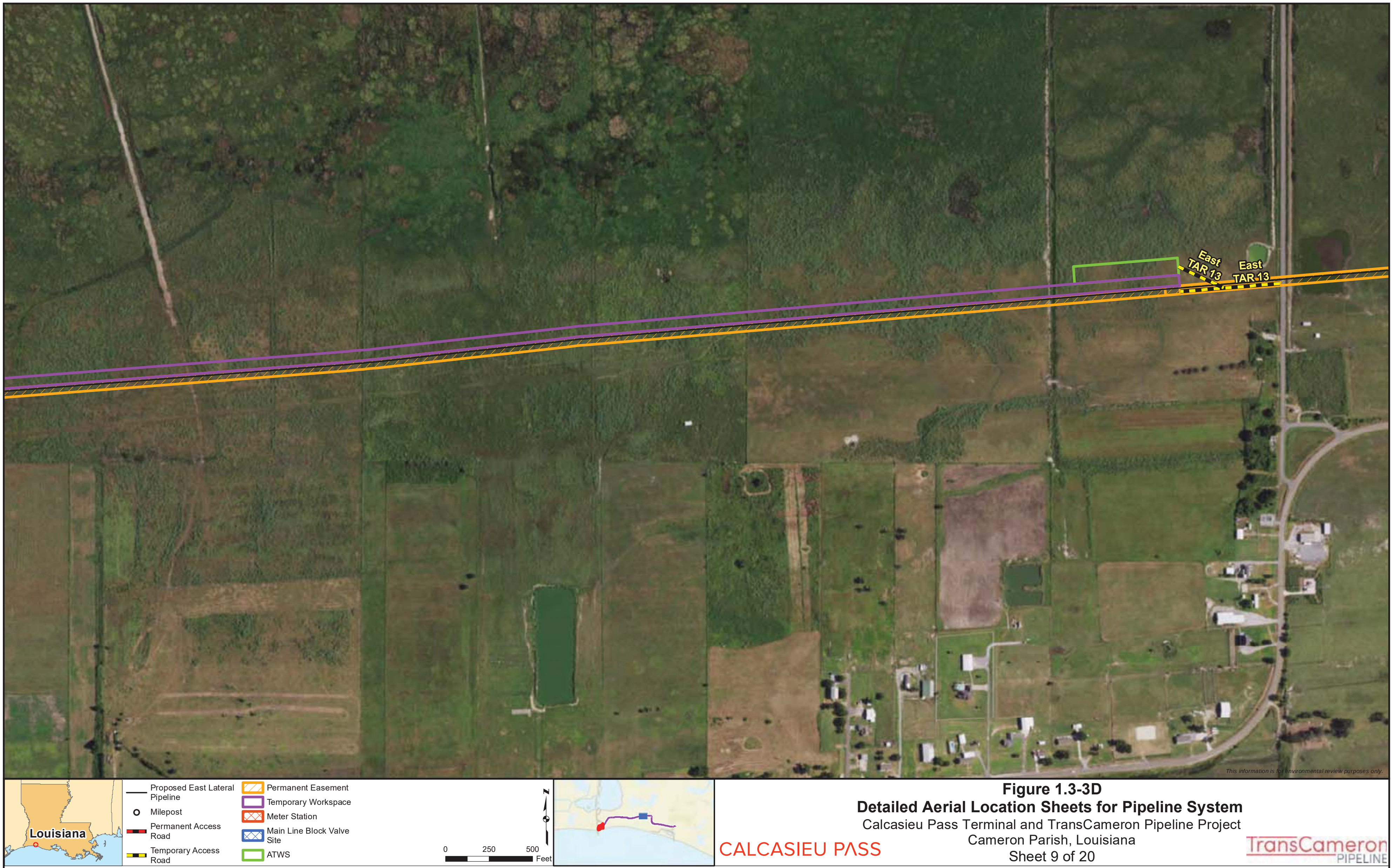

Figure 1.3-3D

Detailed Aerial Location Sheets for Pipeline System

Calcasieu Pass Terminal and TransCameron Pipeline Project

Cameron Parish, Louisiana

Sheet 9 of 20

CALCASIEU PASS

TransCameron PIPELINE

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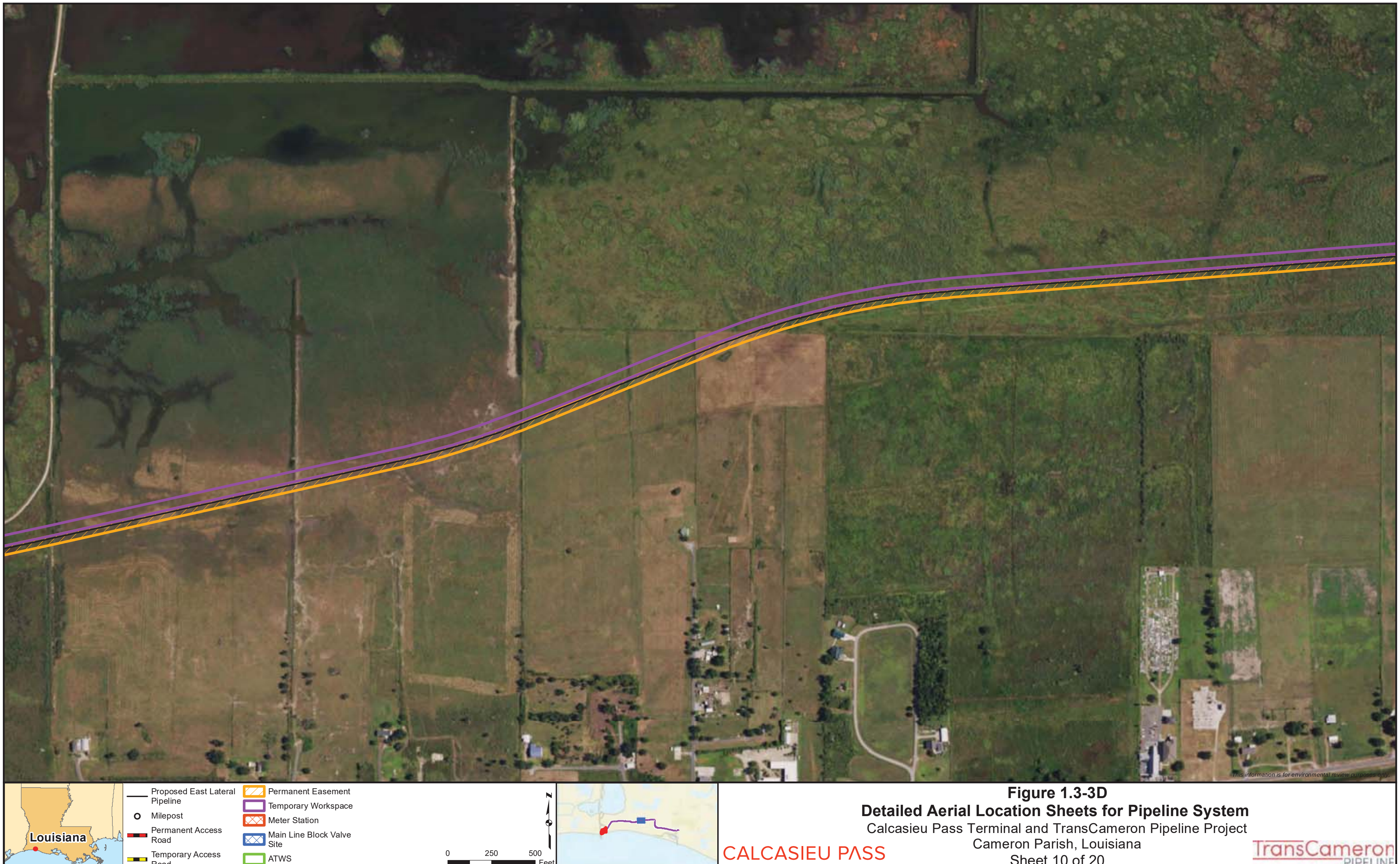

Figure 1.3-3D

Detailed Aerial Location Sheets for Pipeline System

Calcasieu Pass Terminal and TransCameron Pipeline Project

Cameron Parish, Louisiana

Sheet 10 of 20

CALCASIEU PASS

TransCameron PIPELINE

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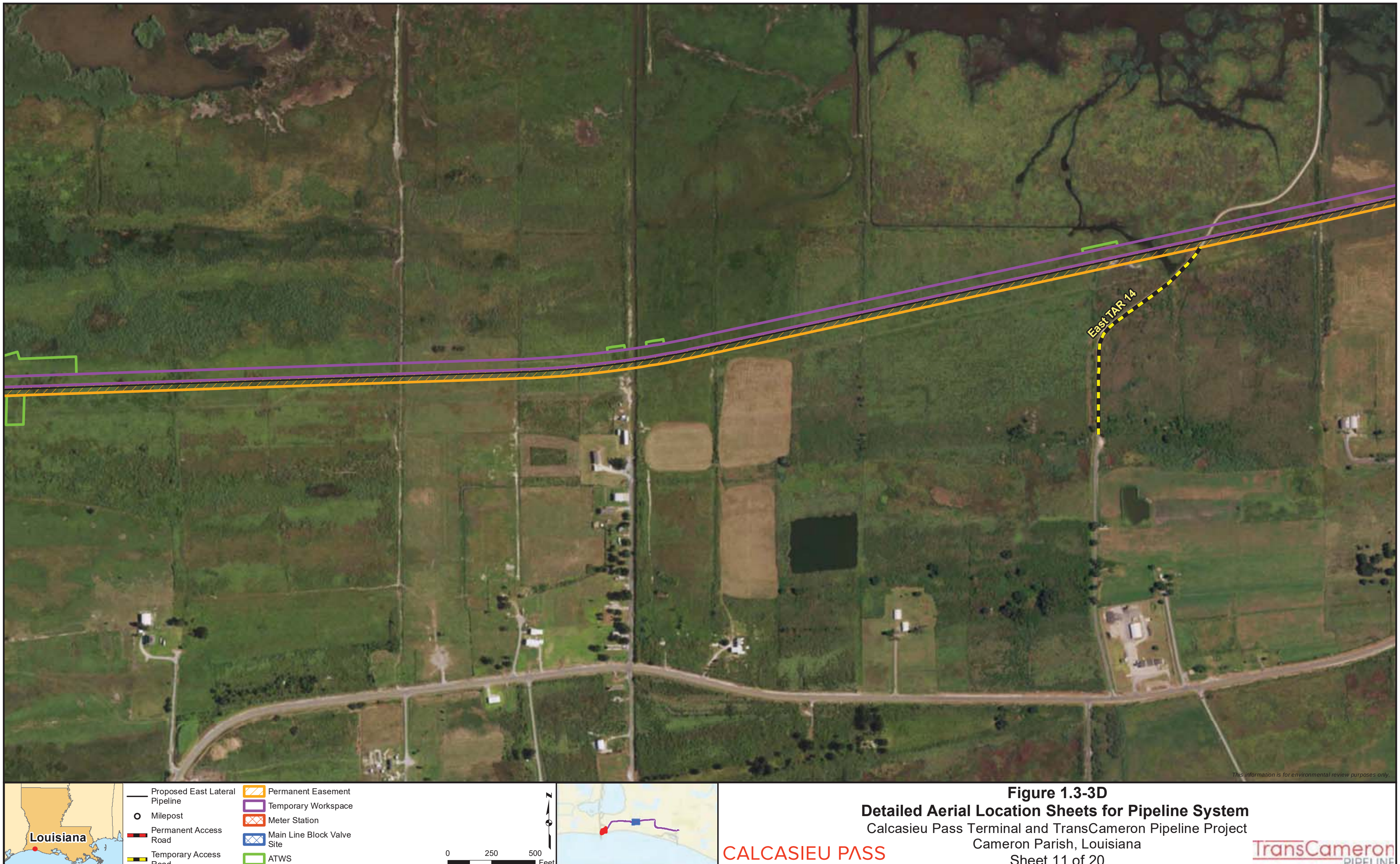

Figure 1.3-3D

Detailed Aerial Location Sheets for Pipeline System

Calcasieu Pass Terminal and TransCameron Pipeline Project

Cameron Parish, Louisiana

Sheet 11 of 20

CALCASIEU PASS

TransCameron PIPELINE

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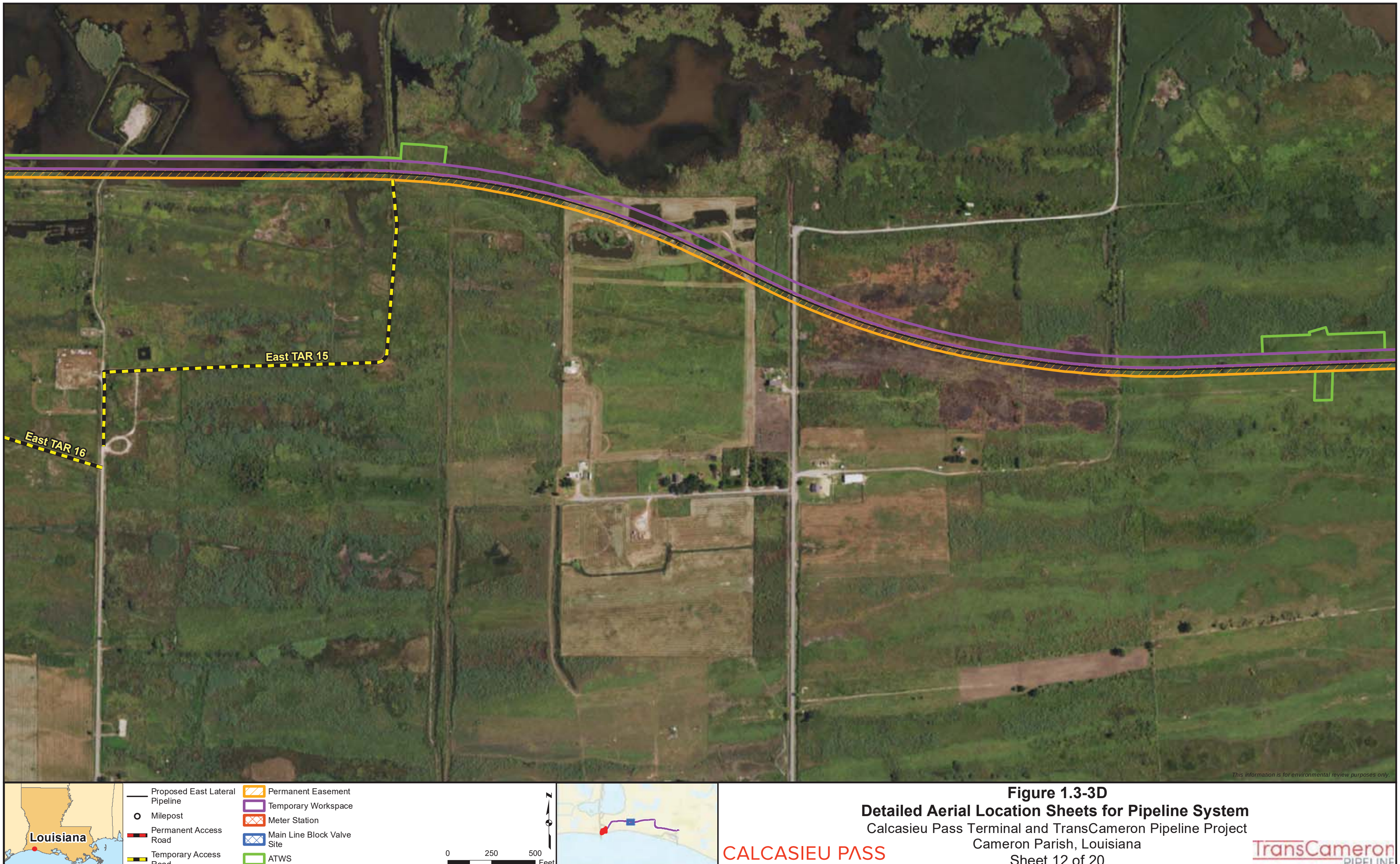

Figure 1.3-3D

Detailed Aerial Location Sheets for Pipeline System

Calcasieu Pass Terminal and TransCameron Pipeline Project

Cameron Parish, Louisiana

Sheet 12 of 20

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Proposed East Lateral Pipeline
Milepost
Permanent Access Road
Temporary Access Road
Permanent Easement
Temporary Workspace
Meter Station
Main Line Block Valve Site
ATWS

0 250 500 Feet

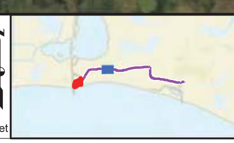

Figure 1.3-3D
Detailed Aerial Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 13 of 20

CALCASIEU PASS

TransCameron PIPELINE

FILE: M:\Clients\V-X\VGL\CalcasieuPass_ArcGIS_ResourceReports\RR01_CalcasieuPass_RR01_1_3_3D.mxd | REVISED: 07/12/2016 | SCALE: 1:6,000 when printed at 11x17

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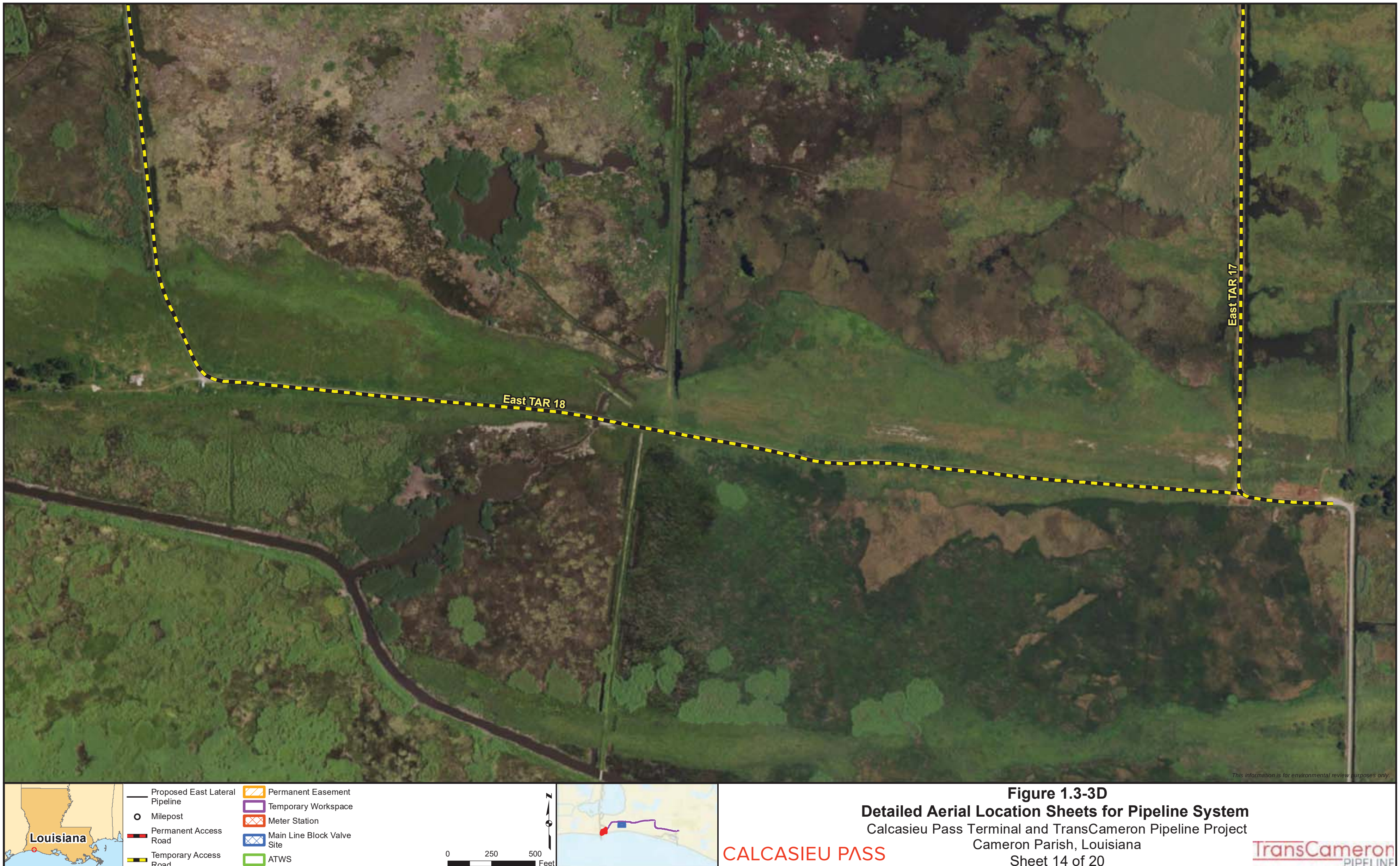

Figure 1.3-3D
Detailed Aerial Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 14 of 20

CALCASIEU PASS
TransCameron PIPELINE

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Proposed East Lateral Pipeline
Milepost
Permanent Access Road
Temporary Access Road
Permanent Easement
Temporary Workspace
Meter Station
Main Line Block Valve Site
ATWS

0 250 500 Feet

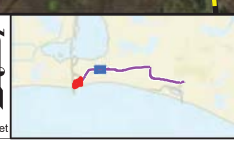

Figure 1.3-3D
Detailed Aerial Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 15 of 20

CALCASIEU PASS

TransCameron PIPELINE

FILE: M:\Clients\V-X\VGL\CalcasieuPass_ArcGIS_ResourceReports\RR01_CalcasieuPass_RR01_1_3_3D.mxd | REVISED: 07/12/2016 | SCALE: 1:6,000 when printed at 11x17

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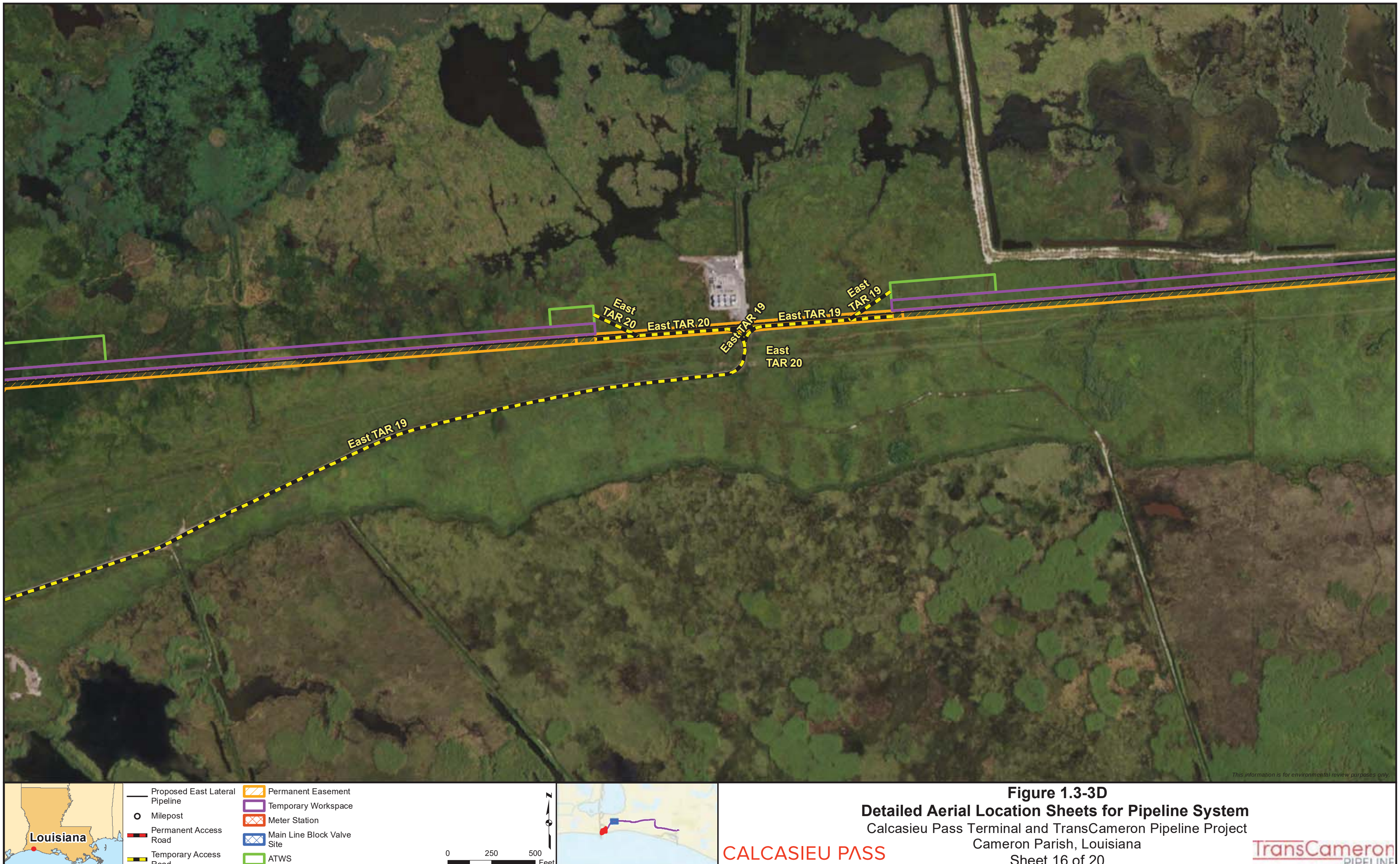

Figure 1.3-3D

Detailed Aerial Location Sheets for Pipeline System

Calcasieu Pass Terminal and TransCameron Pipeline Project

Cameron Parish, Louisiana

Sheet 16 of 20

CALCASIEU PASS

TransCameron PIPELINE

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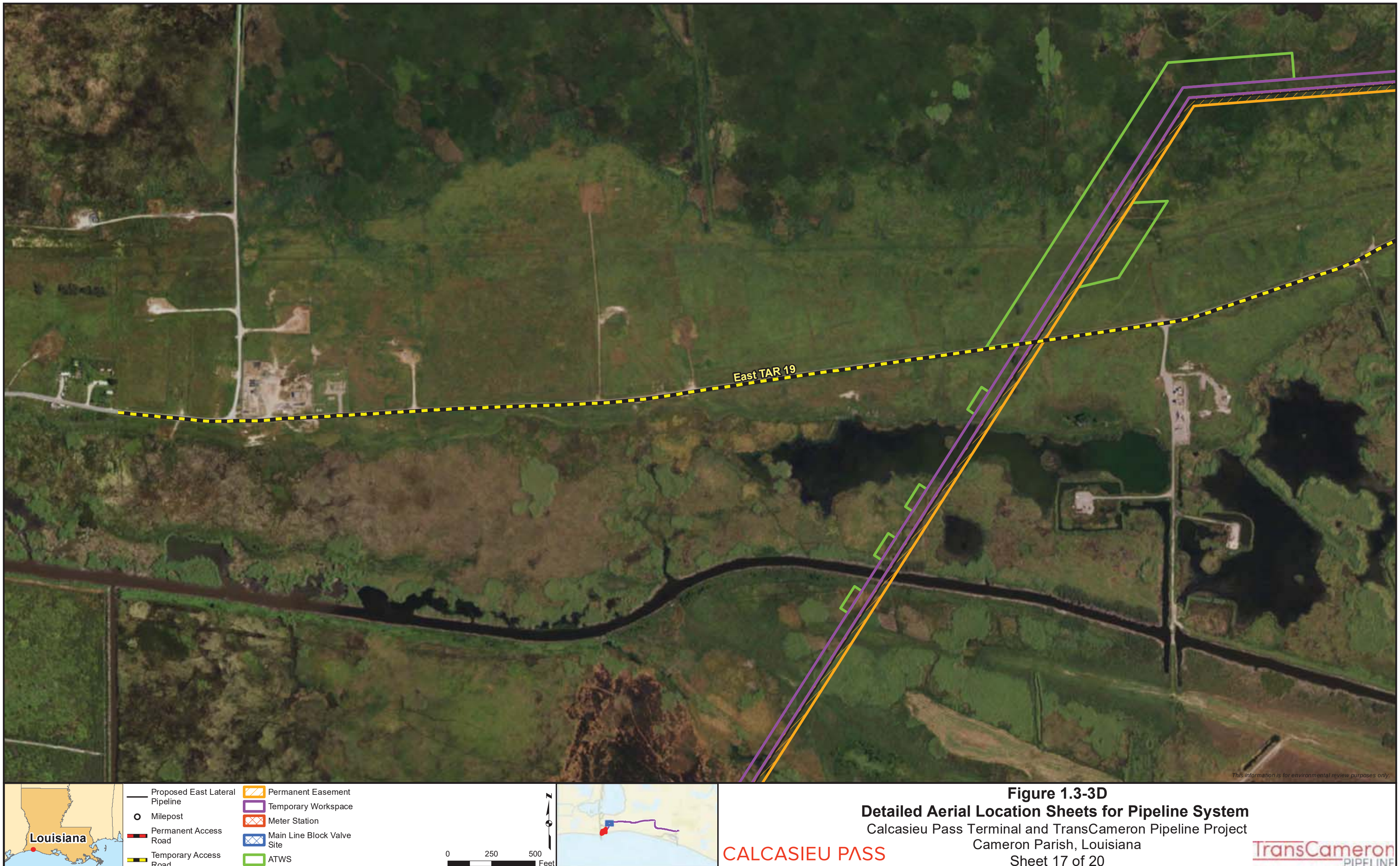

Figure 1.3-3D
Detailed Aerial Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 17 of 20

CALCASIEU PASS
TransCameron PIPELINE

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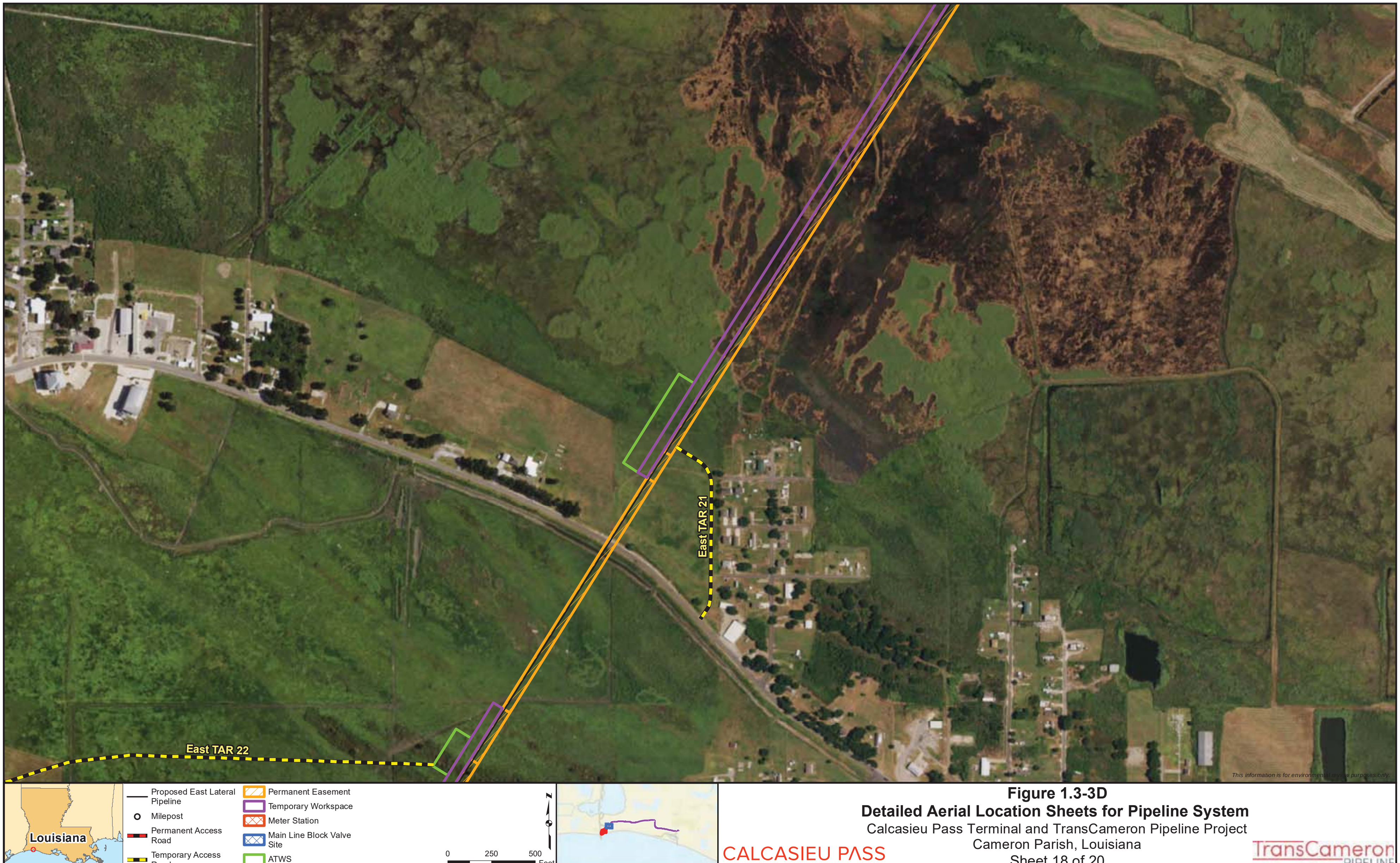

Figure 1.3-3D
Detailed Aerial Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 18 of 20

CALCASIEU PASS

TransCameron PIPELINE

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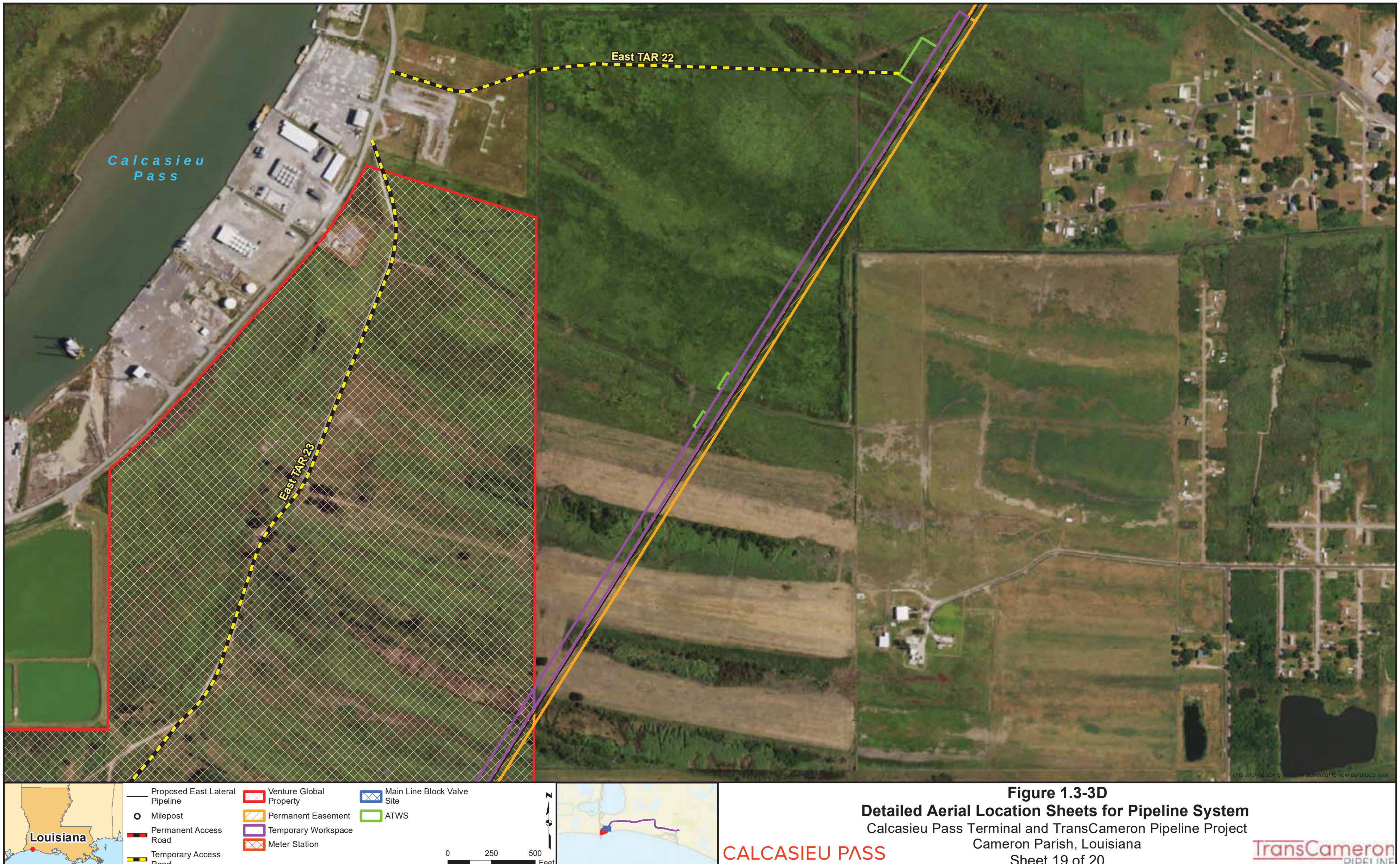

Figure 1.3-3D
Detailed Aerial Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 19 of 20

CALCASIEU PASS

TransCameron PIPELINE

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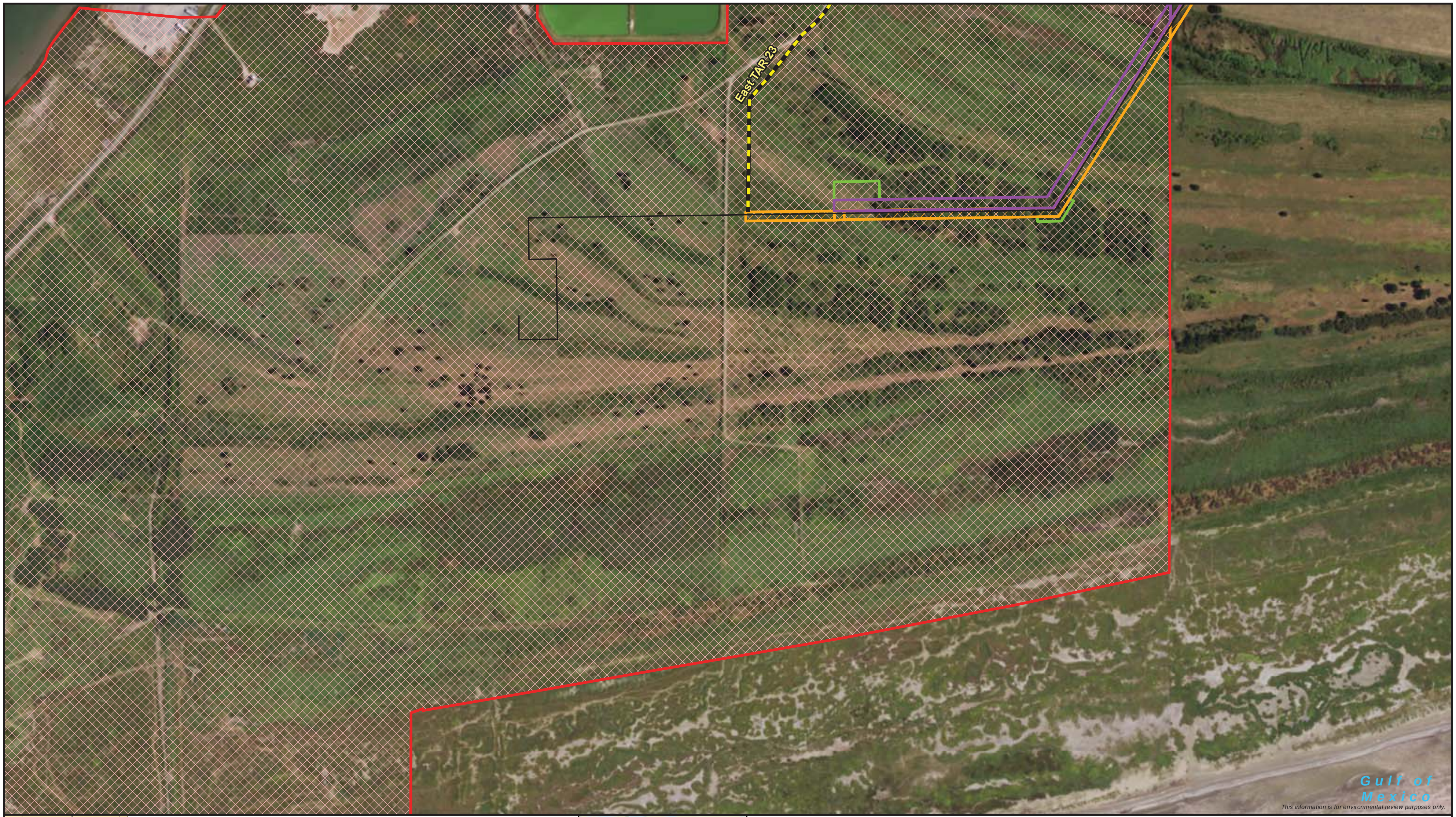

Louisiana

Proposed East Lateral Pipeline
Milepost
Permanent Access Road
Temporary Access Road
Venture Global Property
Permanent Easement
Temporary Workspace
Meter Station
Main Line Block Valve Site
ATWS

0 250 500 Feet

Figure 1.3-3D
Detailed Aerial Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 20 of 20

CALCASIEU PASS

TransCameron PIPELINE

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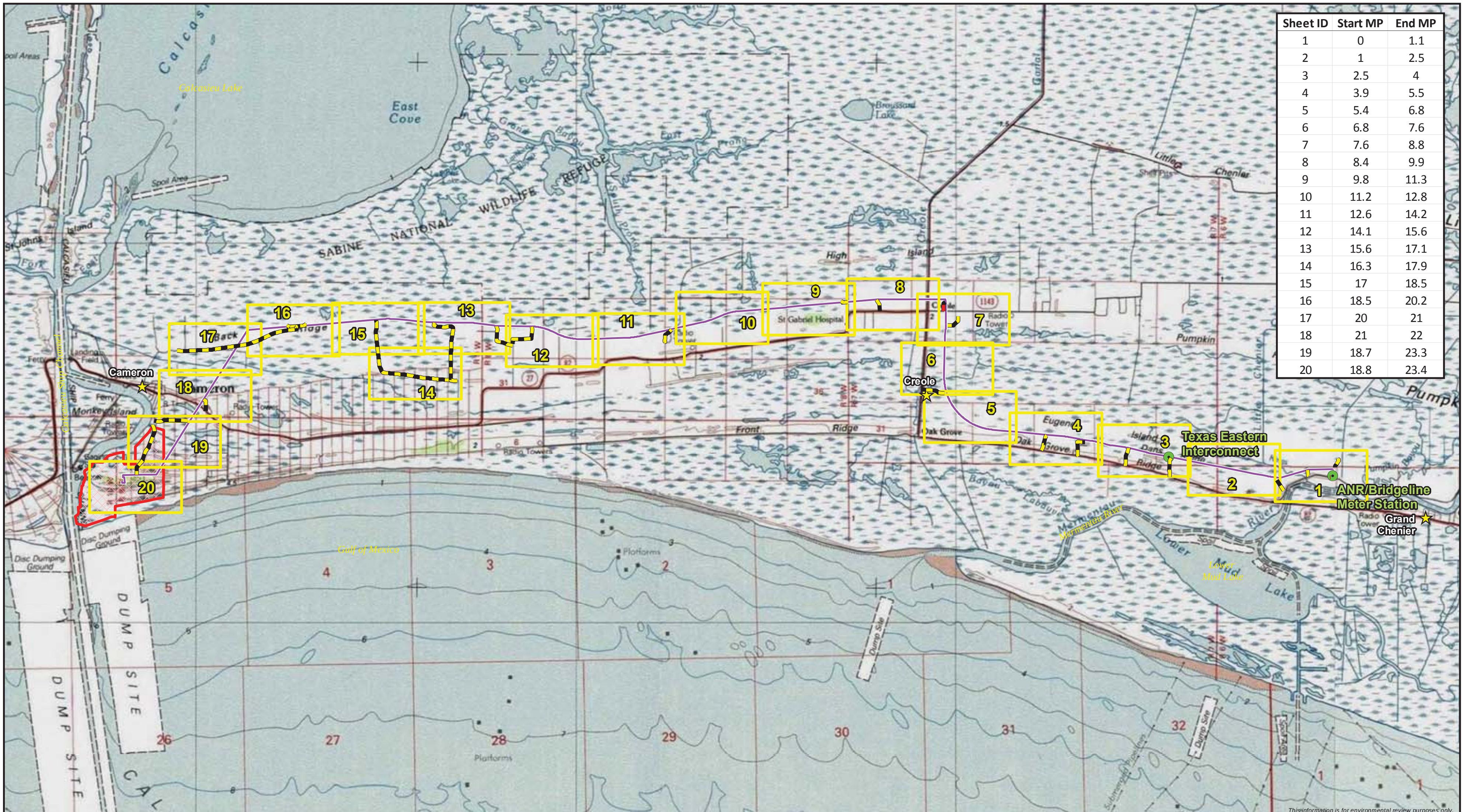

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19	18.7	23.3
20	18.8	23.4

Louisiana

Proposed East Lateral Pipeline
Meter Station
Venture Global Property
Permanent Access Road
Temporary Access Road

1:95,040

0 0.75 1.5 Miles

Figure 1.3-5
Proposed Pipeline System – Topographic Routing Overview
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana

CALCASIEU PASS

TransCameron PIPELINE

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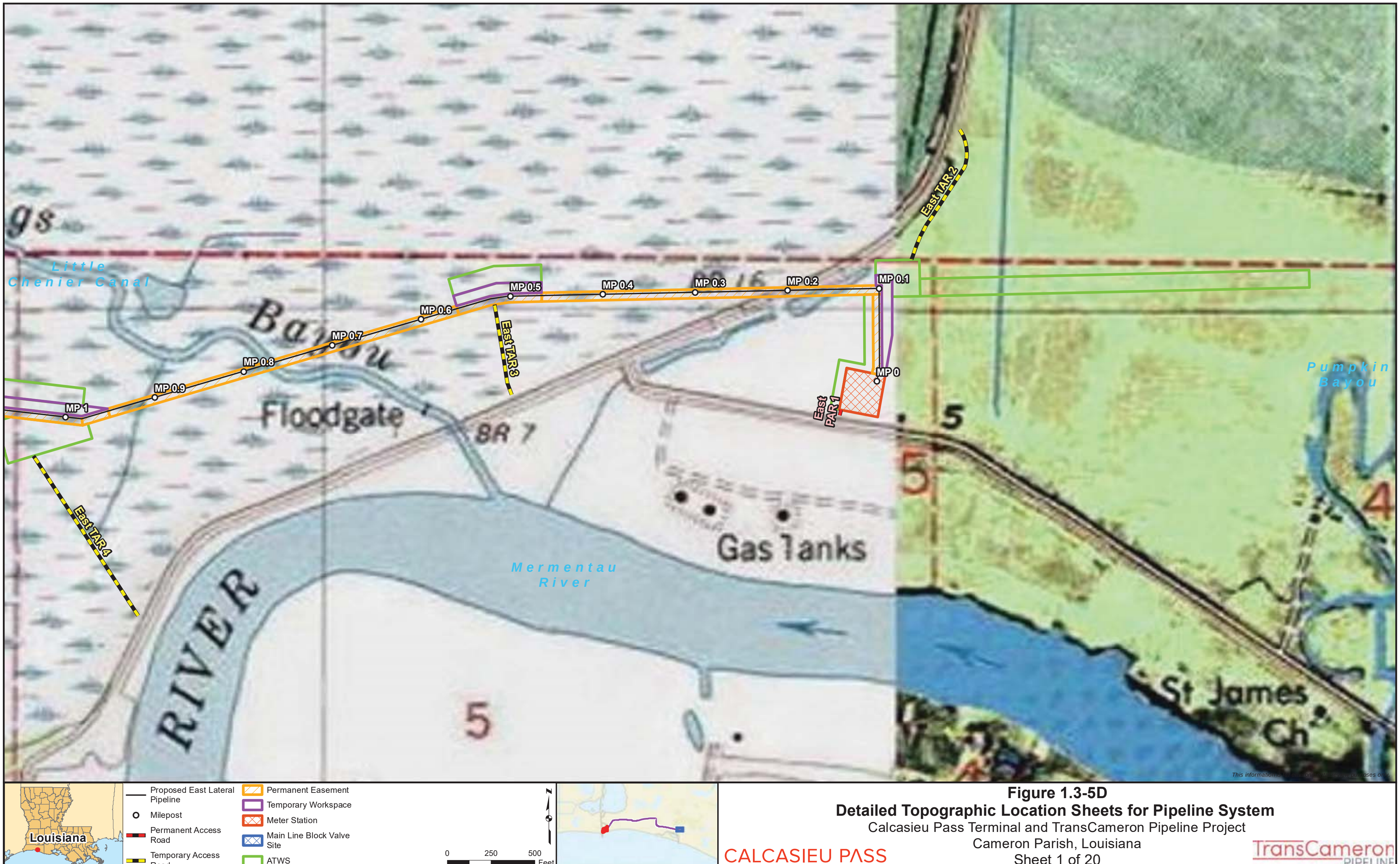

Figure 1.3-5D

Detailed Topographic Location Sheets for Pipeline System

Calcasieu Pass Terminal and TransCameron Pipeline Project

Cameron Parish, Louisiana

Sheet 1 of 20

CALCASIEU PASS

TransCameron PIPELINE

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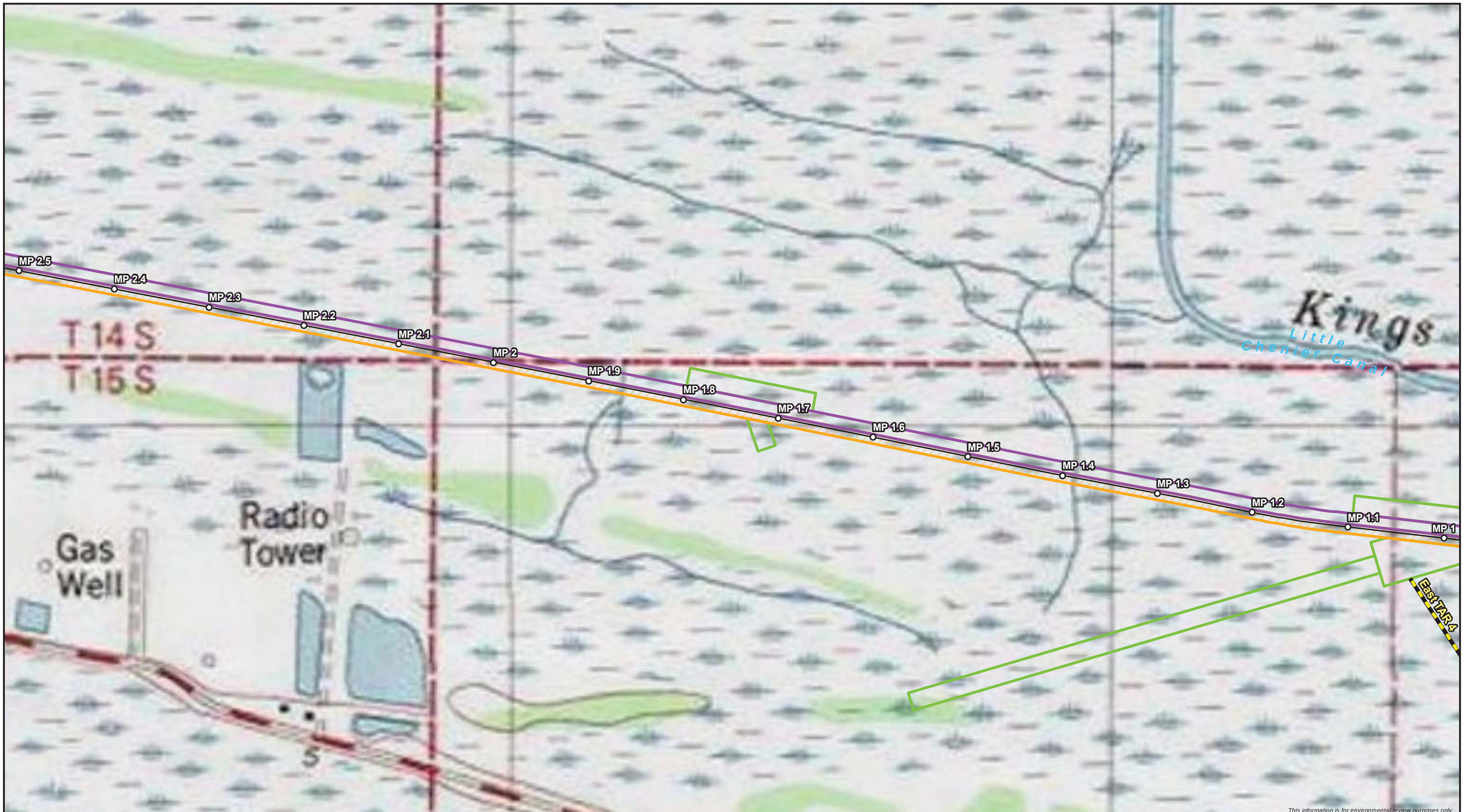

- Proposed East Lateral Pipeline
- Milepost
- Permanent Access Road
- Temporary Access Road
- Permanent Easement
- Temporary Workspace
- Meter Station
- Main Line Block Valve Site
- ATWS

0 250 500 Feet

N

CALCASIEU PASS

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 2 of 20

TransCameron PIPELINE

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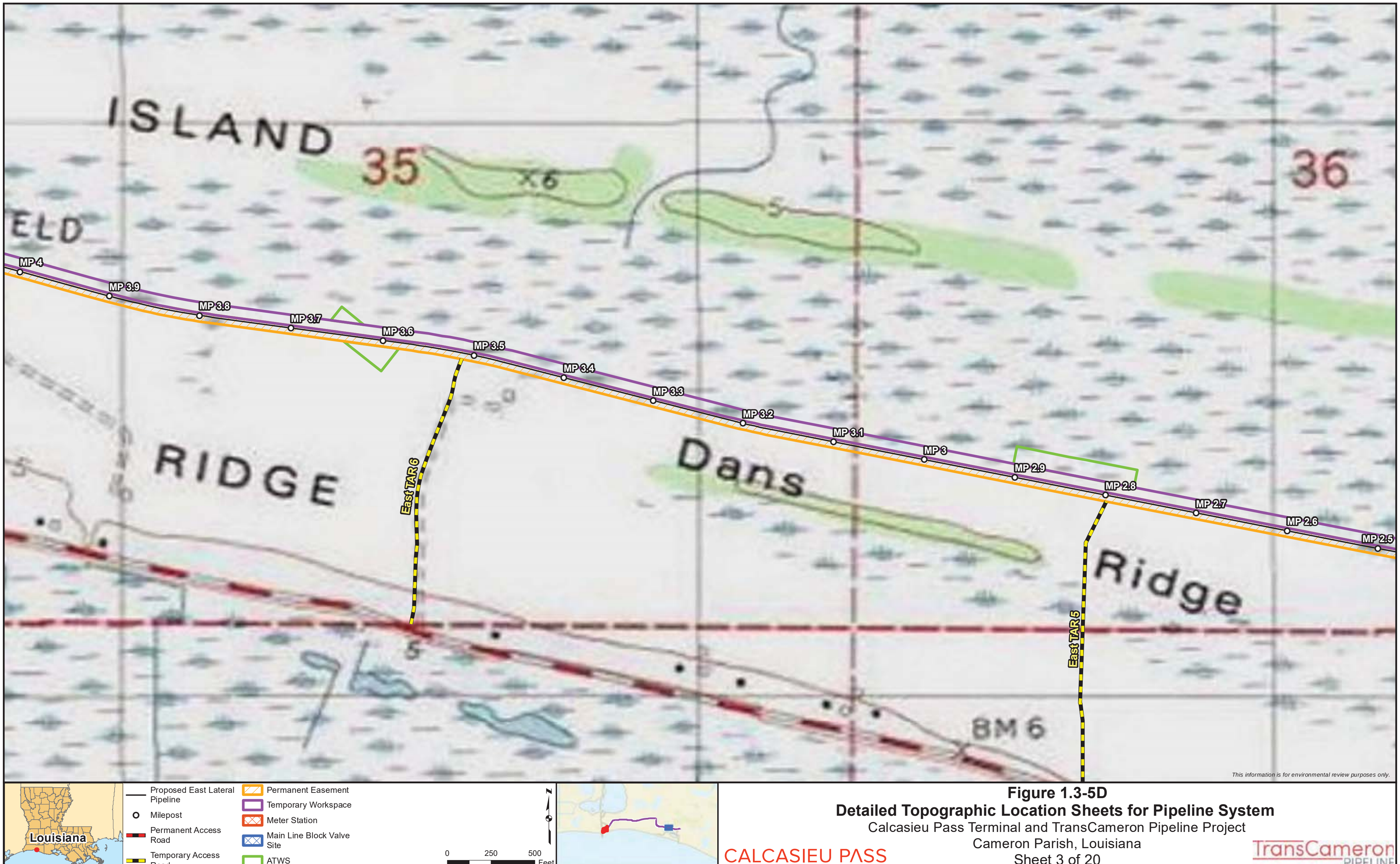

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 3 of 20

CALCASIEU PASS

TransCameron PIPELINE

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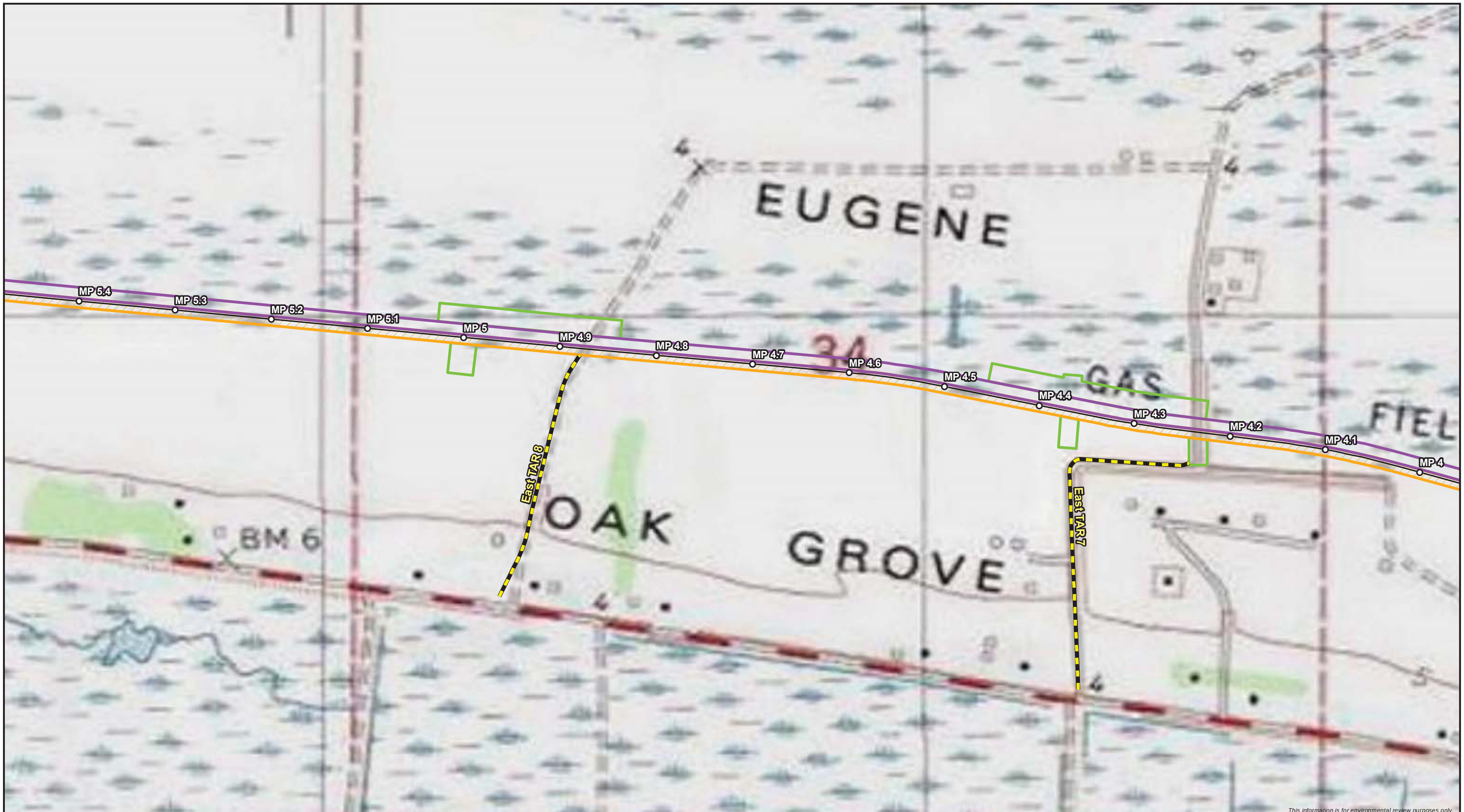

Proposed East Lateral Pipeline

Milepost

Permanent Access Road

Temporary Access Road

Permanent Easement

Temporary Workspace

Meter Station

Main Line Block Valve Site

ATWS

0 250 500 Feet

Figure 1.3-5D

Detailed Topographic Location Sheets for Pipeline System

Calcasieu Pass Terminal and TransCameron Pipeline Project

Cameron Parish, Louisiana

Sheet 4 of 20

CALCASIEU PASS

TransCameron PIPELINE

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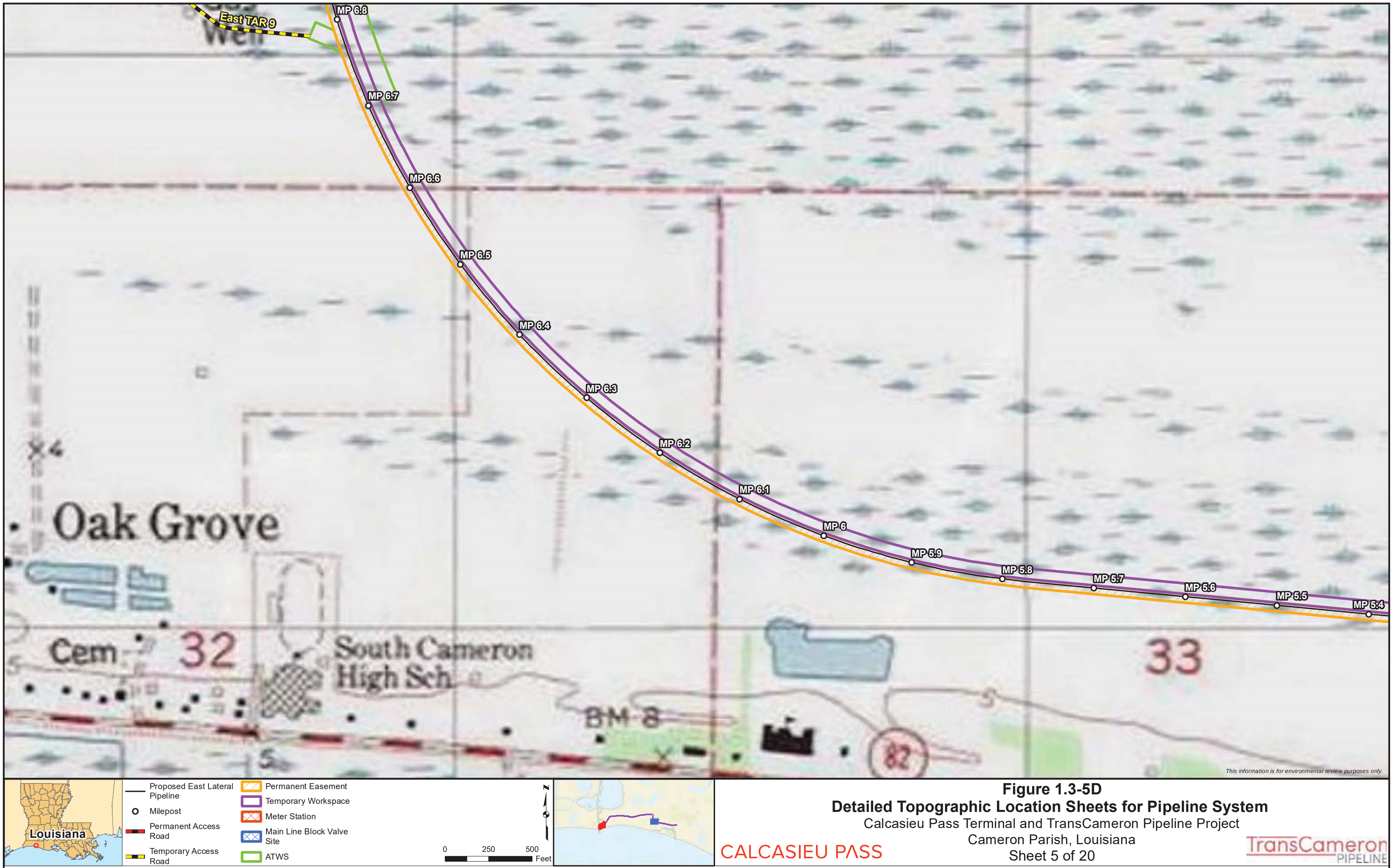

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 5 of 20

CALCASIEU PASS

TransCameron PIPELINE

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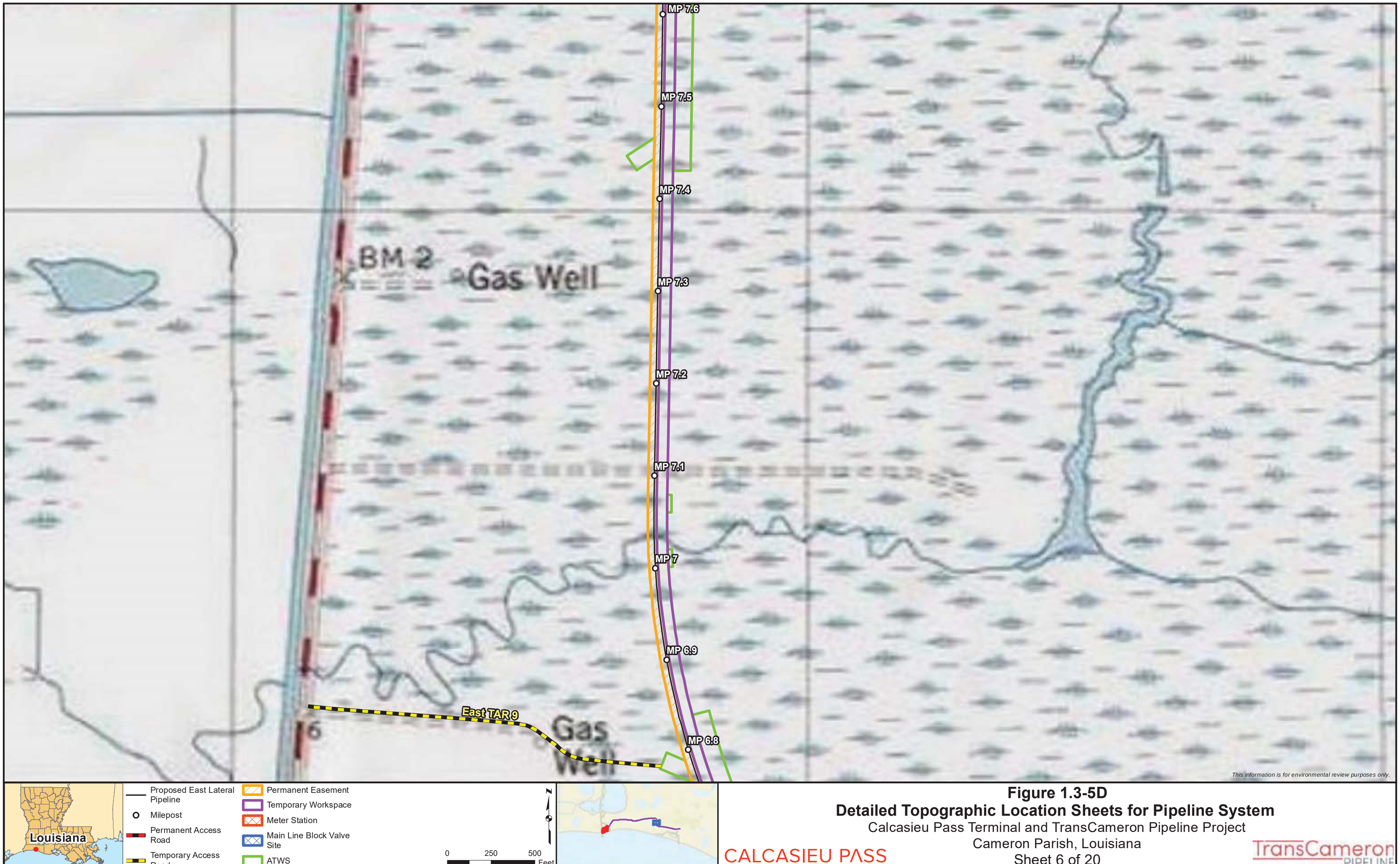

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 6 of 20

CALCASIEU PASS

TransCameron PIPELINE

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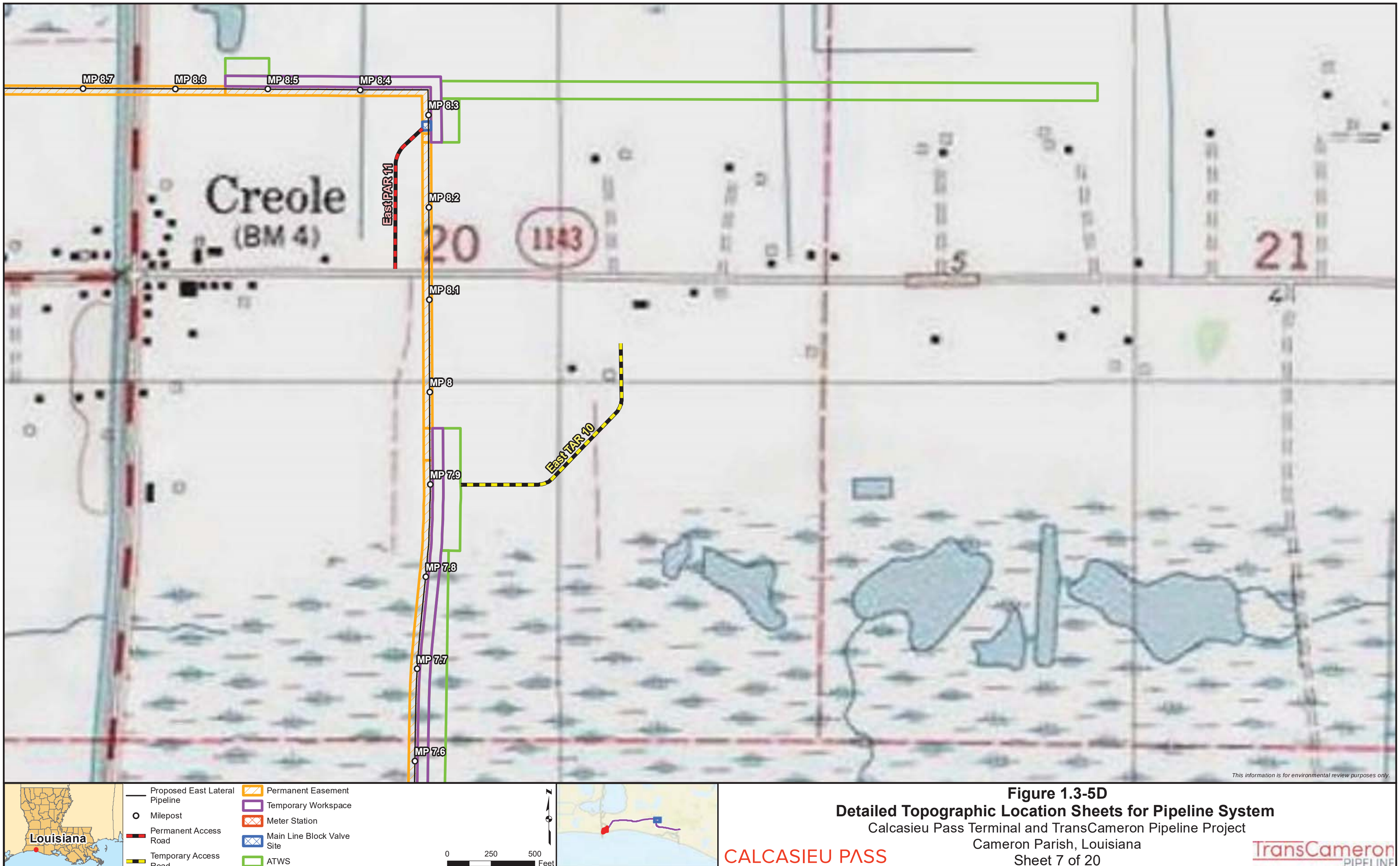

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 7 of 20

CALCASIEU PASS

TransCameron PIPELINE

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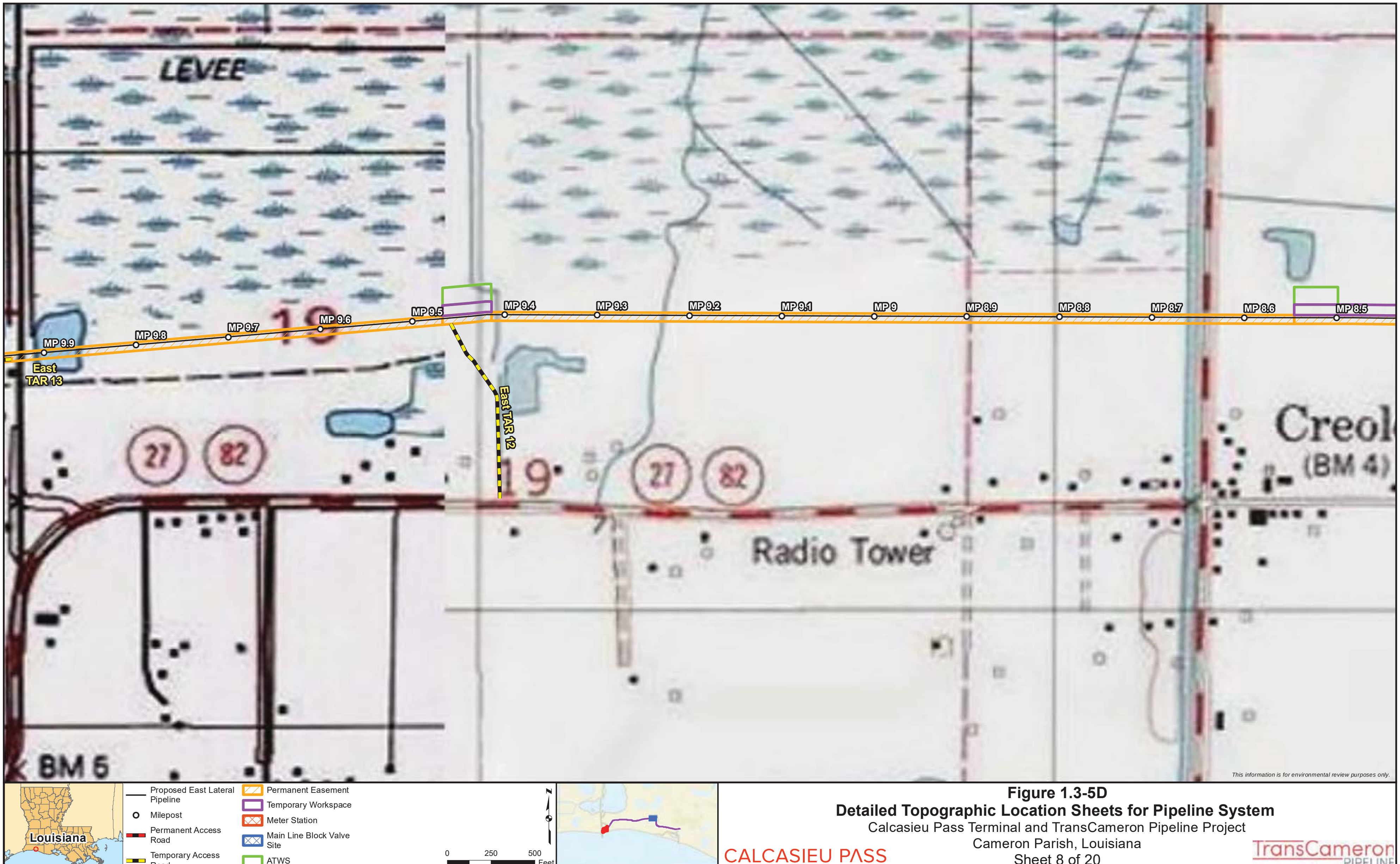

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 8 of 20

CALCASIEU PASS

TransCameron PIPELINE

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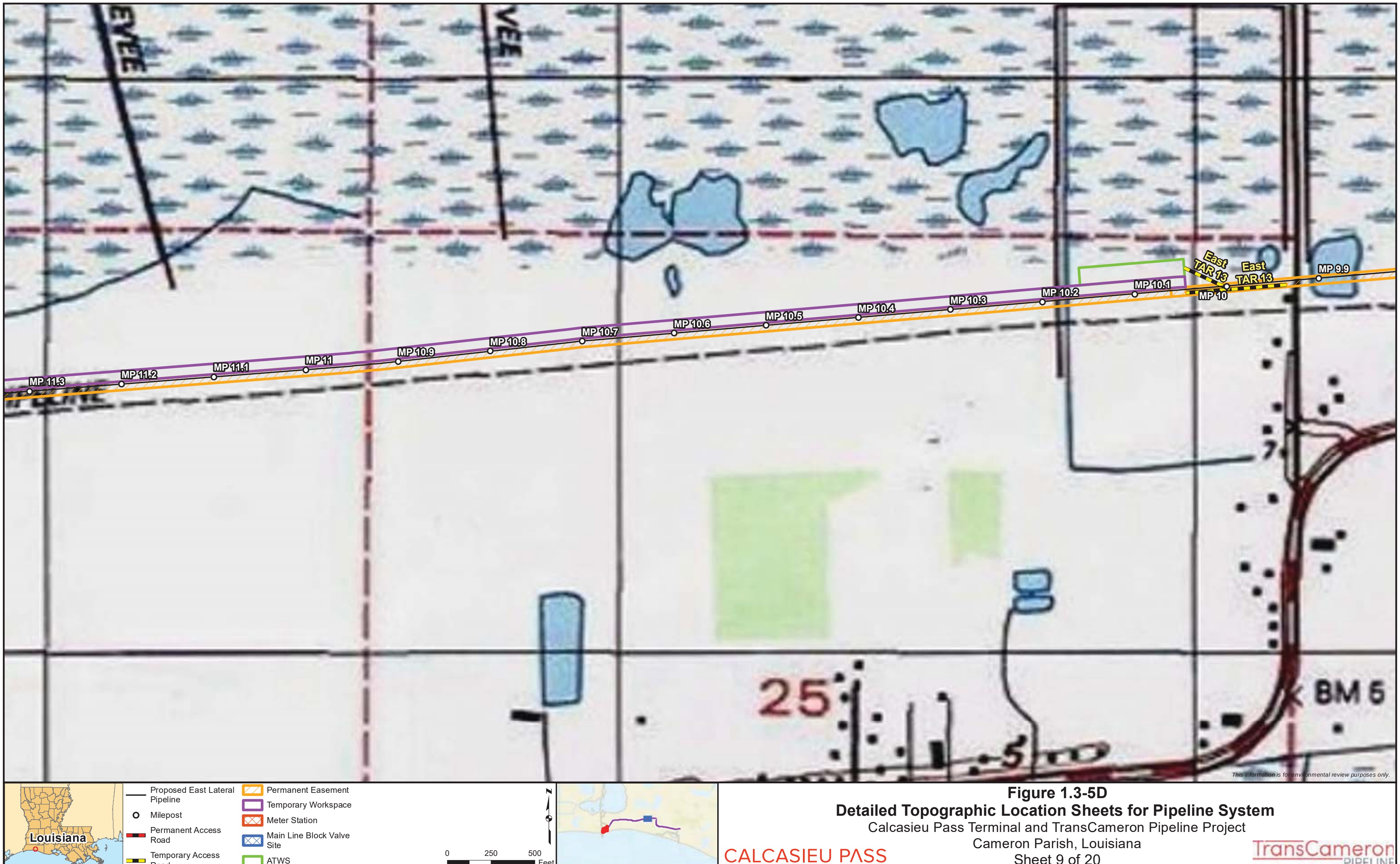

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 9 of 20

CALCASIEU PASS

TransCameron PIPELINE

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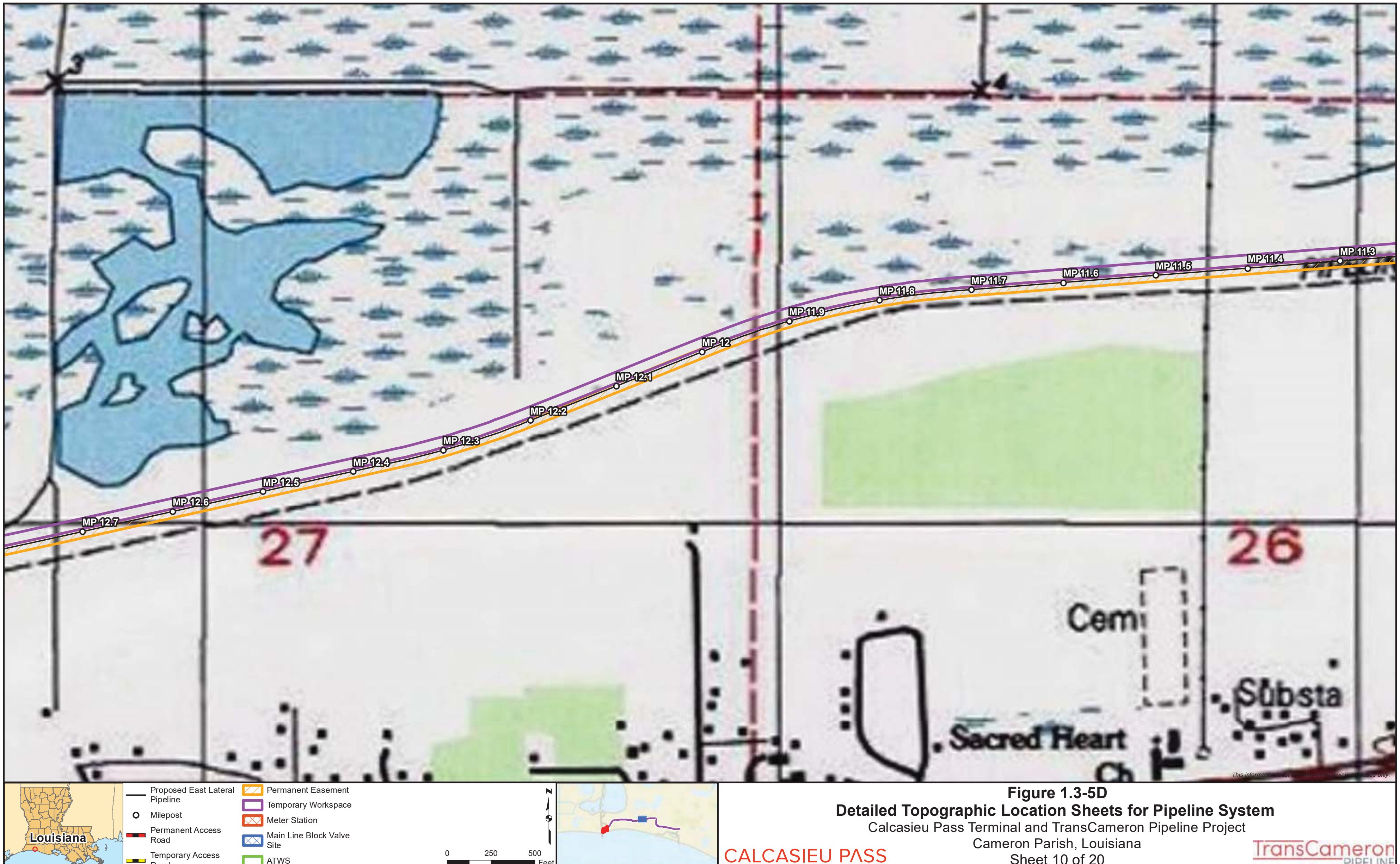

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 10 of 20

CALCASIEU PASS

TransCameron PIPELINE

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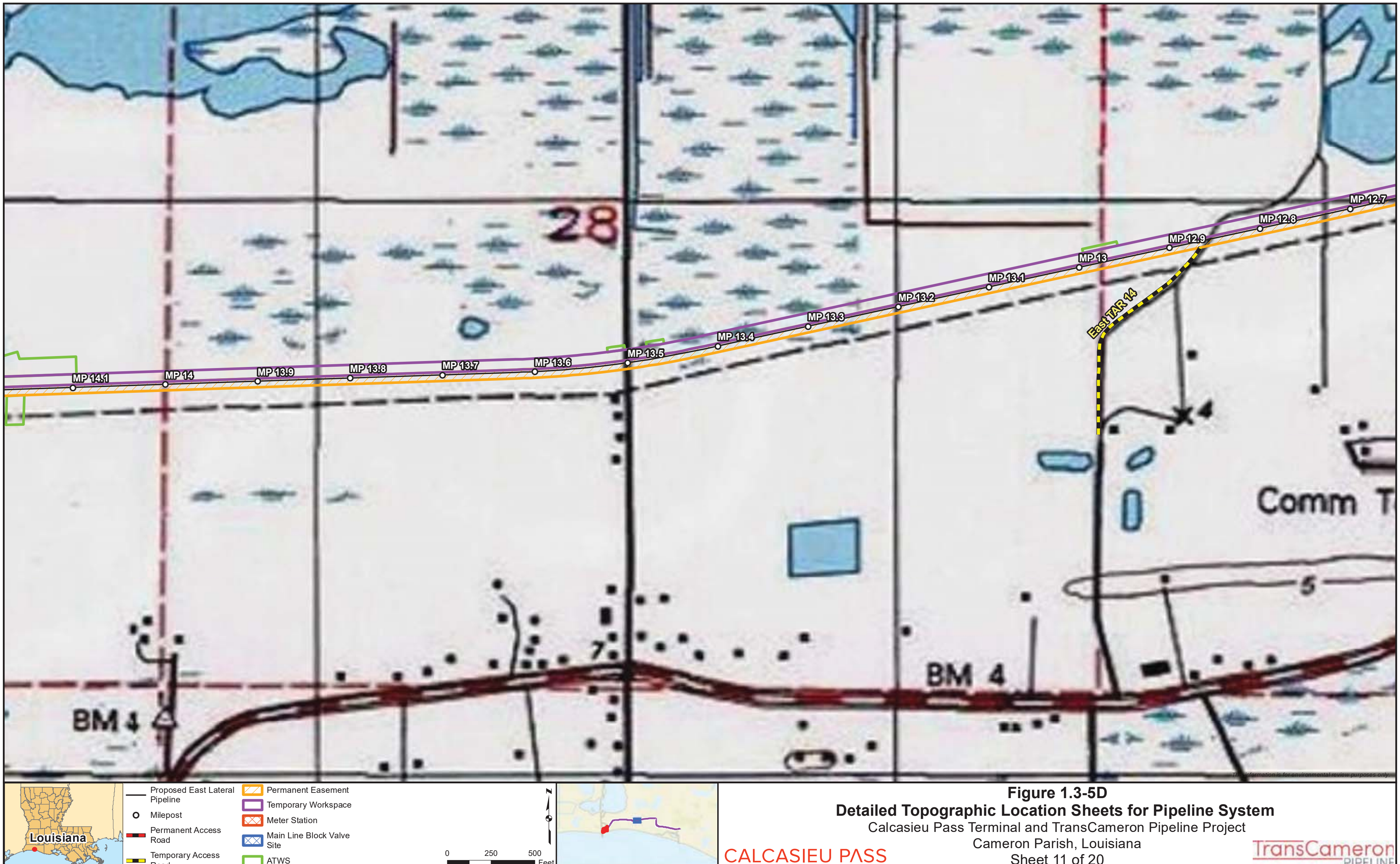

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 11 of 20

CALCASIEU PASS

TransCameron PIPELINE

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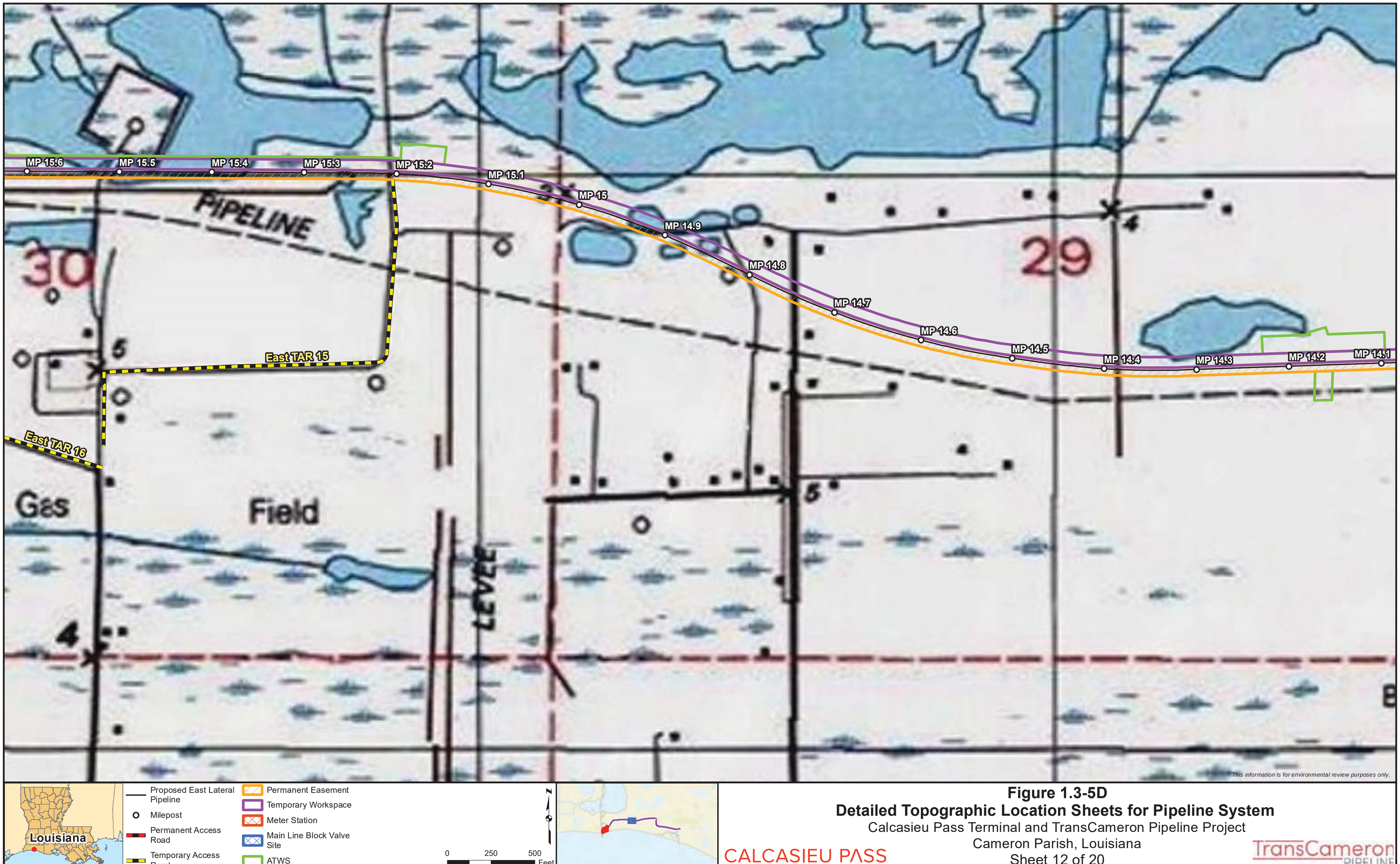

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 12 of 20

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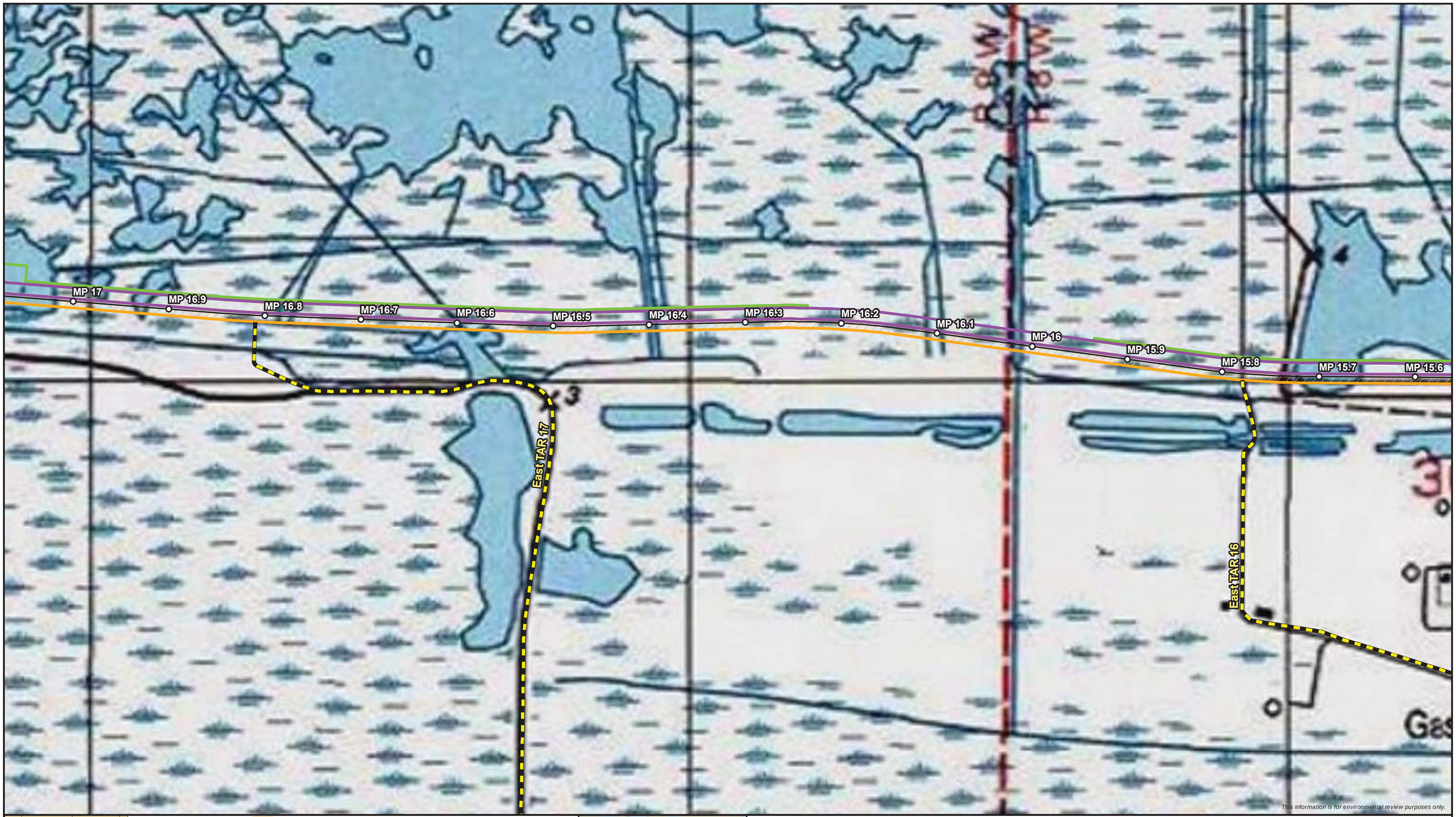

Louisiana

- Proposed East Lateral Pipeline
- Milepost
- Permanent Access Road
- Temporary Access Road
- Permanent Easement
- Temporary Workspace
- Meter Station
- Main Line Block Valve Site
- ATWS

0 250 500 Feet

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 13 of 20

CALCASIEU PASS

TransCameron PIPELINE

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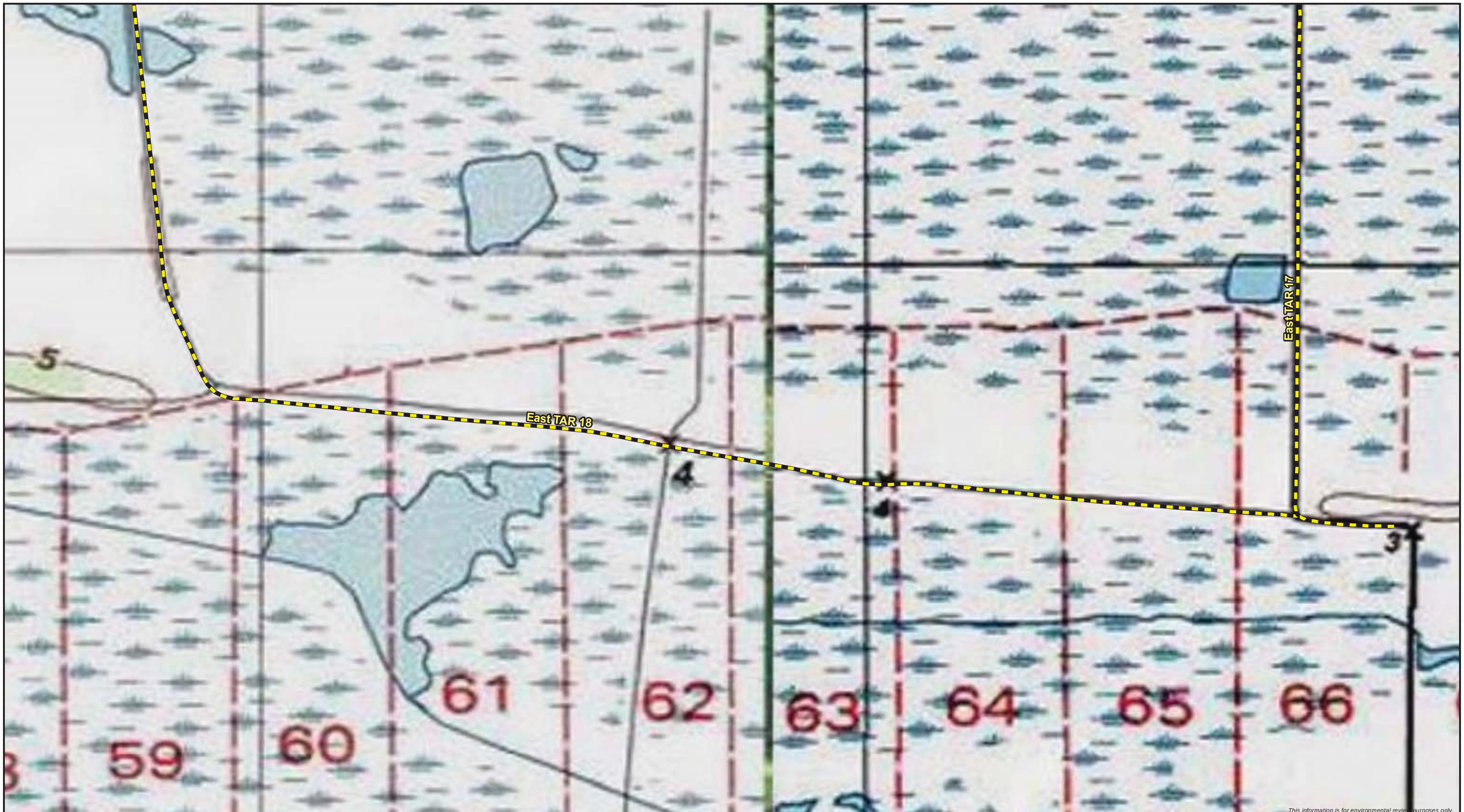

Proposed East Lateral Pipeline
Milepost
Permanent Access Road
Temporary Access Road
Permanent Easement
Temporary Workspace
Meter Station
Main Line Block Valve Site
ATWS

0 250 500 Feet

Louisiana

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 14 of 20

CALCASIEU PASS

TransCameron PIPELINE

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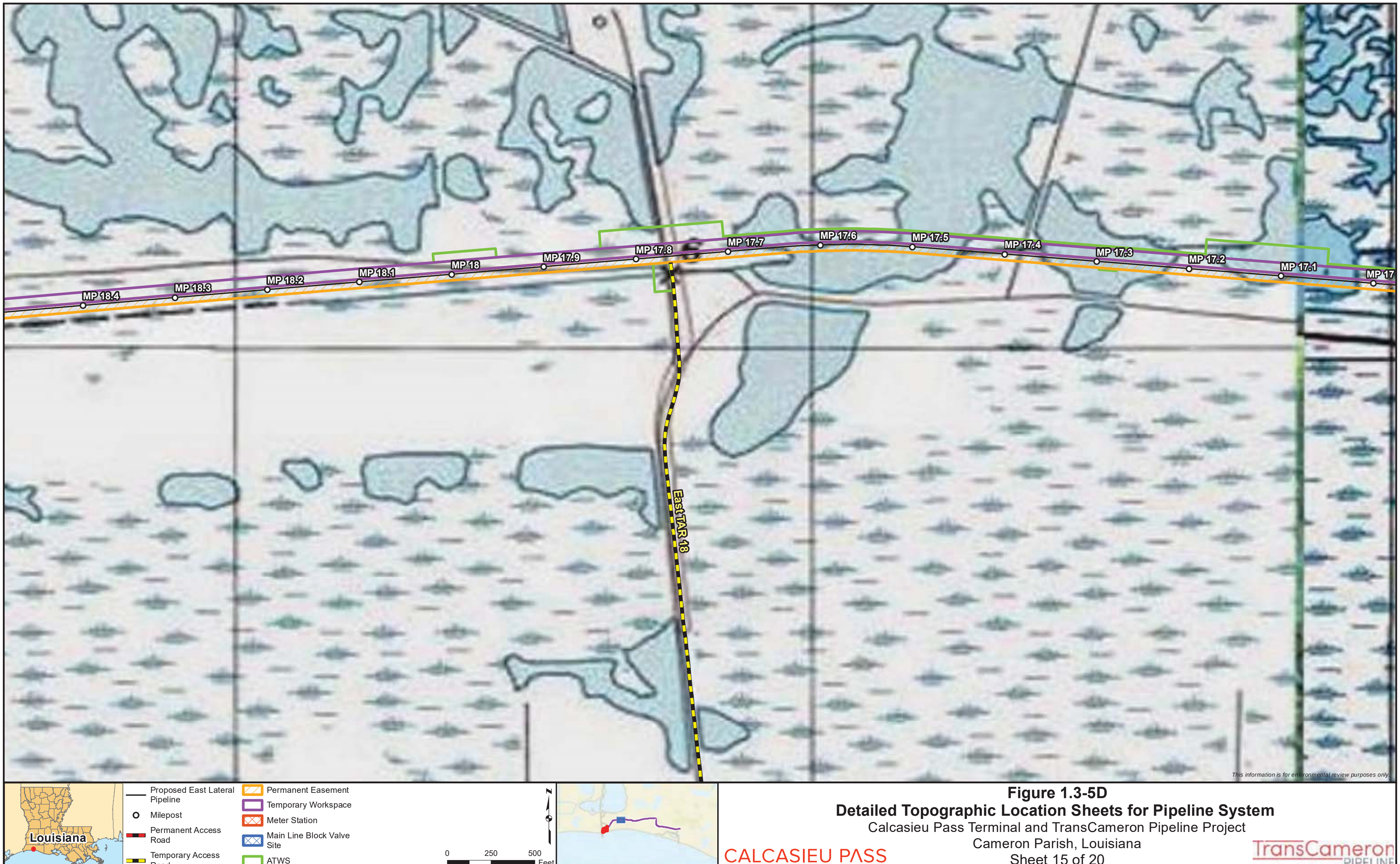

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 15 of 20

FILE: M:\Clients\V-X\VGL\CalcasieuPass_ArcGIS_ResourceReports\RR01_CalcasieuPass_RR01_1_3_5D.mxd | REVISED: 07/12/2016 | SCALE: 1:6,000 when printed at 11x17
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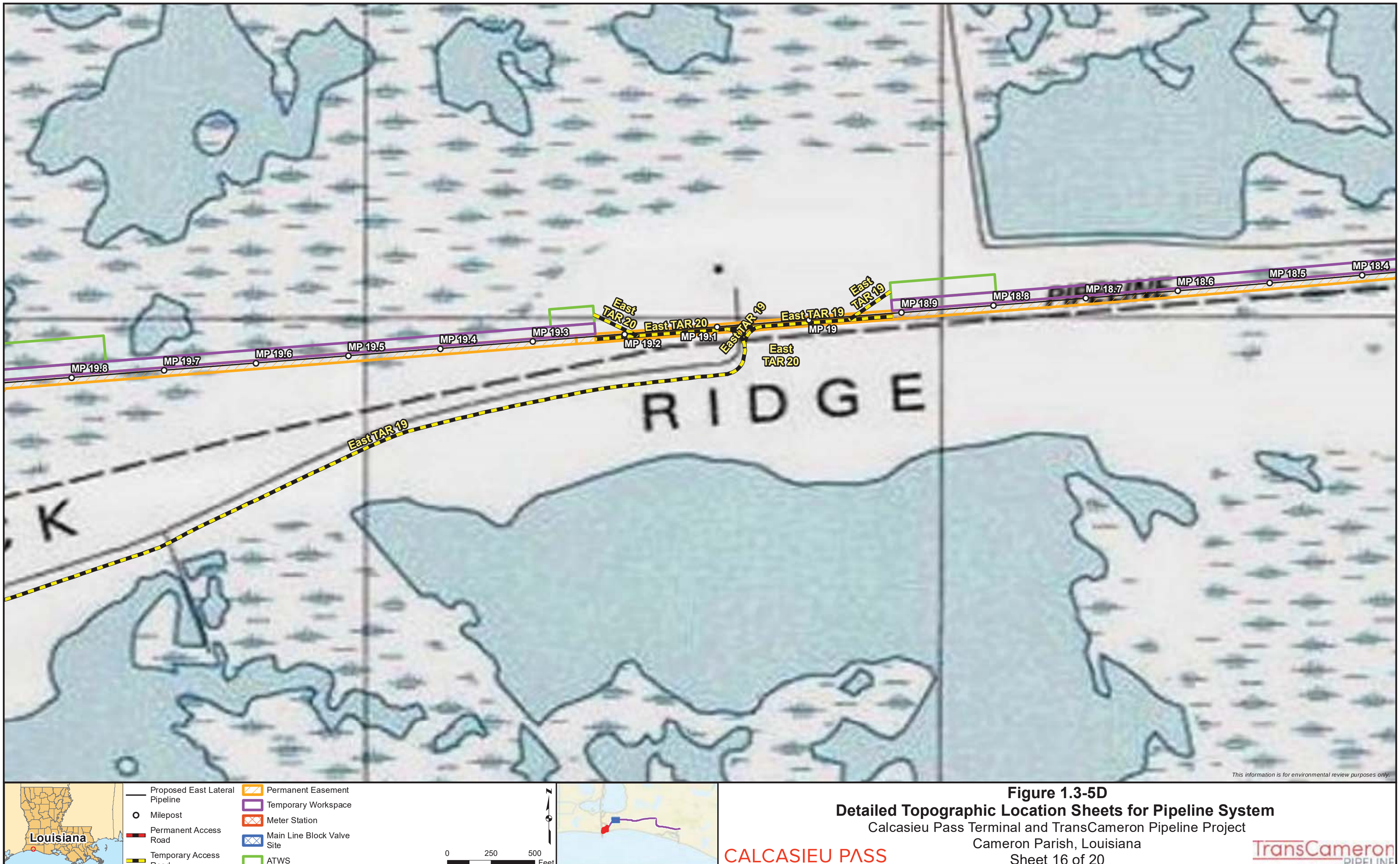

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 16 of 20

CALCASIEU PASS

TransCameron PIPELINE

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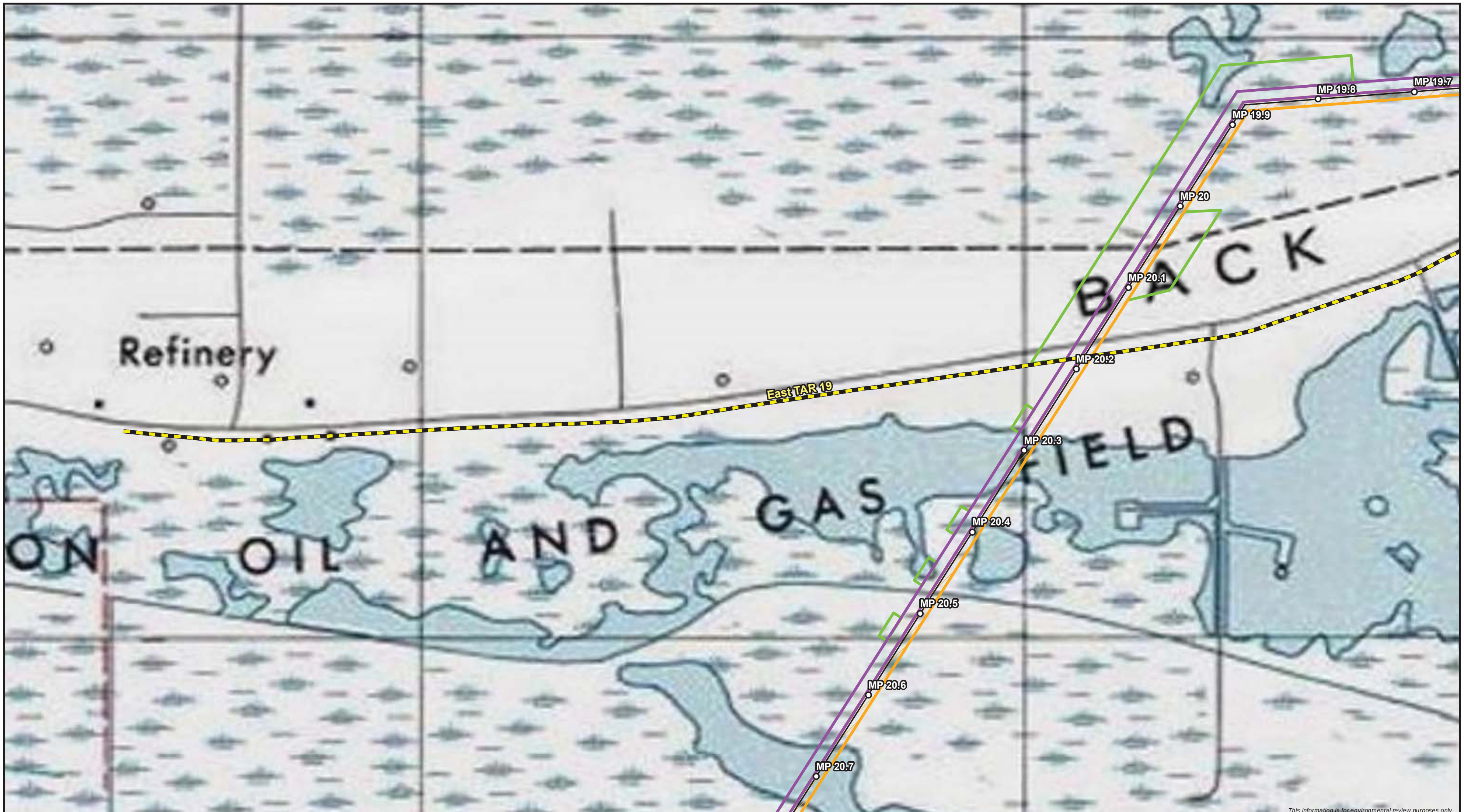

Louisiana

Proposed East Lateral Pipeline
Milepost
Permanent Access Road
Temporary Access Road
Permanent Easement
Temporary Workspace
Meter Station
Main Line Block Valve Site
ATWS

0 250 500 Feet

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 17 of 20

CALCASIEU PASS

TransCameron PIPELINE

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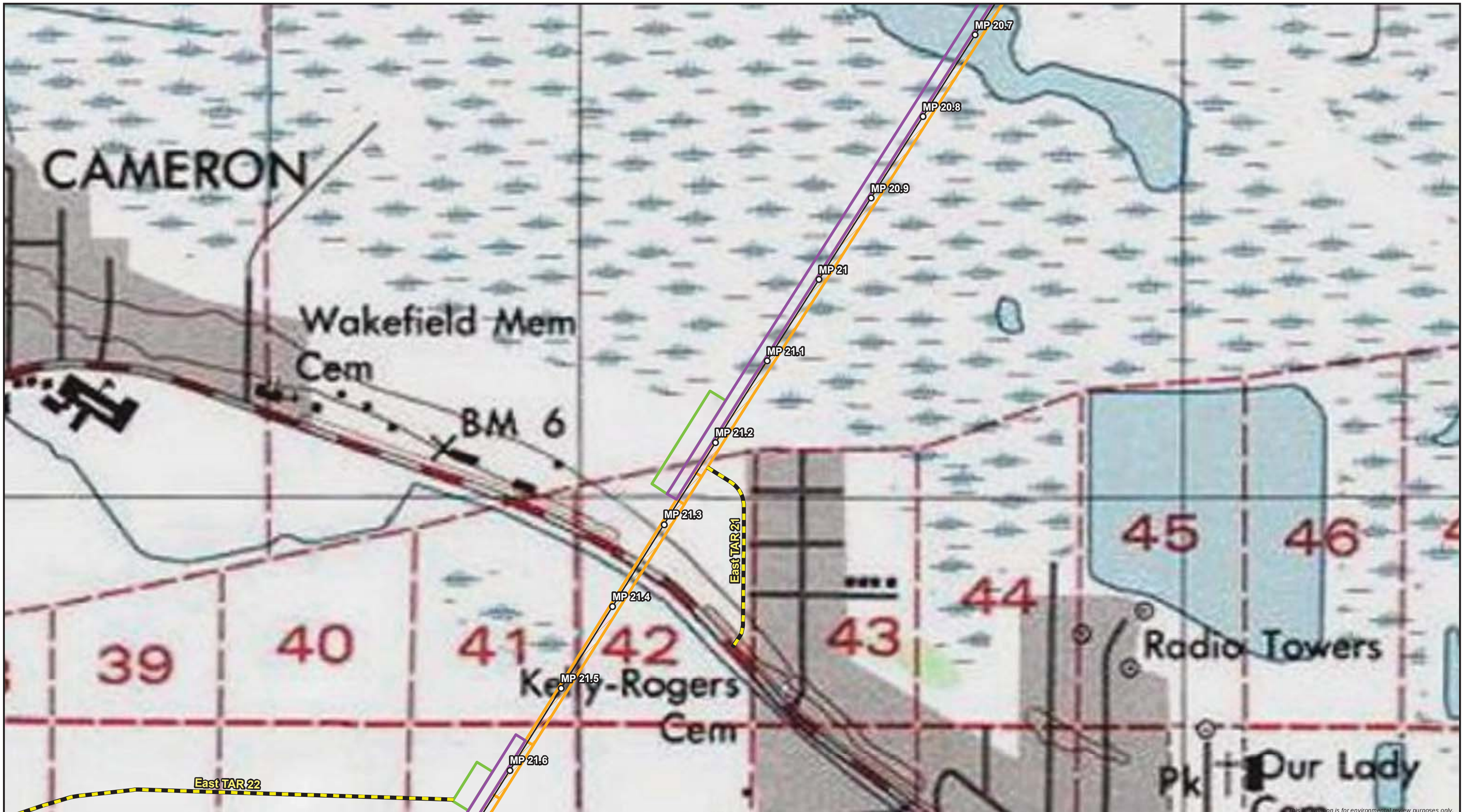

Proposed East Lateral Pipeline
Milepost
Permanent Access Road
Temporary Access Road
Permanent Easement
Temporary Workspace
Meter Station
Main Line Block Valve Site
ATWS

Louisiana

0 250 500 Feet

N

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 18 of 20

CALCASIEU PASS

TransCameron PIPELINE

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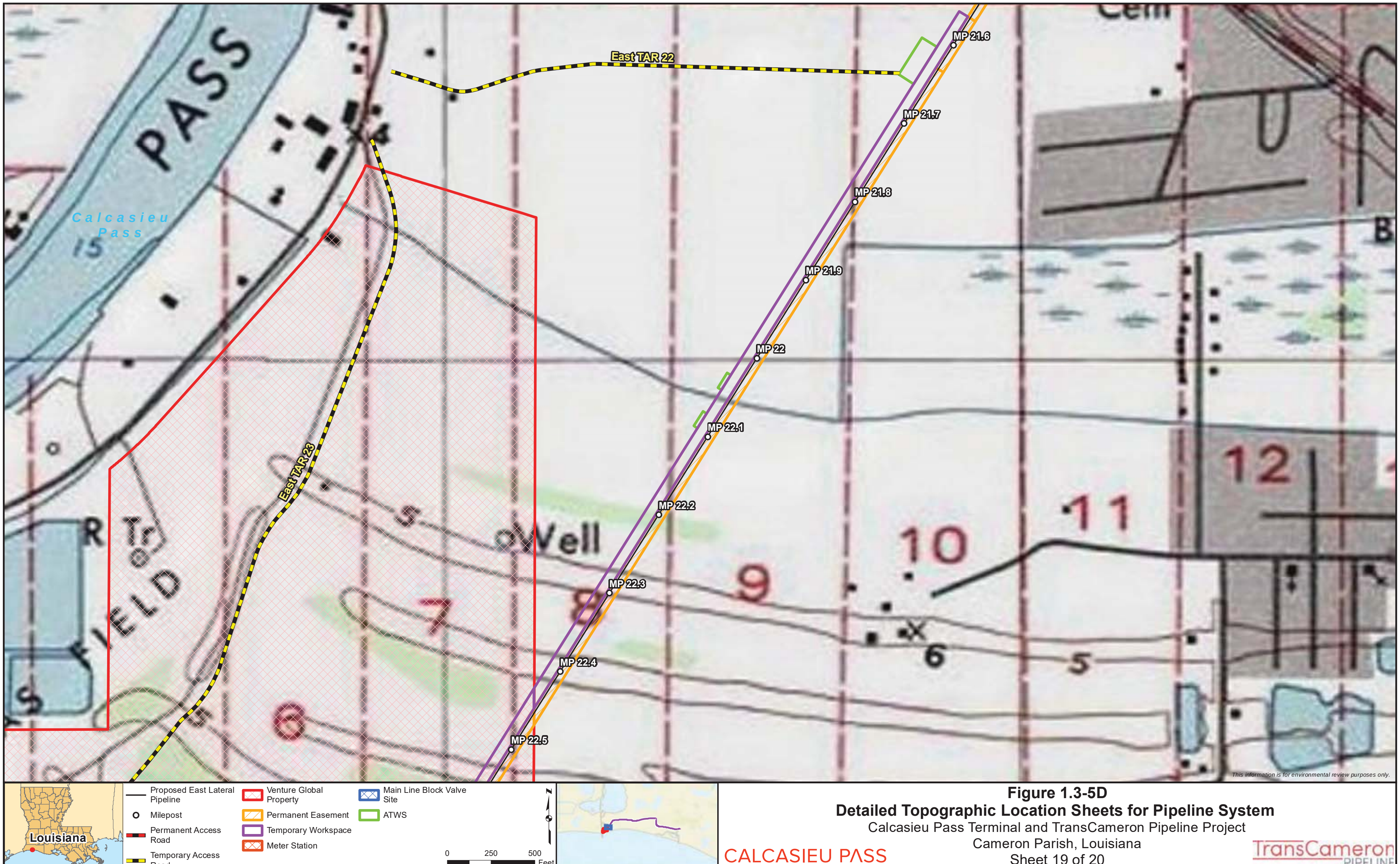

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 19 of 20

CALCASIEU PASS

TransCameron PIPELINE

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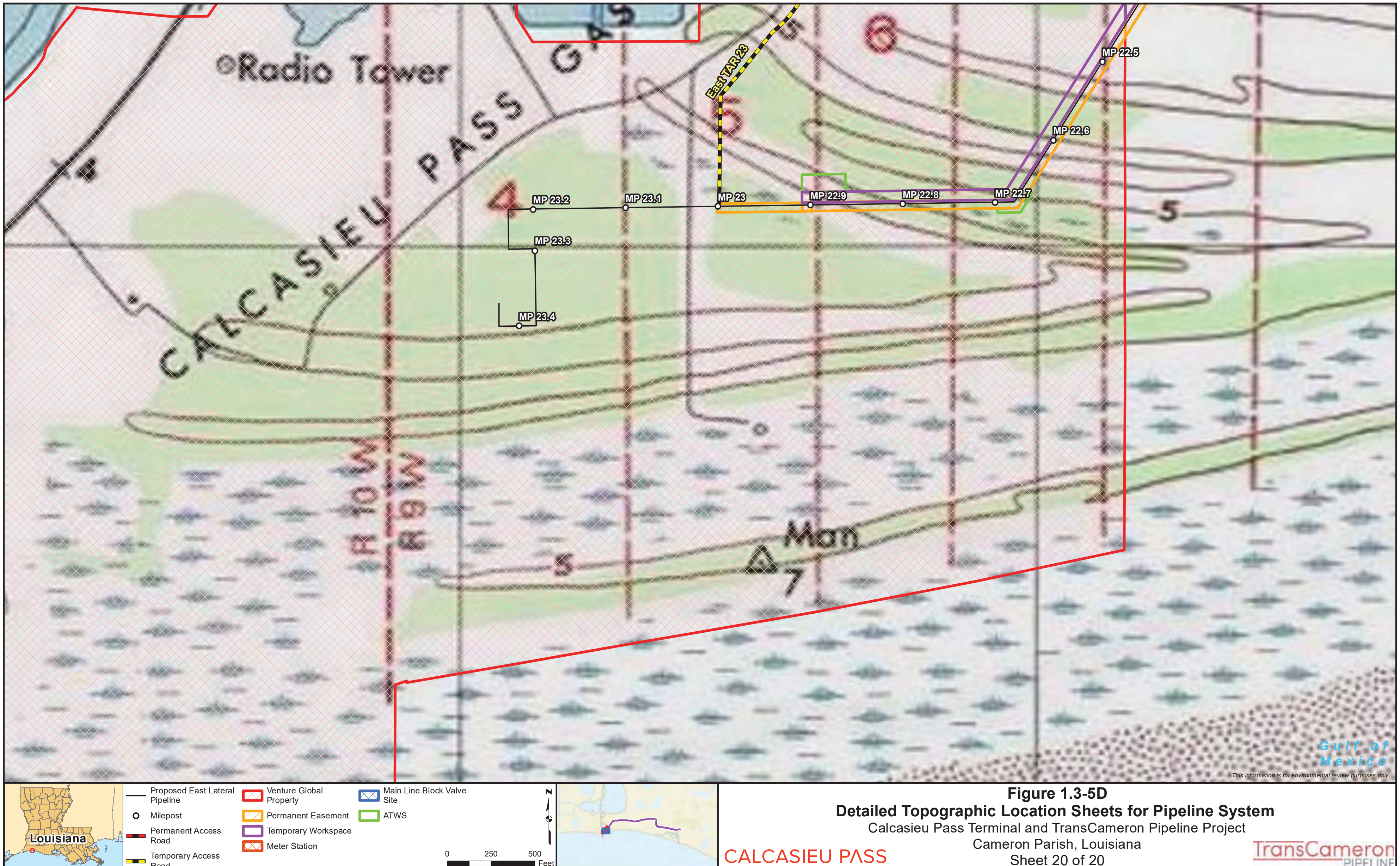

Figure 1.3-5D
Detailed Topographic Location Sheets for Pipeline System
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
Sheet 20 of 20

FILE: M:\Clients\V-X\VGL\CalcasieuPass_ArcGIS_ResourceReports\RR01_CalcasieuPass_RR01_1_3_5D.mxd | REVISED: 07/12/2016 | SCALE: 1:6,000 when printed at 11x17 DRAWN BY: JSnyder

APPENDIX B-3

PIPELINE ACCESS ROADS AND TYPICAL ACCESS ROAD PROFILE DRAWINGS

TRANSCAMERON PIPELINE, LLC

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

EAST LATERAL ACCESS ROADS

CAMERON PARISH, LOUISANA

SHEET NO.	DRAWING NUMBER	REV.	TITLE
1	TCPPL-M-502	A	COVER SHEET
2	TCPPL-M-502.1	A	LOCATION MAP
3	TCPPL-M-502.2	A	EAST LATERAL ACCESS ROADS; PERMANENT ACCESS ROAD #1
4	TCPPL-M-502.3	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #2
5	TCPPL-M-502.4	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #3
6	TCPPL-M-502.5	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #4
7	TCPPL-M-502.6	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #5
8	TCPPL-M-502.7	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #6
9	TCPPL-M-502.8	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #7
10	TCPPL-M-502.9	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #8
11	TCPPL-M-502.10	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #9
12	TCPPL-M-502.11	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #10
13	TCPPL-M-502.12A	A	EAST LATERAL ACCESS ROADS; PERMANENT ACCESS ROAD #11
14	TCPPL-M-502.12B	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #11
15	TCPPL-M-502.13	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #12
16	TCPPL-M-502.14	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #13
17	TCPPL-M-502.15	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #14
18	TCPPL-M-502.16	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #15
19	TCPPL-M-502.17	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #16
20	TCPPL-M-502.18A	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #17
21	TCPPL-M-502.18B	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #17
22	TCPPL-M-502.19A	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #18
23	TCPPL-M-502.19B	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #18
24	TCPPL-M-502.19C	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #18
25	TCPPL-M-502.20A	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #19
26	TCPPL-M-502.20B	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #19
27	TCPPL-M-502.20C	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #19
28	TCPPL-M-502.20D	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #19
29	TCPPL-M-502.21	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #20
30	TCPPL-M-502.22	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #21
31	TCPPL-M-502.23	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #22
32	TCPPL-M-502.24A	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #23
33	TCPPL-M-502.25B	A	EAST LATERAL ACCESS ROADS; TEMPORARY ACCESS ROAD #23

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COVER SHEET
CALCASIEU PASS TERMINAL AND
TRANSCAMERON PIPELINE PROJECT
EAST LATERAL ACCESS ROADS

CAMERON PARISH — LOUISIANA

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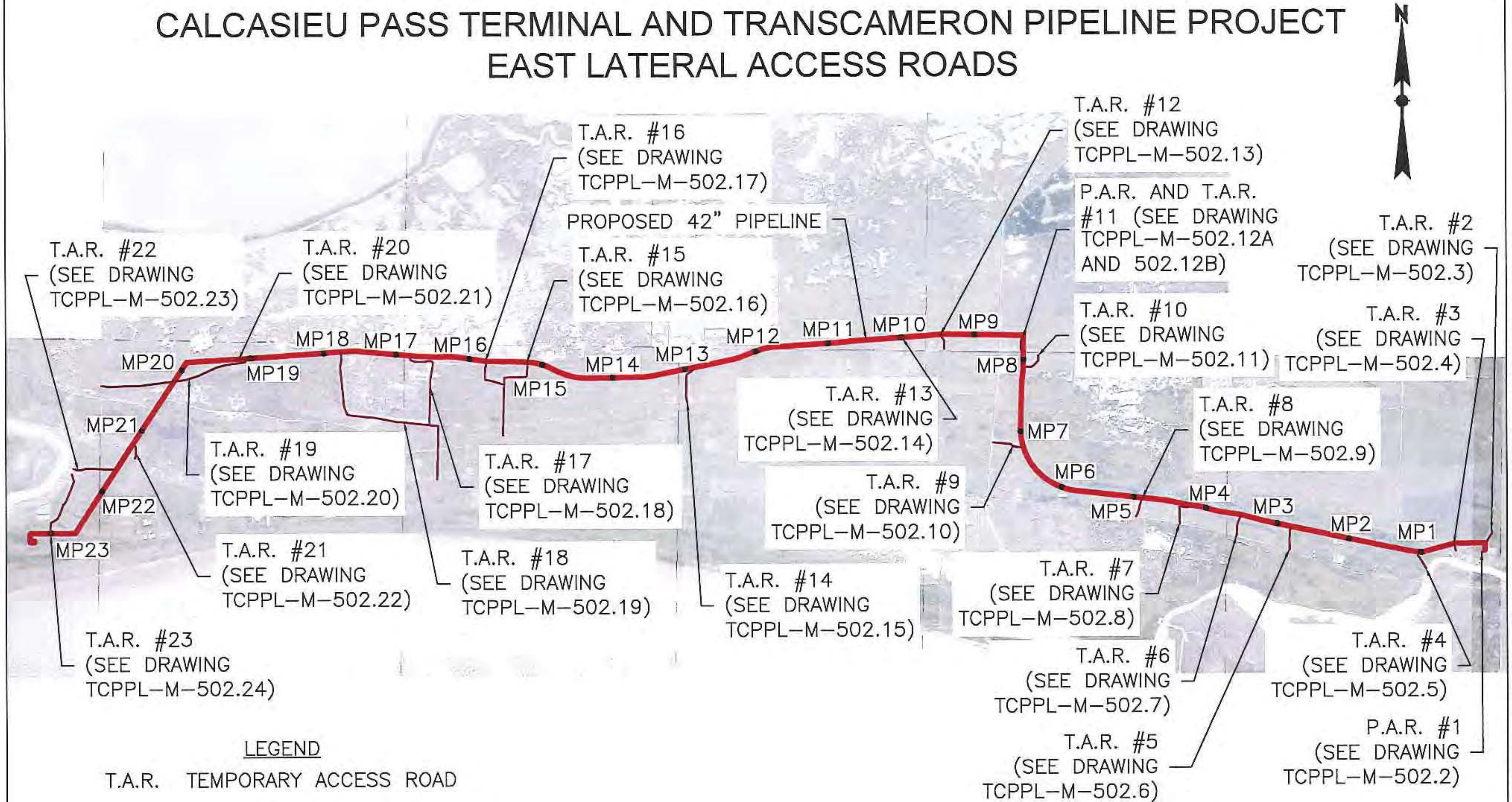
CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
EAST LATERAL ACCESS ROADS



LEGEND

T.A.R. TEMPORARY ACCESS ROAD

P.A.R. PERMANENT ACCESS ROAD

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LOCATION MAP
CALCASIEU PASS TERMINAL AND
TRANSCAMERON PIPELINE PROJECT
EAST LATERAL ACCESS ROADS

CAMERON PARISH LOUISIANA

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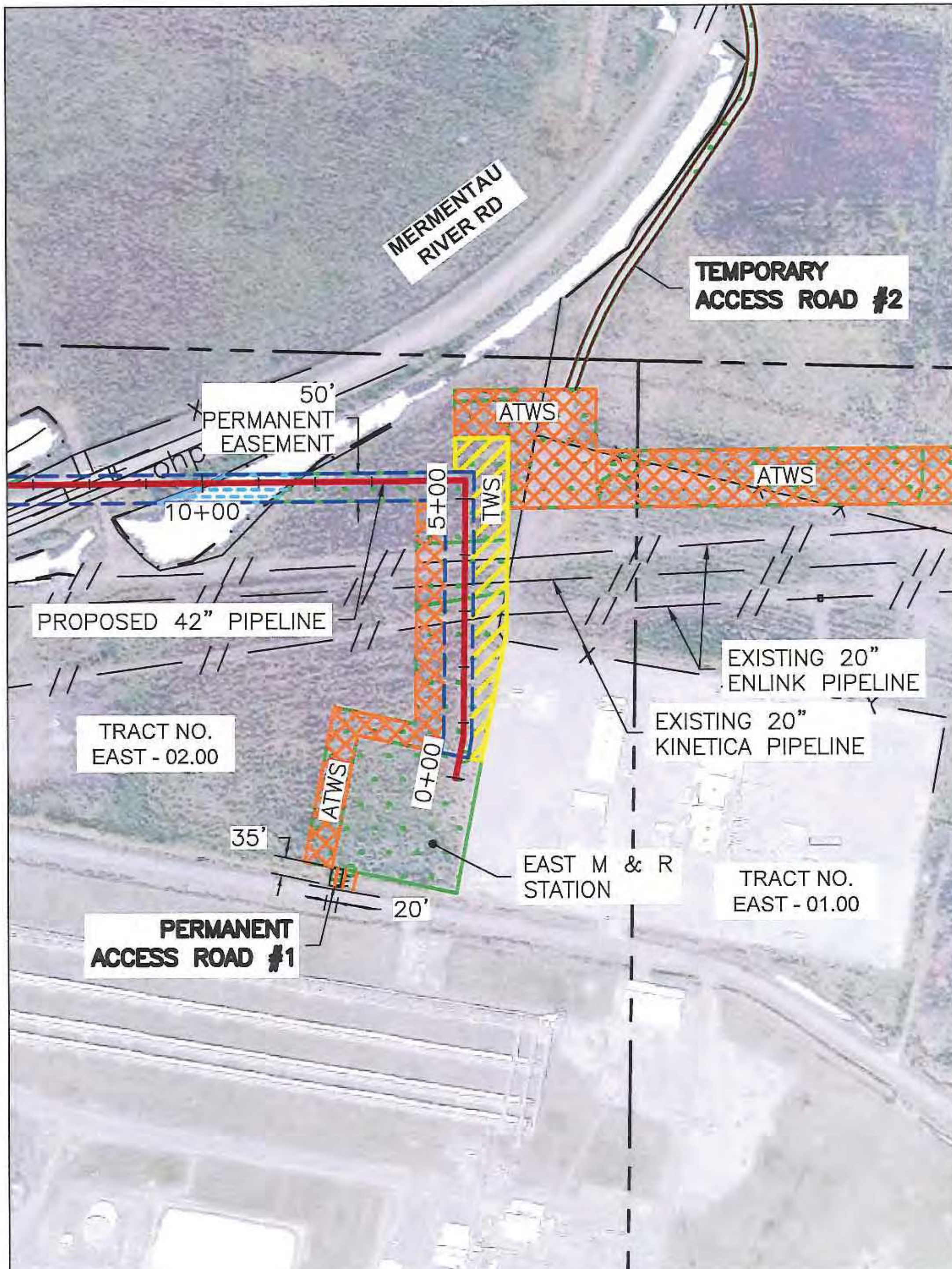

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0 300 600
1" = 300'

ACCESS ROAD NAME	ACCESS ROAD #1
ACCESS ROAD CLASS	PERMANENT
ACCESS ROAD LENGTH (SQ)	35
ACCESS ROAD WIDTH (SQ)	20
ACCESS ROAD AREA (SQ FT)	655
ACCESS ROAD AREA (AC)	0.02
ACCESS ROAD AREA DISTURBED (SQ FT)	655
ACCESS ROAD AREA DISTURBED (AC)	0.02
ACCESS ROAD PERMANENT FILL (CU FT)	327.50
ACCESS ROAD TEMPORARY FILL (CU FT)	0.00
ACCESS ROAD IMPROVEMENTS	CURRENTLY UNDISTURBED. REQUIRES 20 FOOT WIDE OF 6 INCH AGGREGATE FOR ENTIRE LENGTH.

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EAST LATERAL ACCESS ROADS

CAMERON PARISH LOUISIANA

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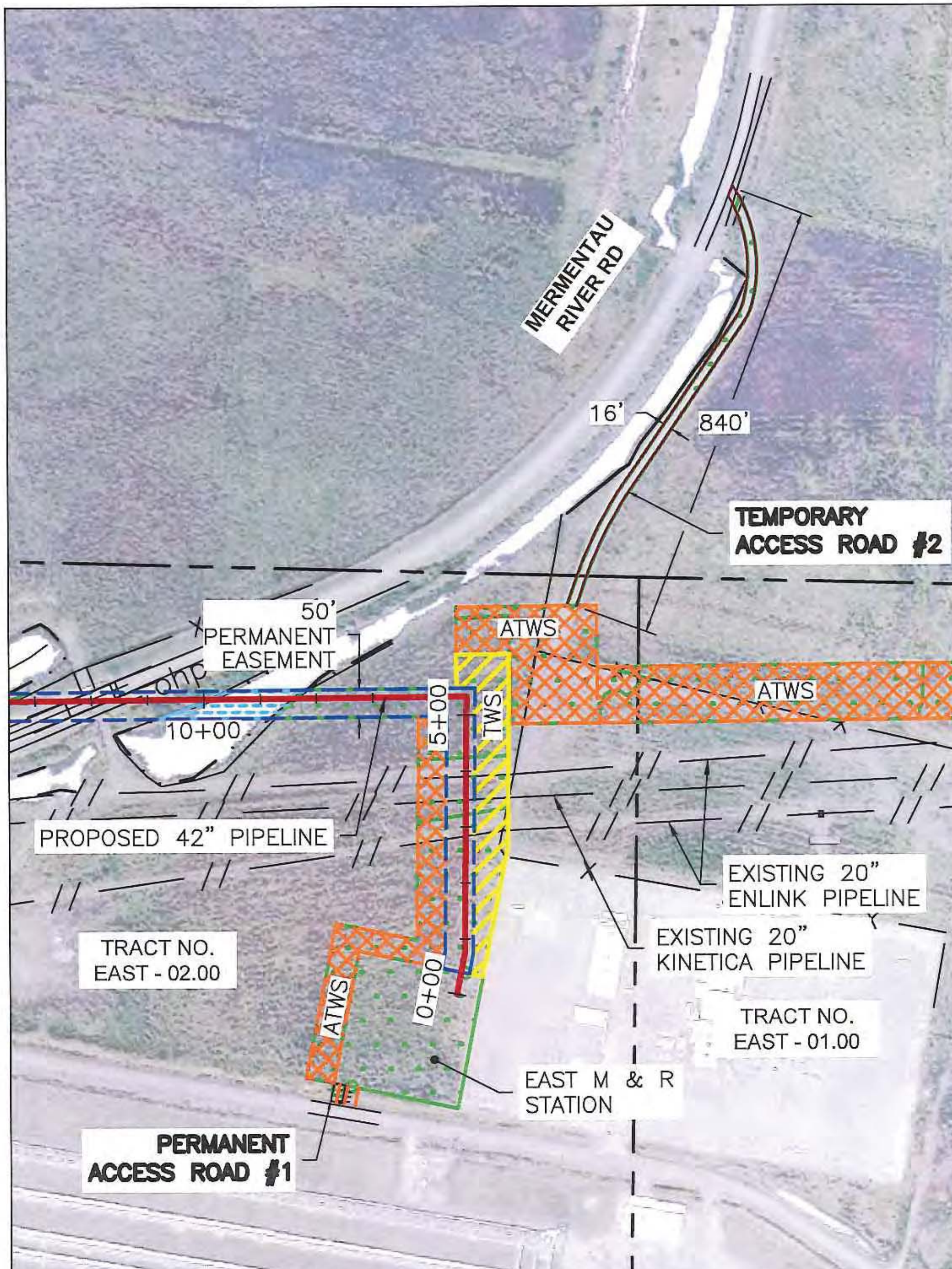

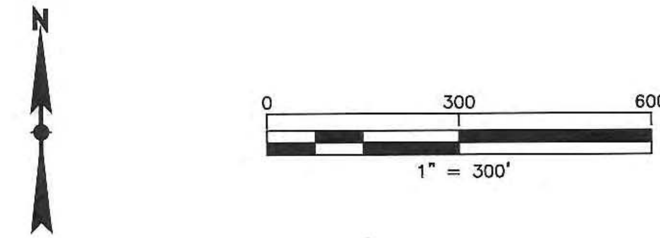

ACCESS ROAD NAME	ACCESS ROAD #2
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (SQ)	840
ACCESS ROAD WIDTH (SQ)	16
ACCESS ROAD AREA (SQ FT)	13,375
ACCESS ROAD AREA (AC)	0.31
ACCESS ROAD AREA DISTURBED (SQ FT)	13,375
ACCESS ROAD AREA DISTURBED (AC)	0.31
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	11,145.83
ACCESS ROAD IMPROVEMENTS	CURRENTLY 12 FOOT WIDE. REQUIRES MATS 16 FOOT WIDE FOR ENTIRE LENGTH.

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EAST LATERAL ACCESS ROADS

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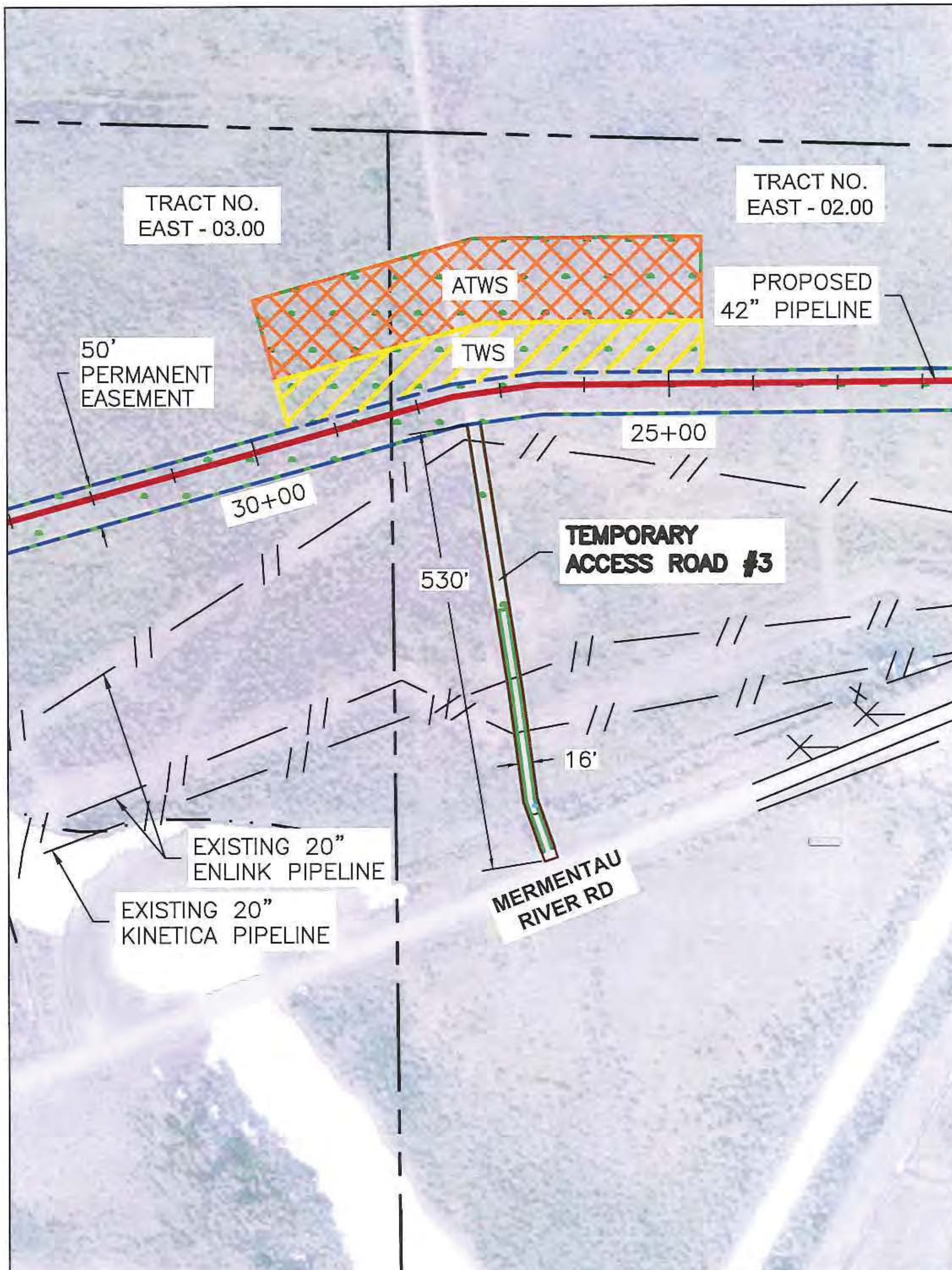

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0 200 400

1" = 200'

ACCESS ROAD NAME	ACCESS ROAD #3
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	530
ACCESS ROAD WIDTH (FT)	16
ACCESS ROAD AREA (SQ FT)	8,440
ACCESS ROAD AREA (AC)	0.19
ACCESS ROAD AREA DISTURBED (SQ FT)	8,440
ACCESS ROAD AREA DISTURBED (AC)	0.19
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	7,033.33
ACCESS ROAD IMPROVEMENTS	CURRENTLY 12 FOOT WIDE. REQUIRES MATS 16 FOOT WIDE FOR ENTIRE LENGTH.

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TEMPORARY ACCESS ROAD #3
CALCASIEU PASS TERMINAL AND
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EAST LATERAL ACCESS ROADS

CAMERON PARISH LOUISIANA

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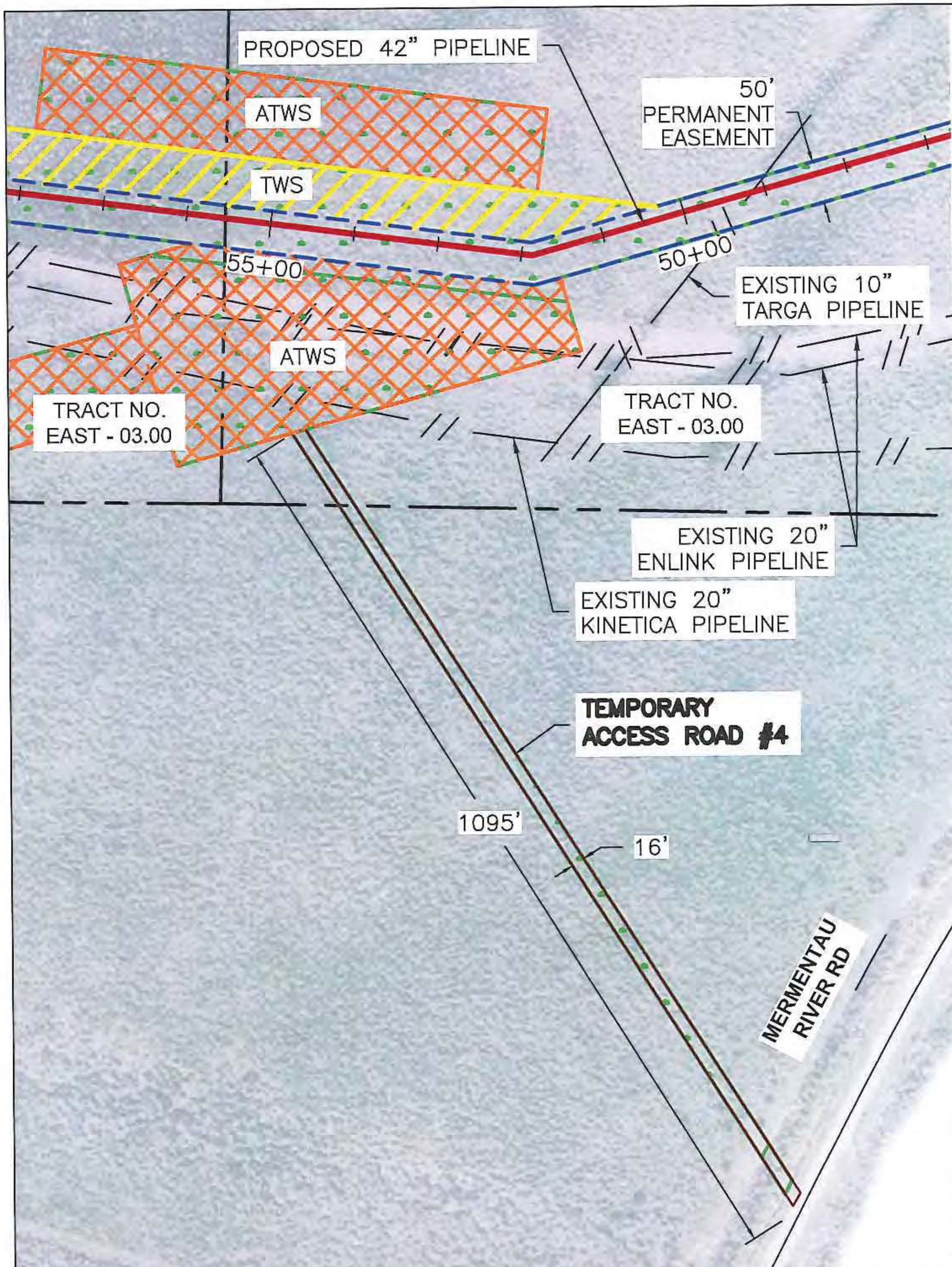

ACCESS ROAD NAME	ACCESS ROAD #4
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	1,095
ACCESS ROAD WIDTH (FT)	16
ACCESS ROAD AREA (SQ FT)	17.460
ACCESS ROAD AREA (AC)	0.40
ACCESS ROAD AREA DISTURBED (SQ FT)	17,460
ACCESS ROAD AREA DISTURBED (AC)	0.40
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	14,550
ACCESS ROAD IMPROVEMENTS	CURRENTLY UNDISTURBED. REQUIRES MATS 16 FOOT WIDE FOR ENTIRE LENGTH.

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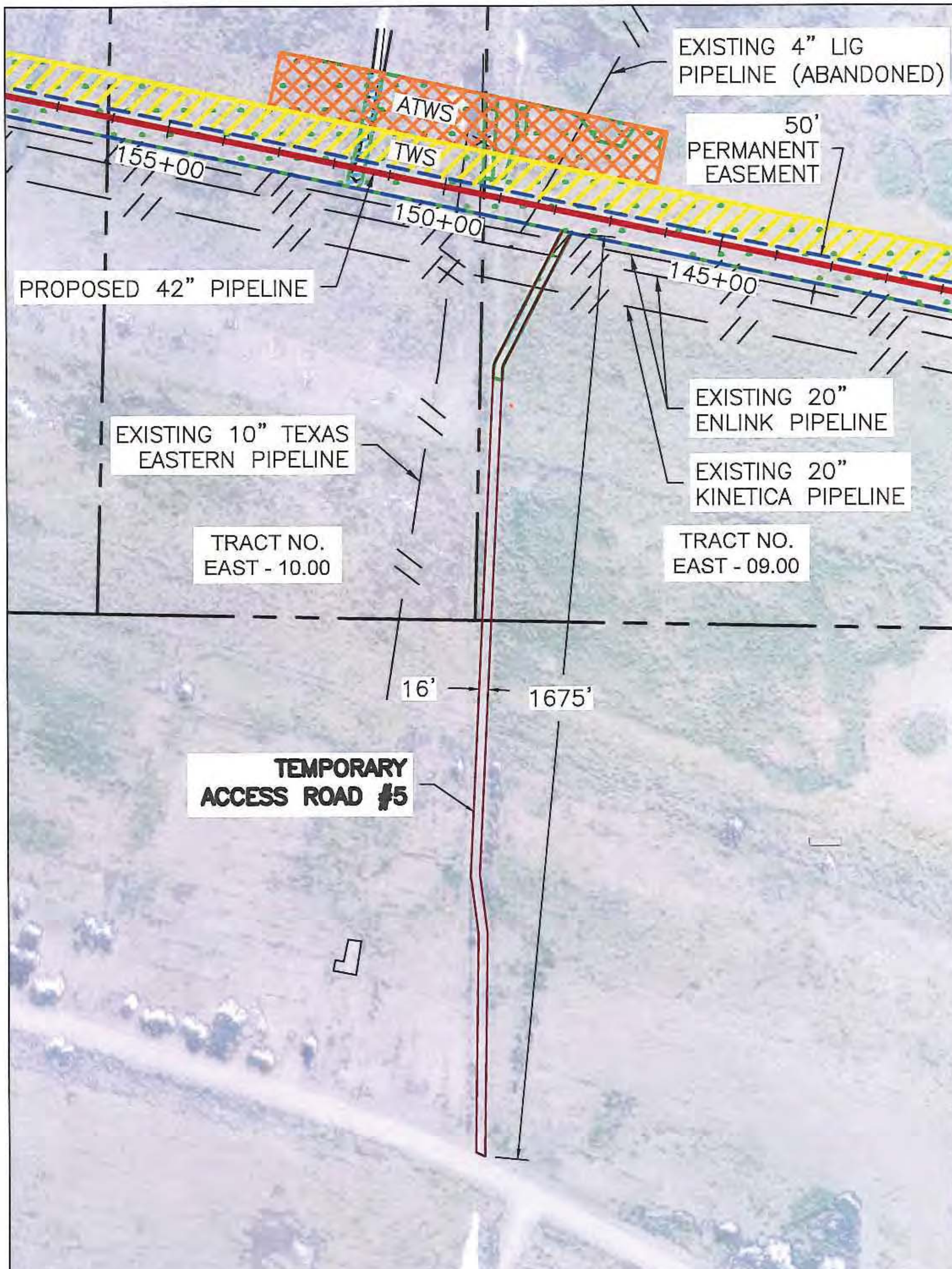

ACCESS ROAD NAME	ACCESS ROAD #5
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	1,675
ACCESS ROAD WIDTH (FT)	16
ACCESS ROAD AREA (SQ FT)	26,805
ACCESS ROAD AREA (AC)	0.62
ACCESS ROAD AREA DISTURBED (SQ FT)	26,805
ACCESS ROAD AREA DISTURBED (AC)	0.62
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	22,337.50
ACCESS ROAD IMPROVEMENTS	CURRENTLY UNDISTURBED. REQUIRES MATS 16 FOOT WIDE FOR ENTIRE LENGTH.

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CAMERON PARISH — LOUISIANA

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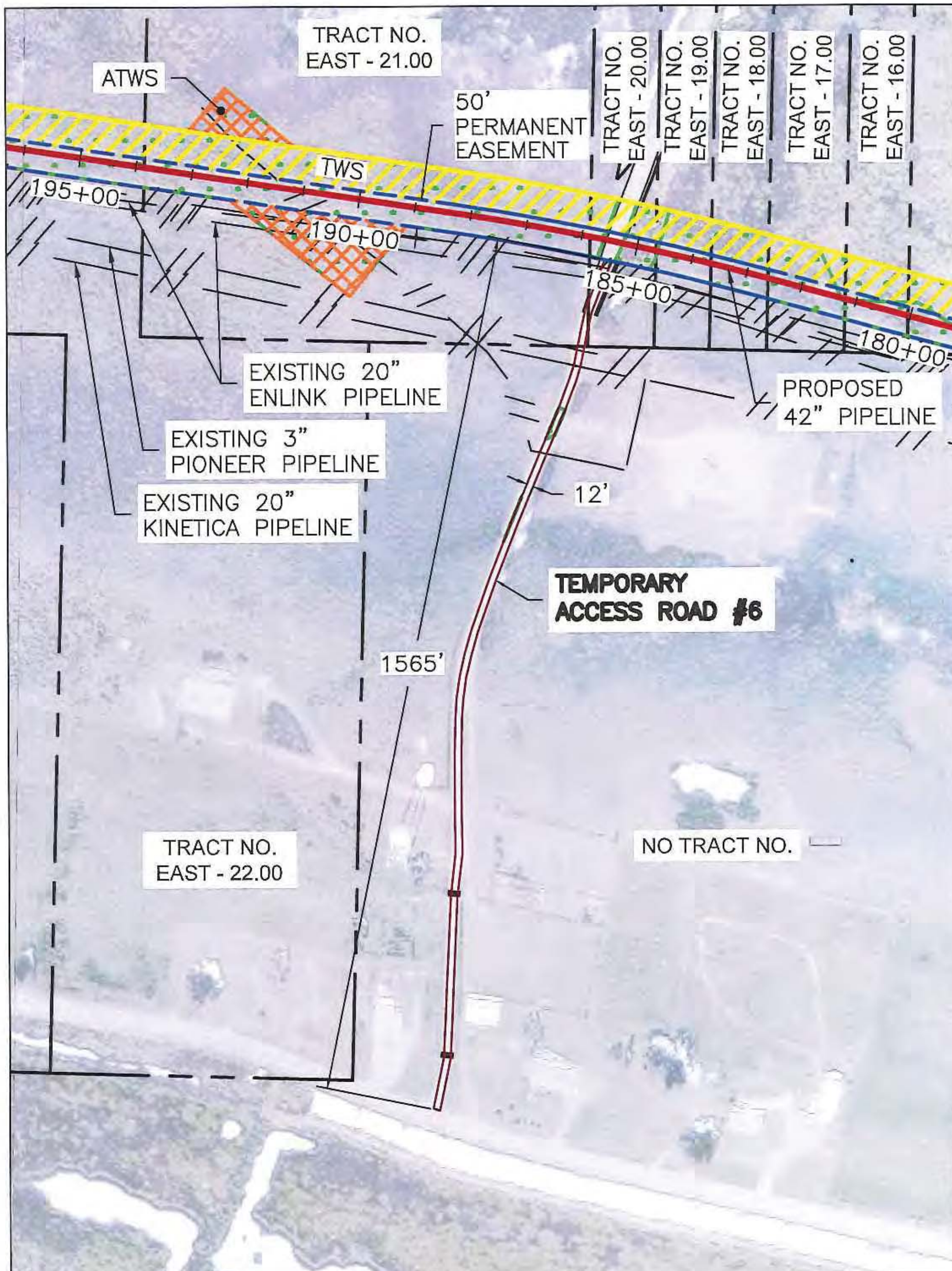

ACCESS ROAD NAME	ACCESS ROAD #6
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	1,565
ACCESS ROAD WIDTH (FT)	12
ACCESS ROAD AREA (SQ FT)	18,735
ACCESS ROAD AREA (AC)	0.43
ACCESS ROAD AREA DISTURBED (SQ FT)	0.00
ACCESS ROAD AREA DISTURBED (AC)	0.00
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	0.00
ACCESS ROAD IMPROVEMENTS	EXISTING CONDITIONS ARE SUITABLE, NO IMPROVEMENTS NECESSARY.

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CAMERON PARISH — LOUISIANA

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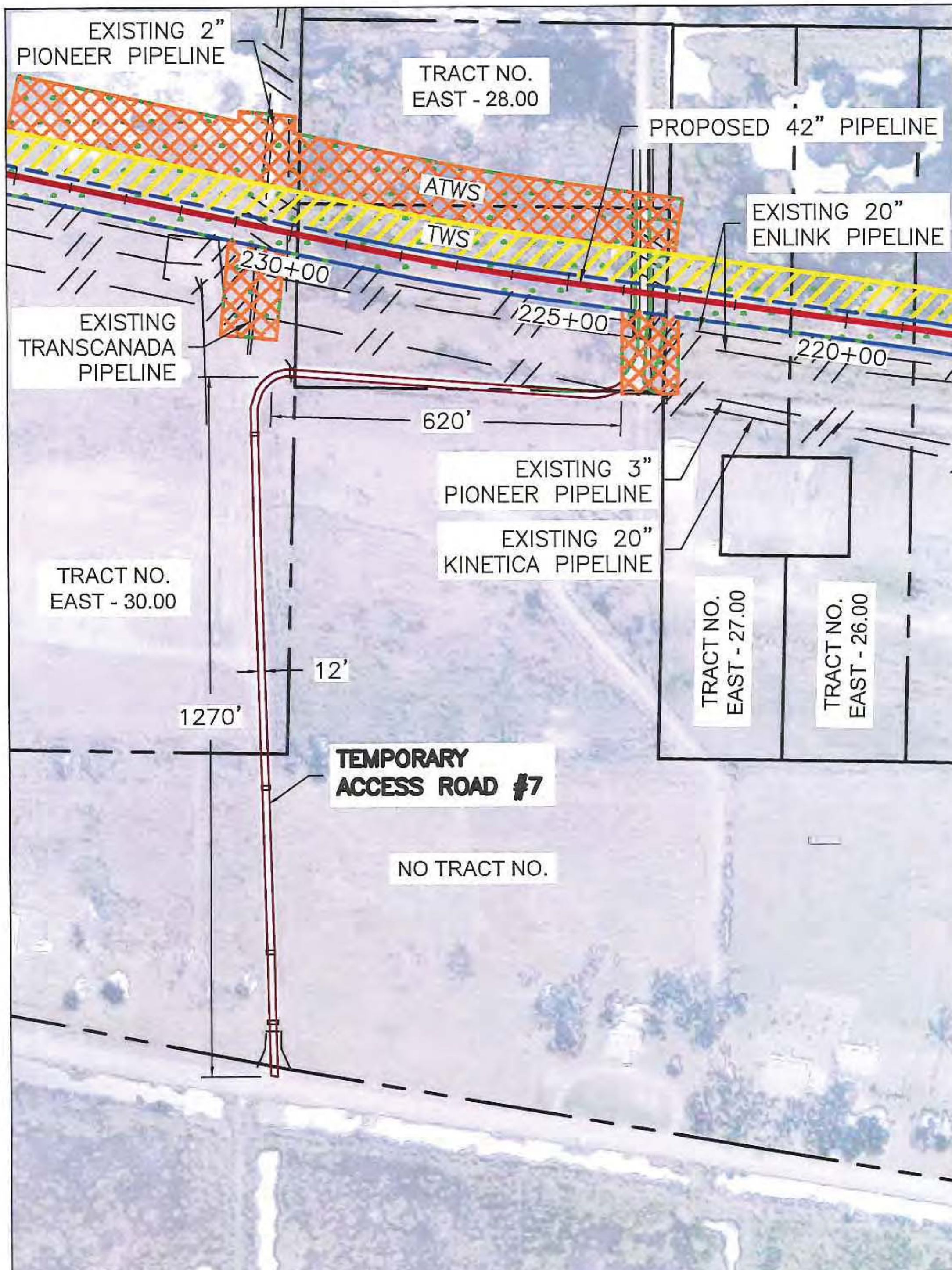

ACCESS ROAD NAME	ACCESS ROAD #7
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	1,890
ACCESS ROAD WIDTH (FT)	12
ACCESS ROAD AREA (SQ FT)	22,655
ACCESS ROAD AREA (AC)	0.52
ACCESS ROAD AREA DISTURBED (SQ FT)	0.00
ACCESS ROAD AREA DISTURBED (AC)	0.00
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	0.00
ACCESS ROAD IMPROVEMENTS	EXISTING CONDITIONS ARE SUITABLE, NO IMPROVEMENTS NECESSARY.

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EAST LATERAL ACCESS ROADS

CAMERON PARISH — LOUISIANA

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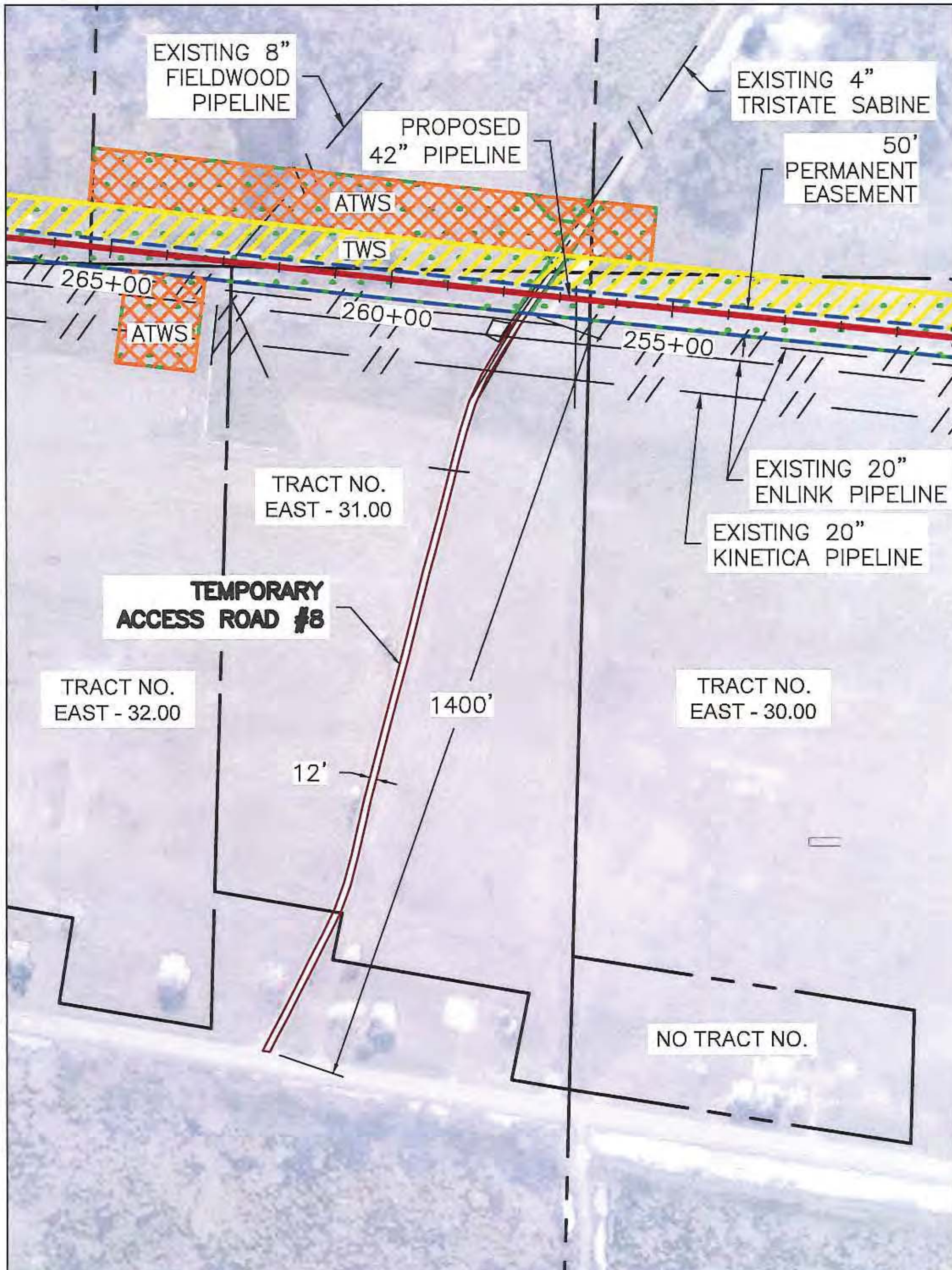

N

0 300 600

1" = 300'

ACCESS ROAD NAME	ACCESS ROAD #8
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	1,400
ACCESS ROAD WIDTH (FT)	12
ACCESS ROAD AREA (SQ FT)	16,810
ACCESS ROAD AREA (AC)	0.39
ACCESS ROAD AREA DISTURBED (SQ FT)	0.00
ACCESS ROAD AREA DISTURBED (AC)	0.00
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	0.00
ACCESS ROAD IMPROVEMENTS	EXISTING CONDITIONS ARE SUITABLE, NO IMPROVEMENTS NECESSARY.

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EAST LATERAL ACCESS ROADS

CAMERON PARISH LOUISIANA

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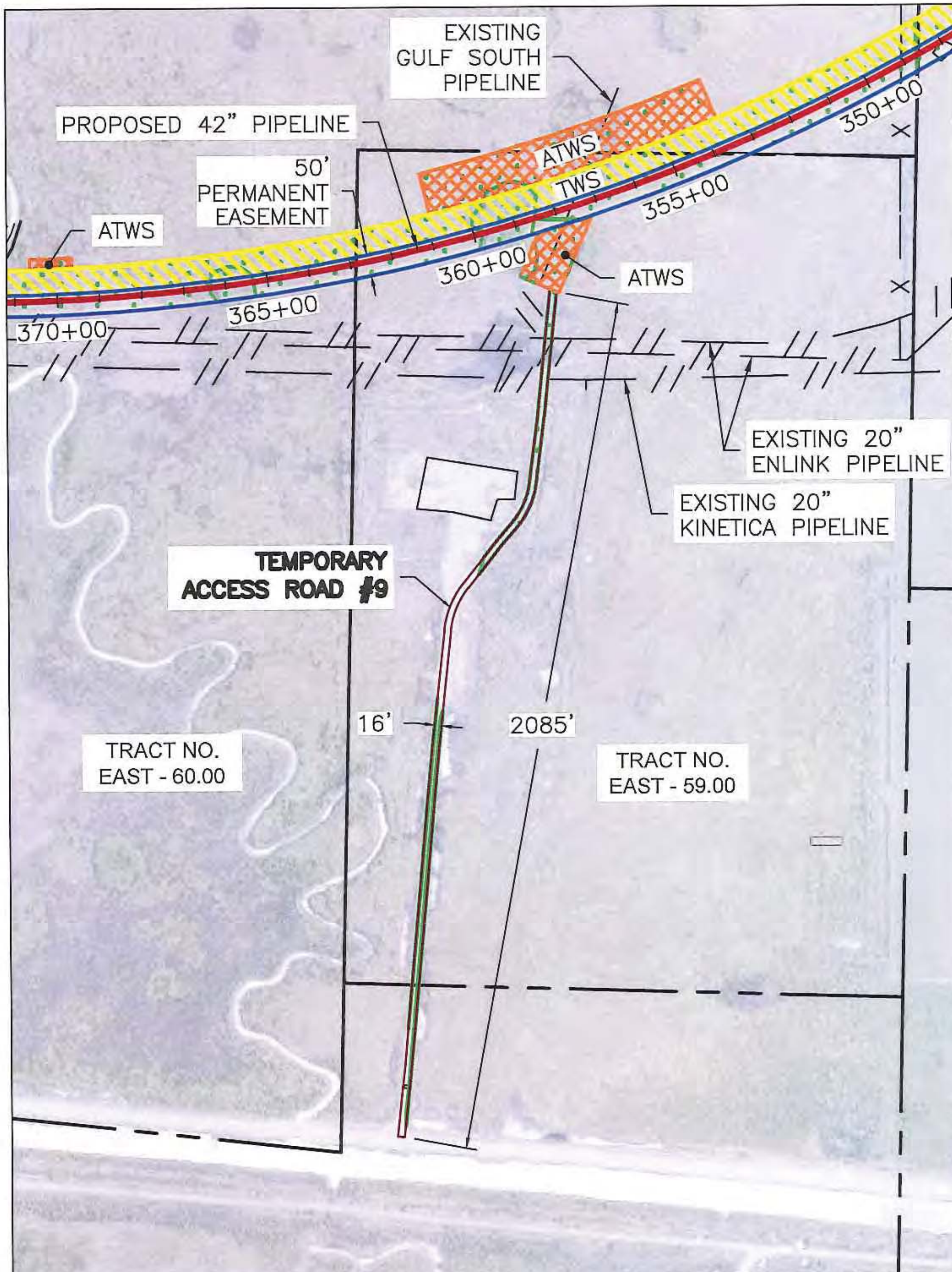

0 400 800

1" = 400'

ACCESS ROAD NAME	ACCESS ROAD #9
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	2,085
ACCESS ROAD WIDTH (FT)	16
ACCESS ROAD AREA (SQ FT)	33,300
ACCESS ROAD AREA (AC)	0.76
ACCESS ROAD AREA DISTURBED (SQ FT)	33,300
ACCESS ROAD AREA DISTURBED (AC)	0.76
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	27,750
ACCESS ROAD IMPROVEMENTS	CURRENTLY 12 FOOT WIDE PARTIAL LENGTH. MAT 16 FOOT WIDE FOR ENTIRE LENGTH.

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EAST LATERAL ACCESS ROADS

CAMERON PARISH LOUISIANA

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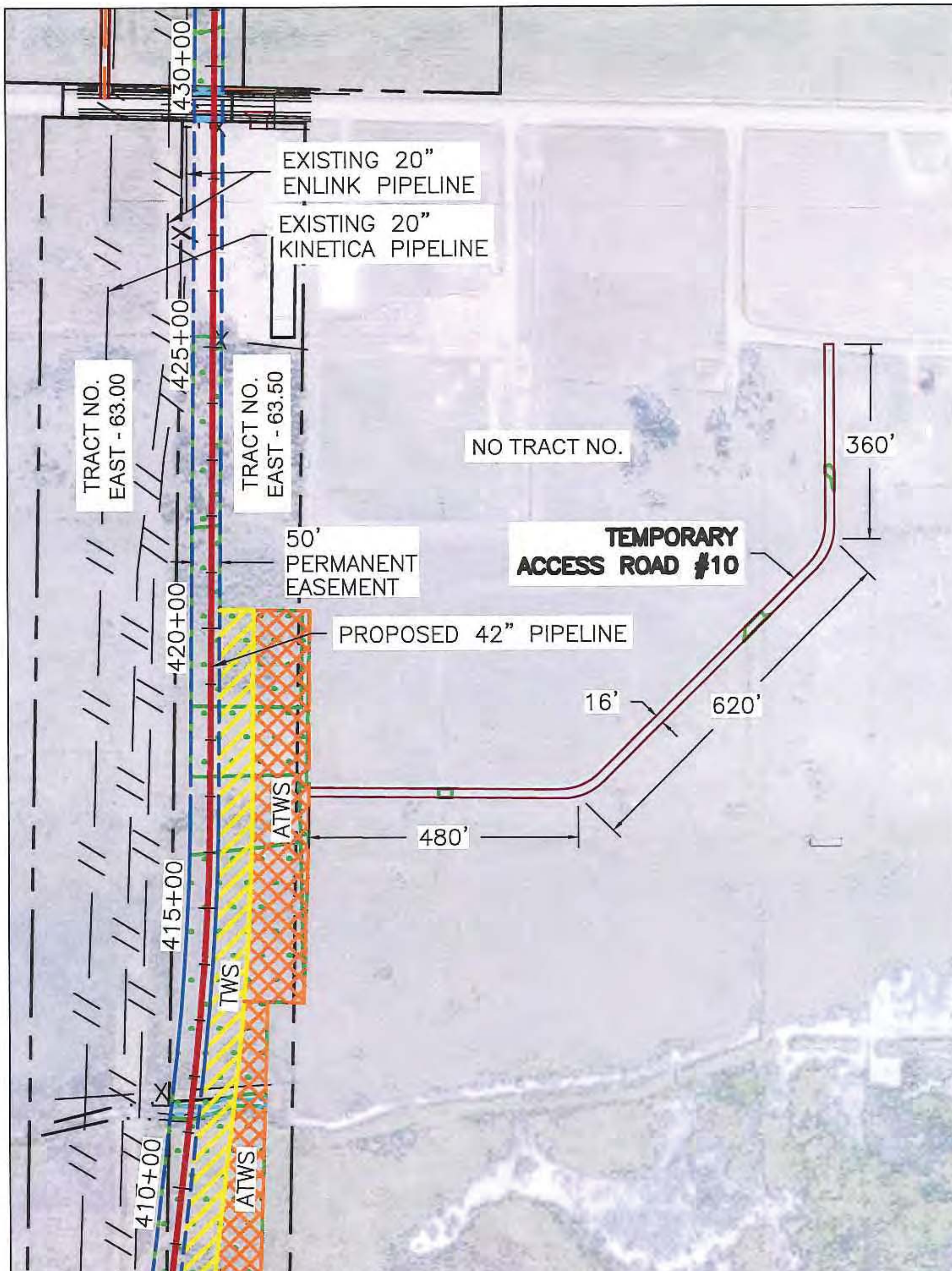

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0 300 600
1" = 300'

ACCESS ROAD NAME	ACCESS ROAD #10
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	1,460
ACCESS ROAD WIDTH (FT)	16
ACCESS ROAD AREA (SQ FT)	23,510
ACCESS ROAD AREA (AC)	0.54
ACCESS ROAD AREA DISTURBED (SQ FT)	23,510
ACCESS ROAD AREA DISTURBED (AC)	0.54
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	19,591.67
ACCESS ROAD IMPROVEMENTS	CURRENTLY UNDISTURBED. REQUIRES MATS 16 FOOT WIDE FOR ENTIRE LENGTH.

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EAST LATERAL ACCESS ROADS

CAMERON PARISH — LOUISIANA

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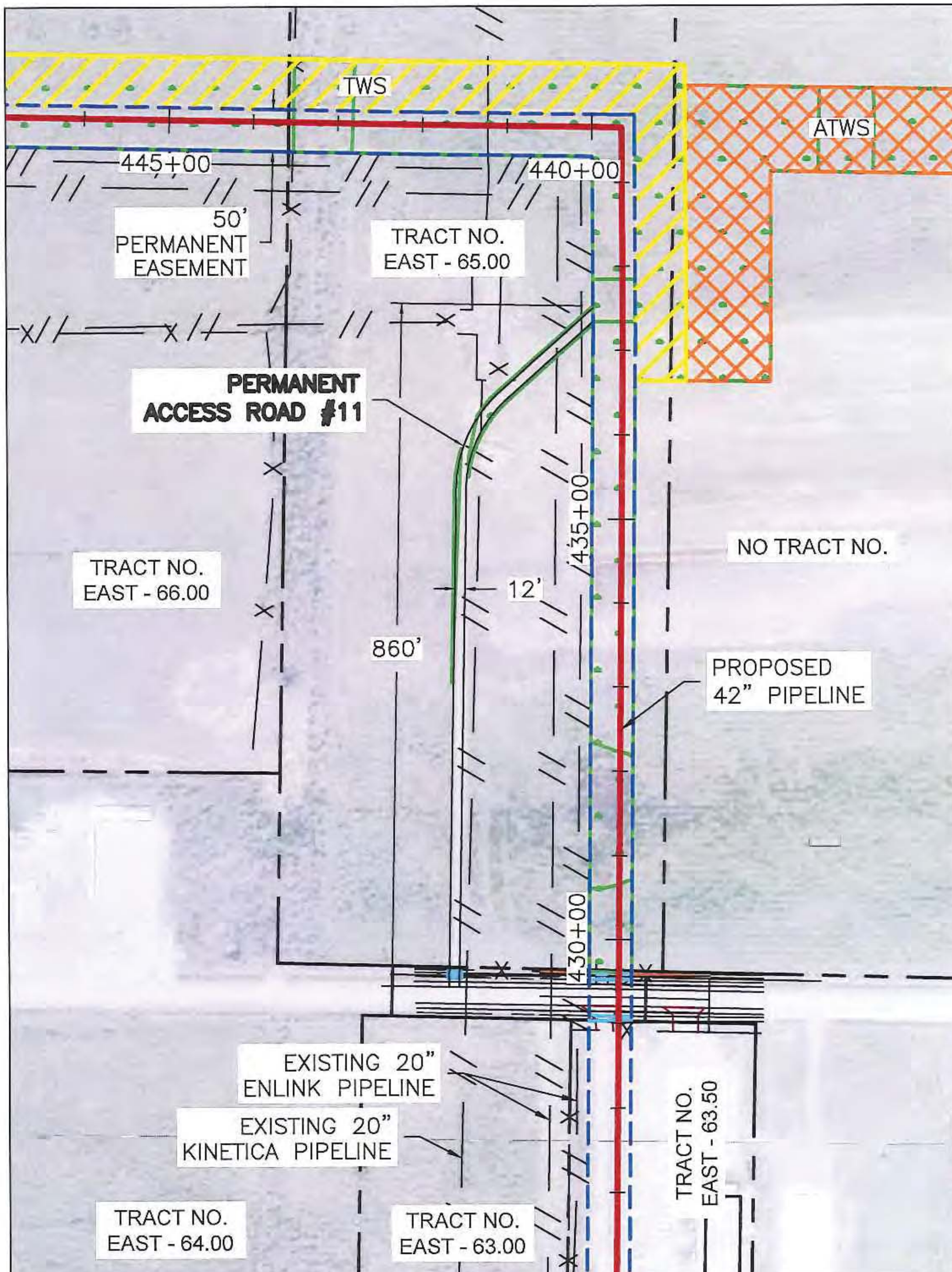

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0 200 400
1" = 200'

ACCESS ROAD NAME	ACCESS ROAD #11
ACCESS ROAD CLASS	PERMANENT
ACCESS ROAD LENGTH (FT)	860
ACCESS ROAD WIDTH (FT)	12
ACCESS ROAD AREA (SQ FT)	10,315
ACCESS ROAD AREA (AC)	0.24
ACCESS ROAD AREA DISTURBED (SQ FT)	10,315
ACCESS ROAD AREA DISTURBED (AC)	0.24
ACCESS ROAD PERMANENT FILL (CU FT)	5,157.50
ACCESS ROAD TEMPORARY FILL (CU FT)	0.00
ACCESS ROAD IMPROVEMENTS	POST CONSTRUCTION REQUIRES 12 FOOT WIDE OF 6 INCH AGGREGATE FOR ENTIRE LENGTH.

REV. LEVEL	DATE	BY	DESCRIPTION	CK.	APP.
A	02/23/16	AS	ISSUED FOR PERMIT	TCB	DK

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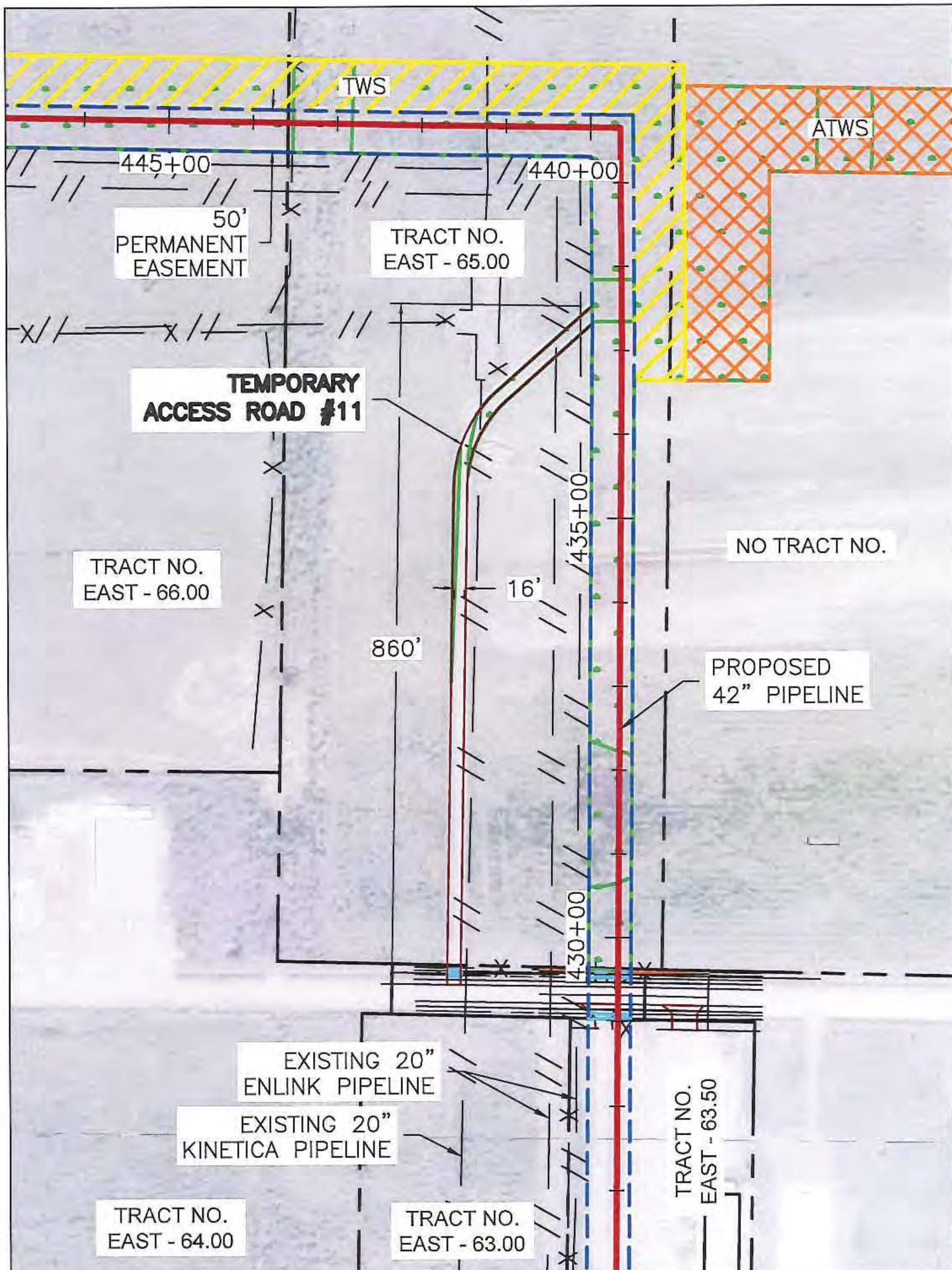
EAST LATERAL ACCESS ROADS

CAMERON PARISH — LOUISIANA

DATE:	SCALE:	DRAWN BY:	LOC. NO:	DRAWING NUMBER:	SHEET NO:	REV:
02/09/16	1"=200'	AS		TCPPL-M-502.12A	13	A



ACCESS ROAD NAME	ACCESS ROAD #11
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	860
ACCESS ROAD WIDTH (FT)	16
ACCESS ROAD AREA (SQ FT)	13,755
ACCESS ROAD AREA (AC)	0.32
ACCESS ROAD AREA DISTURBED (SQ FT)	13,755*
ACCESS ROAD AREA DISTURBED (AC)	0.32*
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	12,358.33
ACCESS ROAD IMPROVEMENTS	REQUIRES 16 FOOT WIDE MATS FOR ENTIRE LENGTH.

* AREA DISTURBED INCLUDES BOTH TEMPORARY AND PERMANENT IMPACTS WITHIN TEMPORARY ACCESS ROAD #11 LIMITS.

REV. LEVEL	DATE	BY	DESCRIPTION	CK.	APP.
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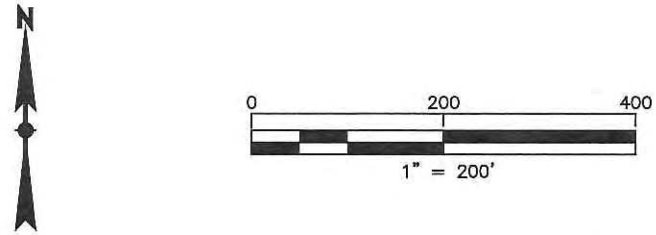
DATE:	SCALE:	DRAWN BY:	LOC. NO:	DRAWING NUMBER:	SHEET NO:	REV:
02/09/16	1"=200'	AS		TCPPL-M-502.12B	14	A



ACCESS ROAD NAME	ACCESS ROAD #12
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	1,075
ACCESS ROAD WIDTH (FT)	16
ACCESS ROAD AREA (SQ FT)	17,210
ACCESS ROAD AREA (AC)	0.40
ACCESS ROAD AREA DISTURBED (SQ FT)	17,210
ACCESS ROAD AREA DISTURBED (AC)	0.40
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	14,341.67
ACCESS ROAD IMPROVEMENTS	CURRENTLY UNDISTURBED. REQUIRES MATS 16 FOOT WIDE FOR ENTIRE LENGTH.

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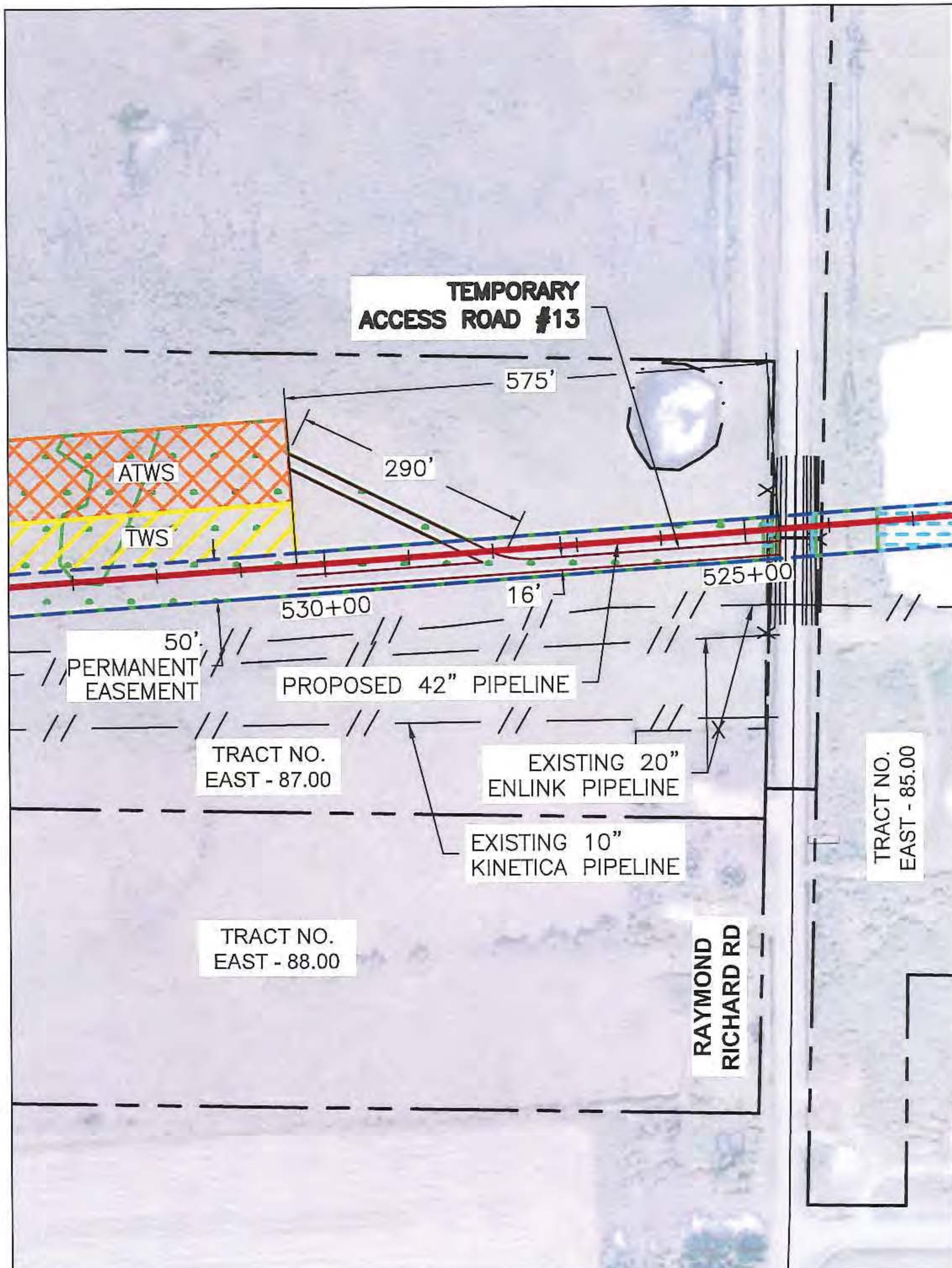
02/09/16	1"=200'	AS		TCPPL-M-502.13	15	A

I:\TR\Projects\157404 Venture Global LNG - Calcasieu Pass FEED\5.0 CADD\5.08 Working Drawings\Pipeline\Access Roads\East_Lateral_Access Roads-JPA.dwg Plotted on: Feb 24, 2016 - 4:12pm by dbegali.abeams



ACCESS ROAD NAME	ACCESS ROAD #13
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	865
ACCESS ROAD WIDTH (FT)	16
ACCESS ROAD AREA (SQ FT)	13,620
ACCESS ROAD AREA (AC)	0.31
ACCESS ROAD AREA DISTURBED (SQ FT)	13,620*
ACCESS ROAD AREA DISTURBED (AC)	0.31*
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	11,350
ACCESS ROAD IMPROVEMENTS	CURRENTLY UNDISTURBED. REQUIRES MATS 16 FOOT WIDE FOR ENTIRE LENGTH.

* AREA DISTURBED BY ACCESS ROAD INCLUDES AREA WITHIN PERMANENT EASEMENT.

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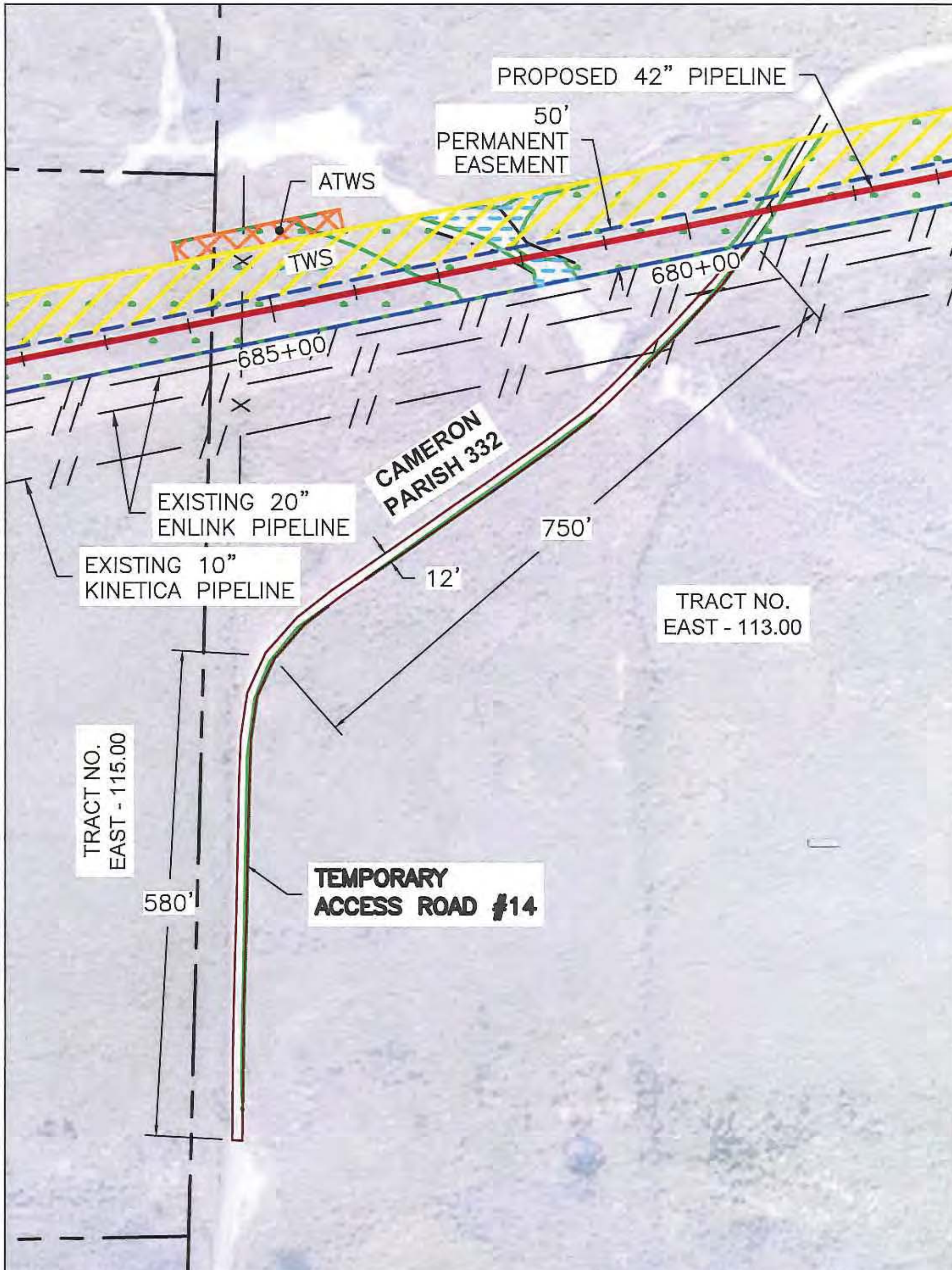

N

0 200 400

1" = 200'

ACCESS ROAD NAME	ACCESS ROAD #14
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	1,330
ACCESS ROAD WIDTH (FT)	12
ACCESS ROAD AREA (SQ FT)	15,920
ACCESS ROAD AREA (AC)	0.37
ACCESS ROAD AREA DISTURBED (SQ FT)	0.00
ACCESS ROAD AREA DISTURBED (AC)	0.00
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	0.00
ACCESS ROAD IMPROVEMENTS	EXISTING CONDITIONS ARE SUITABLE, NO IMPROVEMENTS NECESSARY.

REV. LEVEL	DATE	BY	DESCRIPTION	CK.	APP.
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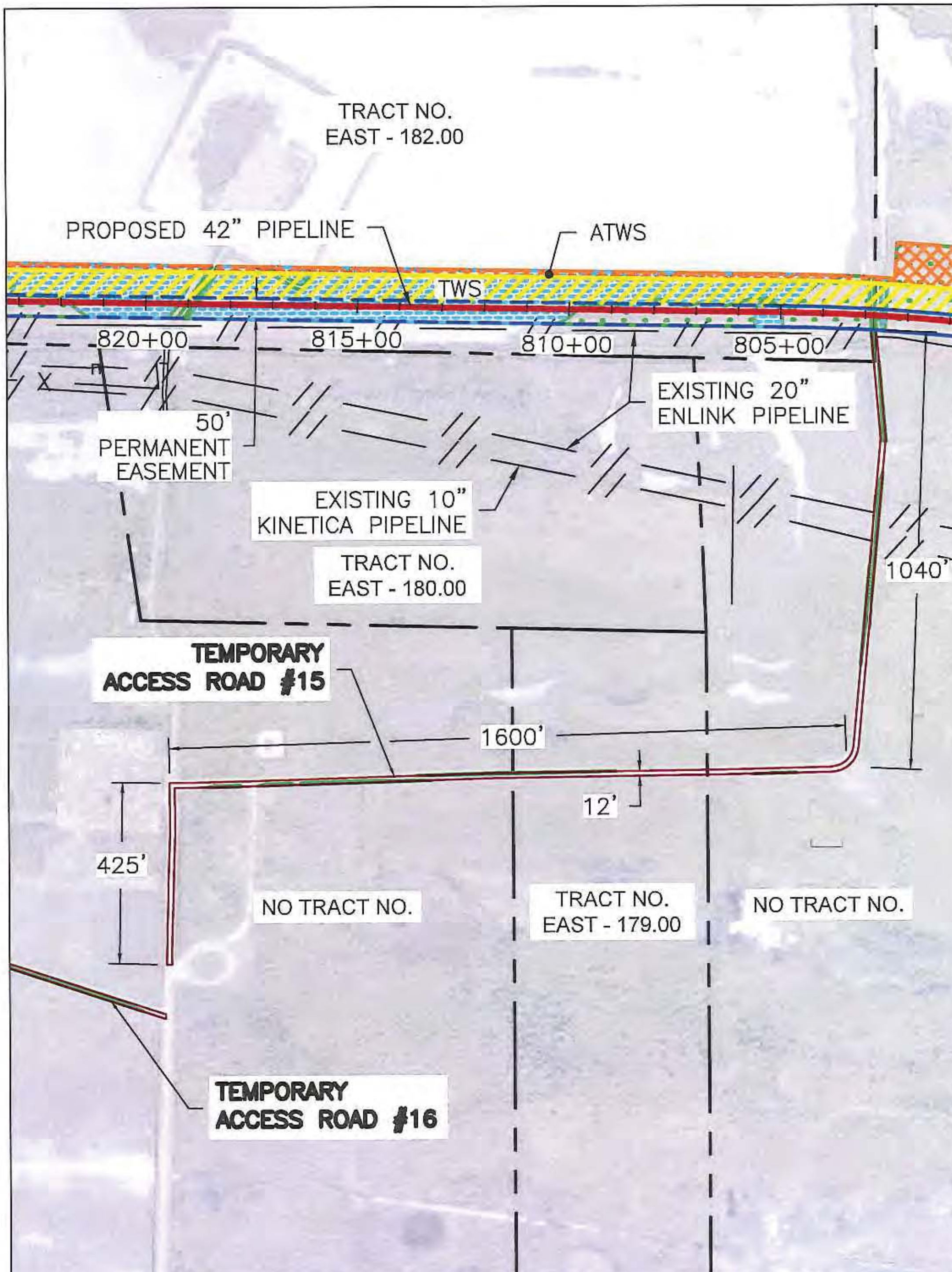
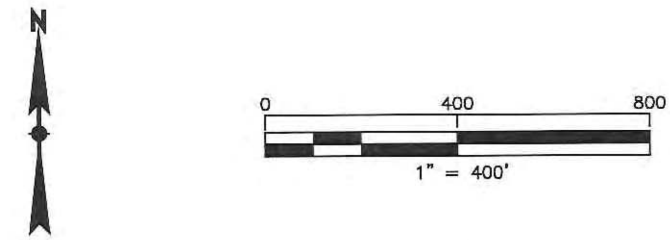
02/09/16	1"=200'	AS		TCPPL-M-502.15	17	A





ACCESS ROAD NAME	ACCESS ROAD #15
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	3,065
ACCESS ROAD WIDTH (FT)	12
ACCESS ROAD AREA (SQ FT)	36,765
ACCESS ROAD AREA (AC)	0.84
ACCESS ROAD AREA DISTURBED (SQ FT)	0.00
ACCESS ROAD AREA DISTURBED (AC)	0.00
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	0.00
ACCESS ROAD IMPROVEMENTS	EXISTING CONDITIONS ARE SUITABLE, NO IMPROVEMENTS NECESSARY.

REV. LEVEL	DATE	BY	DESCRIPTION	CK.	APP.
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CAMERON PARISH — LOUISIANA

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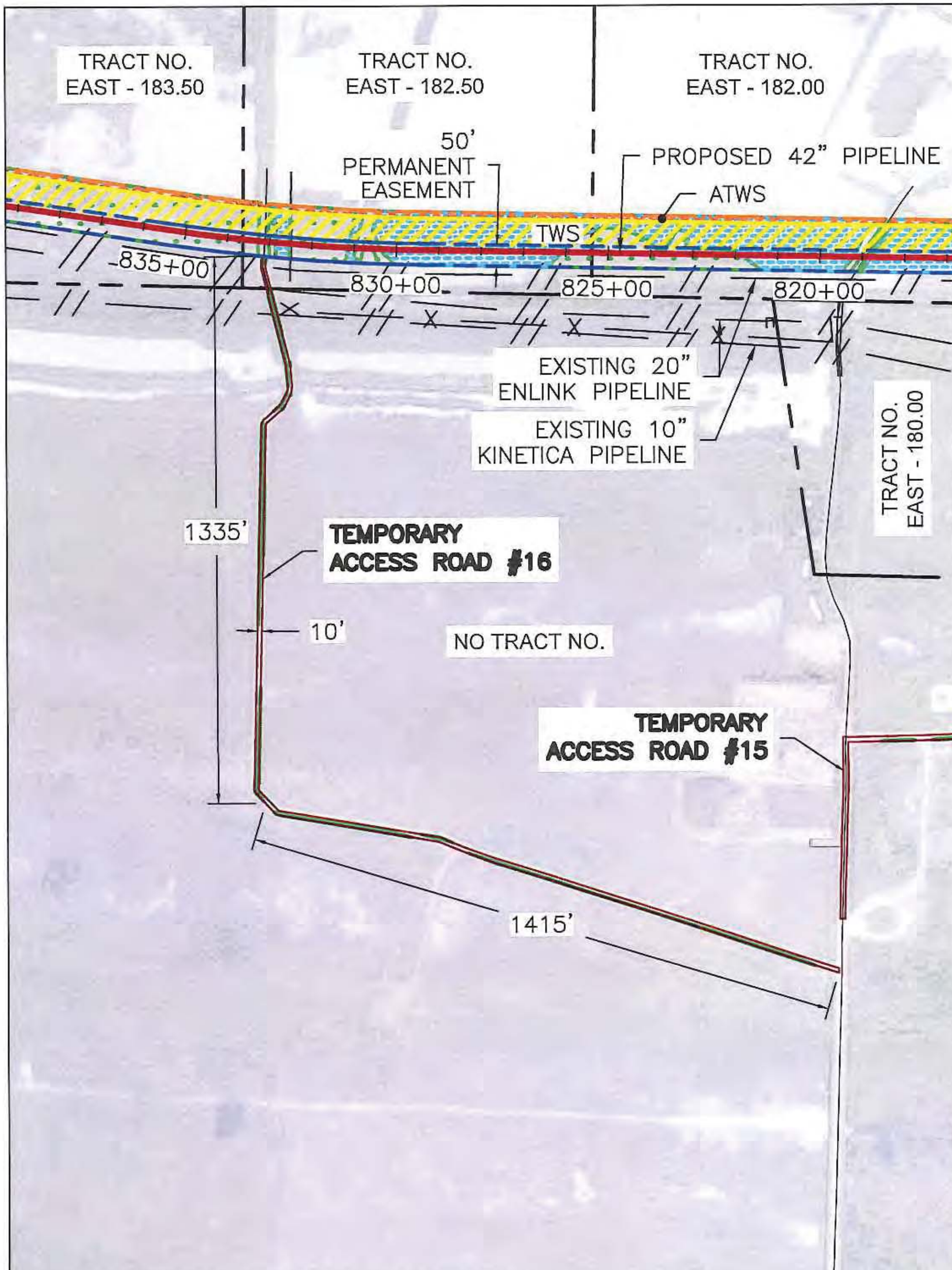

ACCESS ROAD NAME	ACCESS ROAD #16
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	2,750
ACCESS ROAD WIDTH (FT)	10
ACCESS ROAD AREA (SQ FT)	27,510
ACCESS ROAD AREA (AC)	0.63
ACCESS ROAD AREA DISTURBED (SQ FT)	0.00
ACCESS ROAD AREA DISTURBED (AC)	0.00
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	0.00
ACCESS ROAD IMPROVEMENTS	EXISTING CONDITIONS ARE SUITABLE, NO IMPROVEMENTS NECESSARY.

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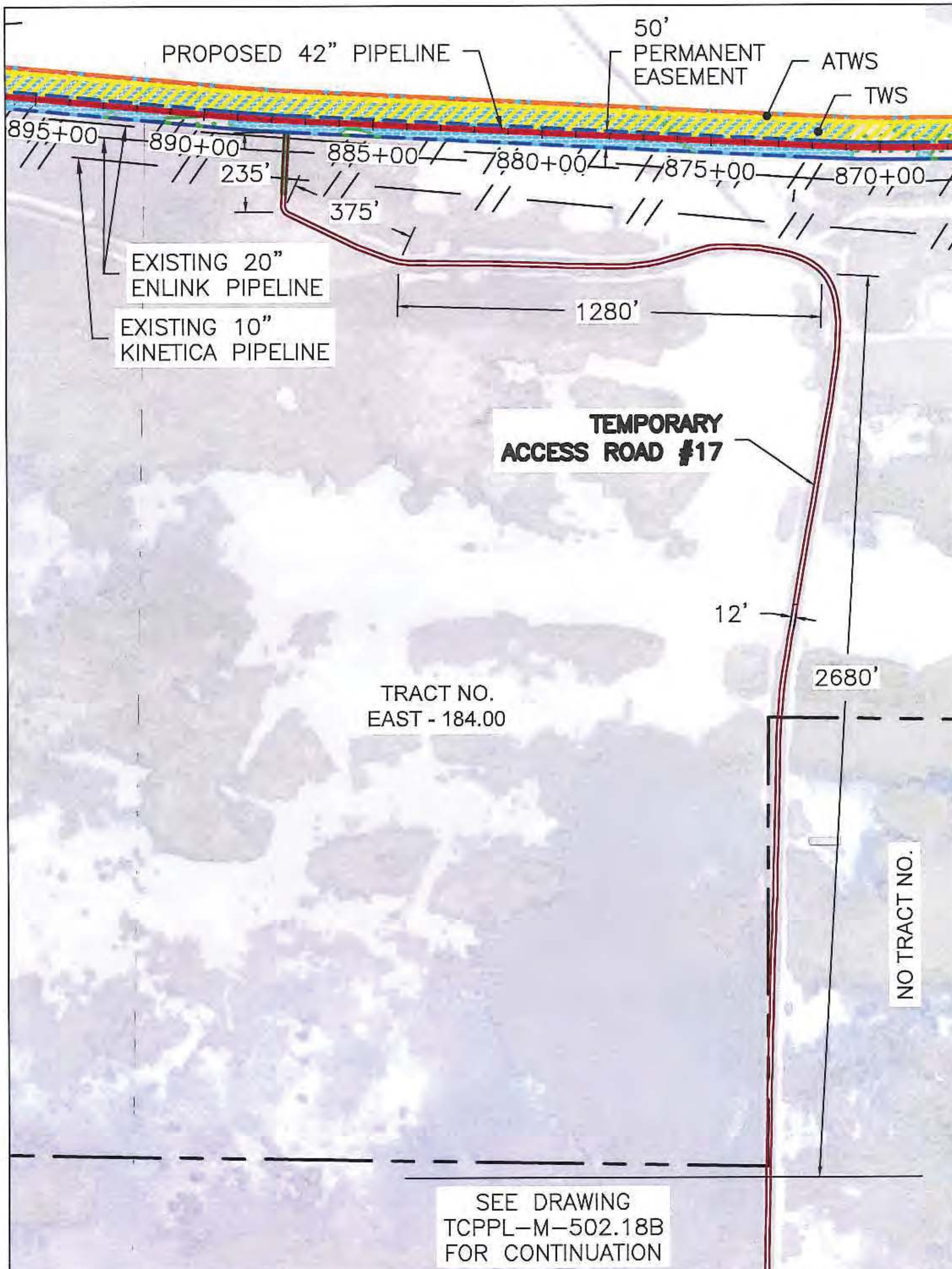
02/09/16	1"=400'	AS		TCPPL-M-502.17	19	A



ACCESS ROAD NAME	ACCESS ROAD #17
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	7,020
ACCESS ROAD WIDTH (FT)	12
ACCESS ROAD AREA (SQ FT)	84,250
ACCESS ROAD AREA (AC)	1.93
ACCESS ROAD AREA DISTURBED (SQ FT)	2,580
ACCESS ROAD AREA DISTURBED (AC)	0.06
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	0.00
ACCESS ROAD IMPROVEMENTS	MAY REQUIRE LEVELING FOR FINAL 215 FOOT (TO ROW).

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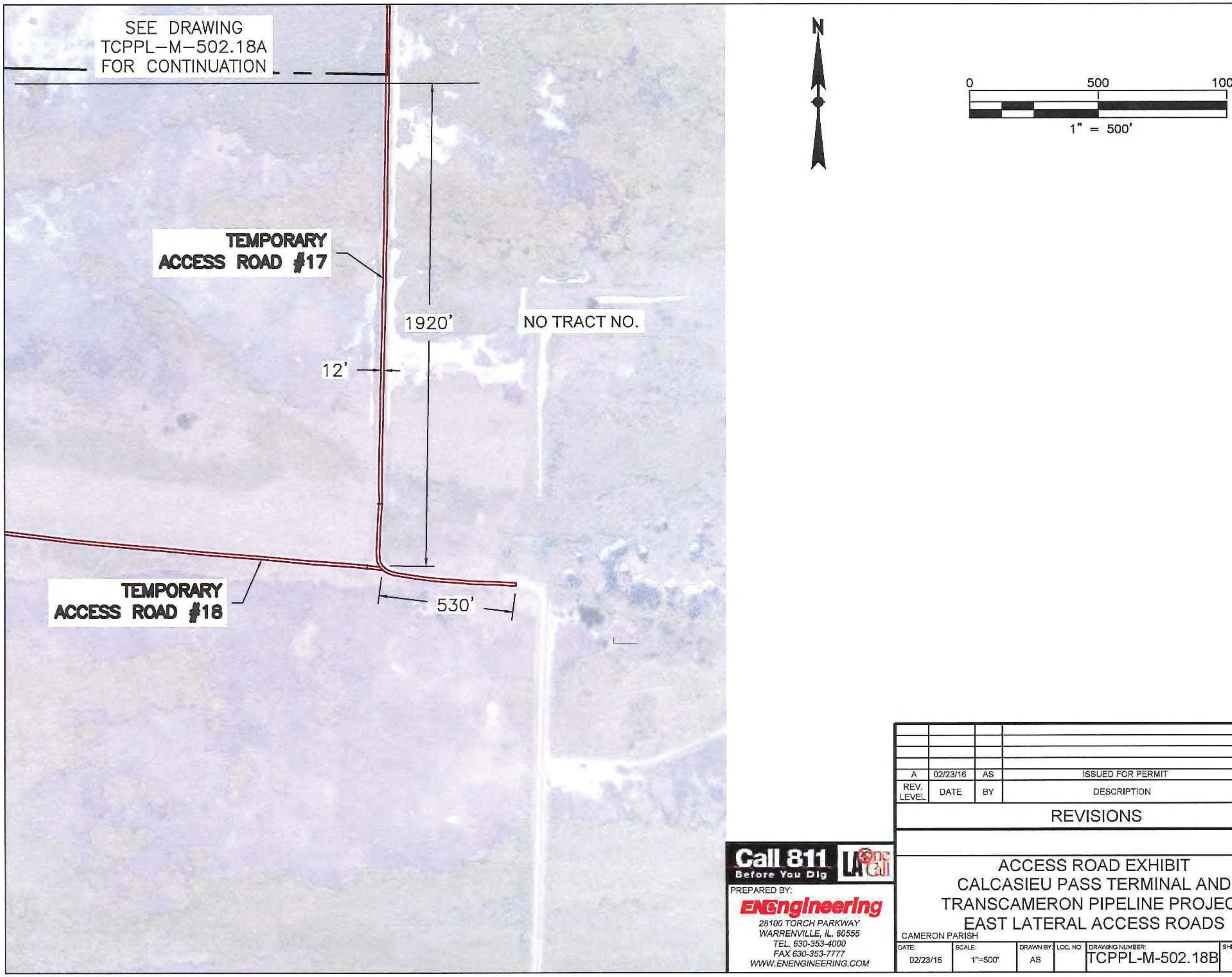

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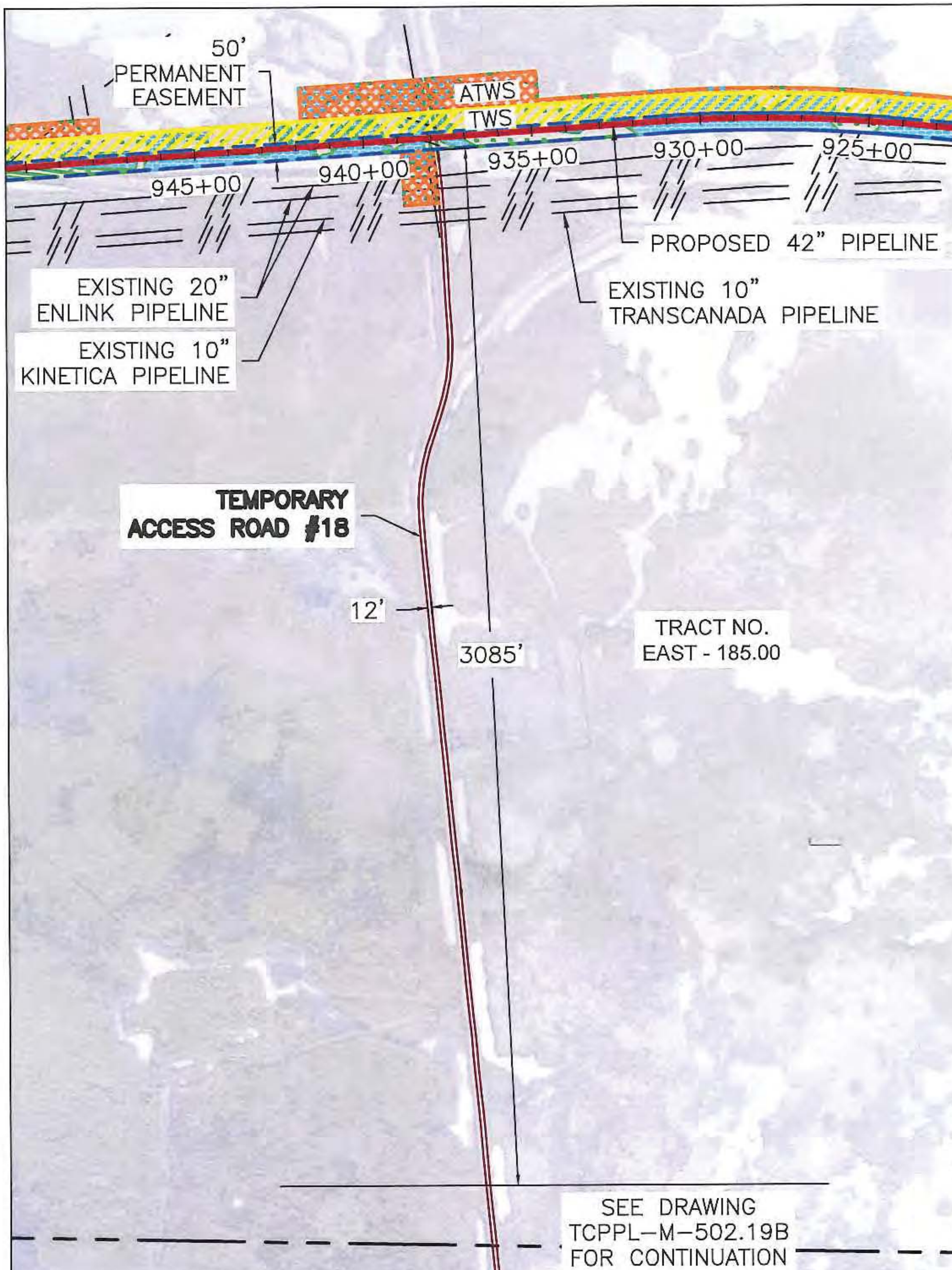

SEE DRAWING TCPPL–M–502.19B FOR CONTINUATION

ACCESS ROAD NAME	ACCESS ROAD #18
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	10,600
ACCESS ROAD WIDTH (FT)	12
ACCESS ROAD AREA (SQ FT)	127,125
ACCESS ROAD AREA (AC)	2.92
ACCESS ROAD AREA DISTURBED (SQ FT)	0.00
ACCESS ROAD AREA DISTURBED (AC)	0.00
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	0.00
ACCESS ROAD IMPROVEMENTS	EXISTING CONDITIONS ARE SUITABLE, NO IMPROVEMENTS NECESSARY.

REV. LEVEL	DATE	BY	DESCRIPTION	CK.	APP.
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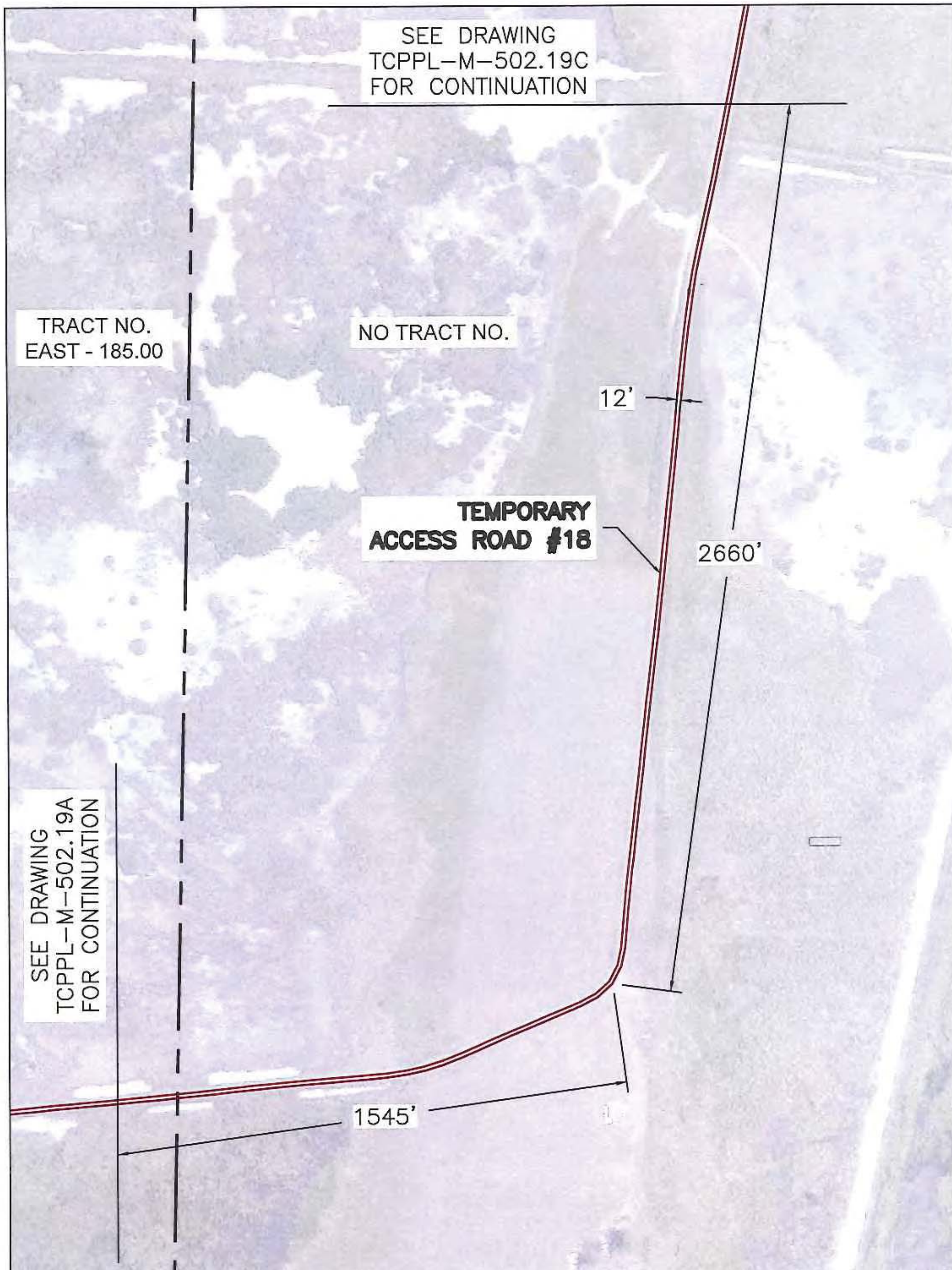
02/23/16	1"=500'	AS		TCPPL-M-502.19A	22	A



0 500 1000

1" = 500'

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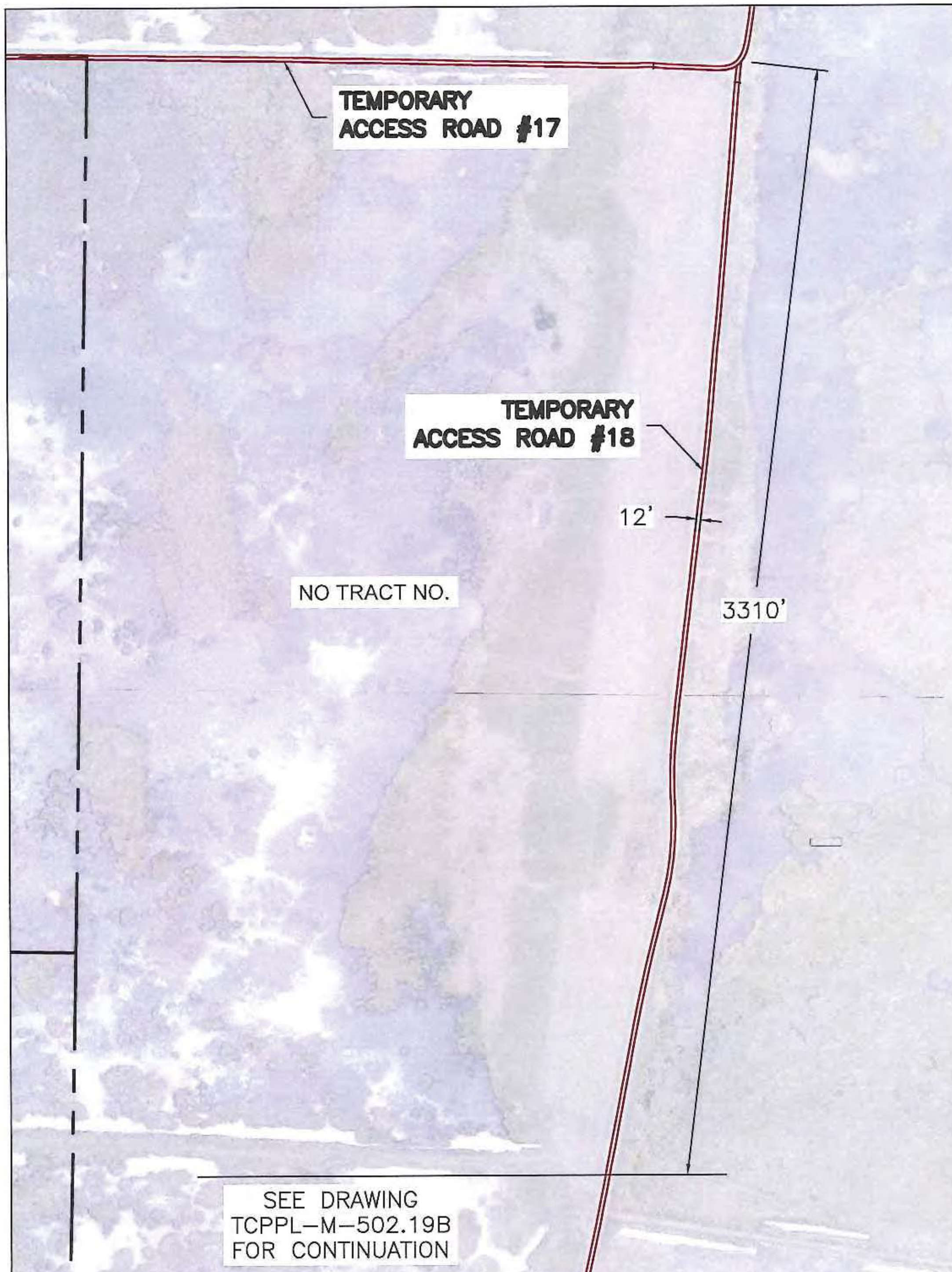

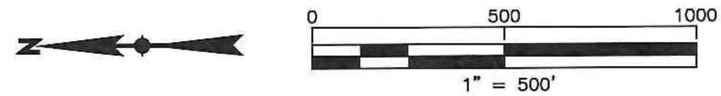

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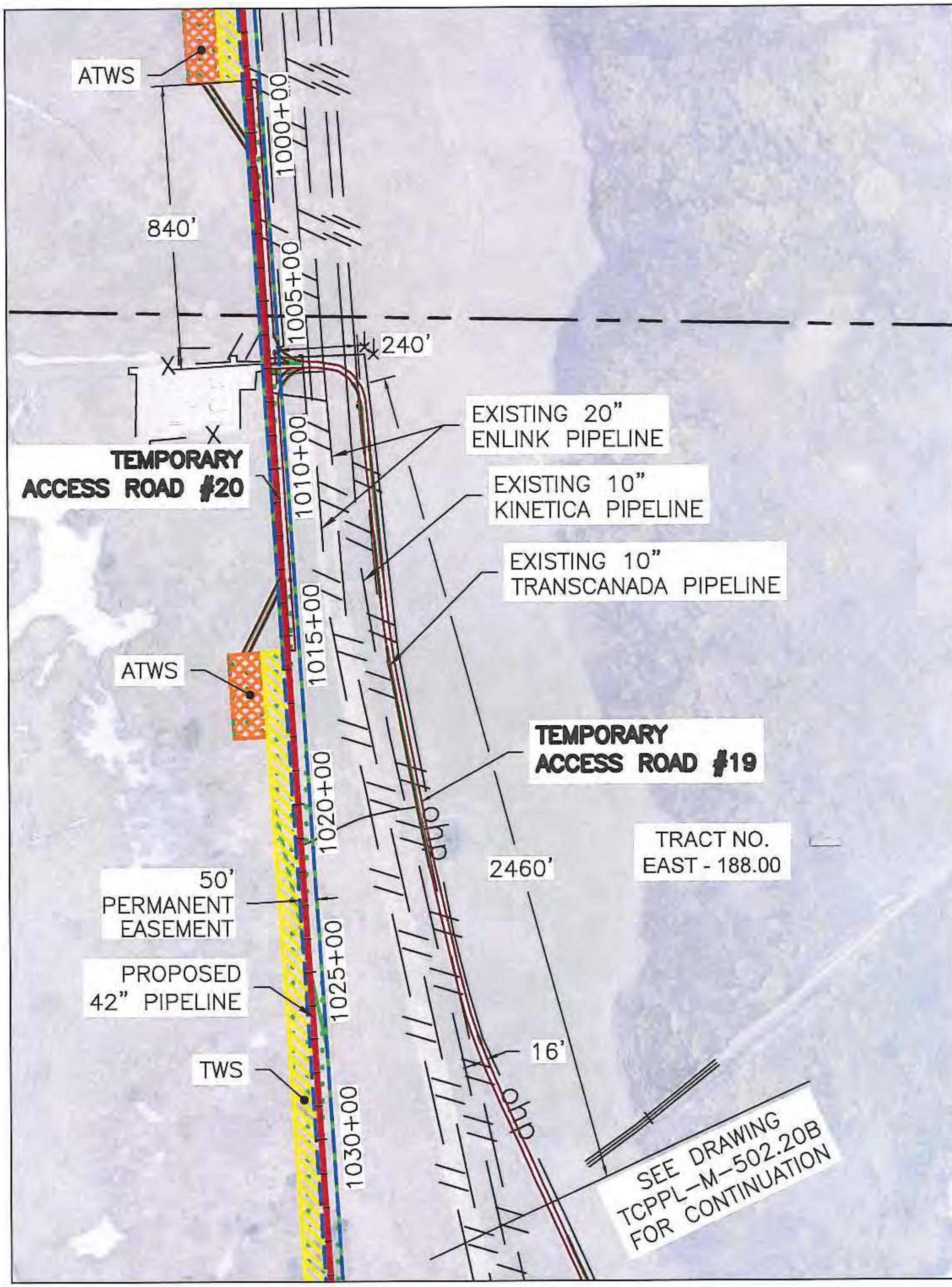

N

0 500 1000

1" = 500'

ACCESS ROAD NAME	ACCESS ROAD #19
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	12,150
ACCESS ROAD WIDTH (FT)	16
ACCESS ROAD AREA (SQ FT)	192,950
ACCESS ROAD AREA (AC)	4.43
ACCESS ROAD AREA DISTURBED (SQ FT)	192,950*
ACCESS ROAD AREA DISTURBED (AC)	4.43*
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	160,791.67
ACCESS ROAD IMPROVEMENTS	MAY REQUIRE MATTING 16 FOOT WIDE FOR ENTIRE LENGTH.

* AREA DISTURBED BY ACCESS ROAD INCLUDES AREA WITHIN PERMANENT EASEMENT.

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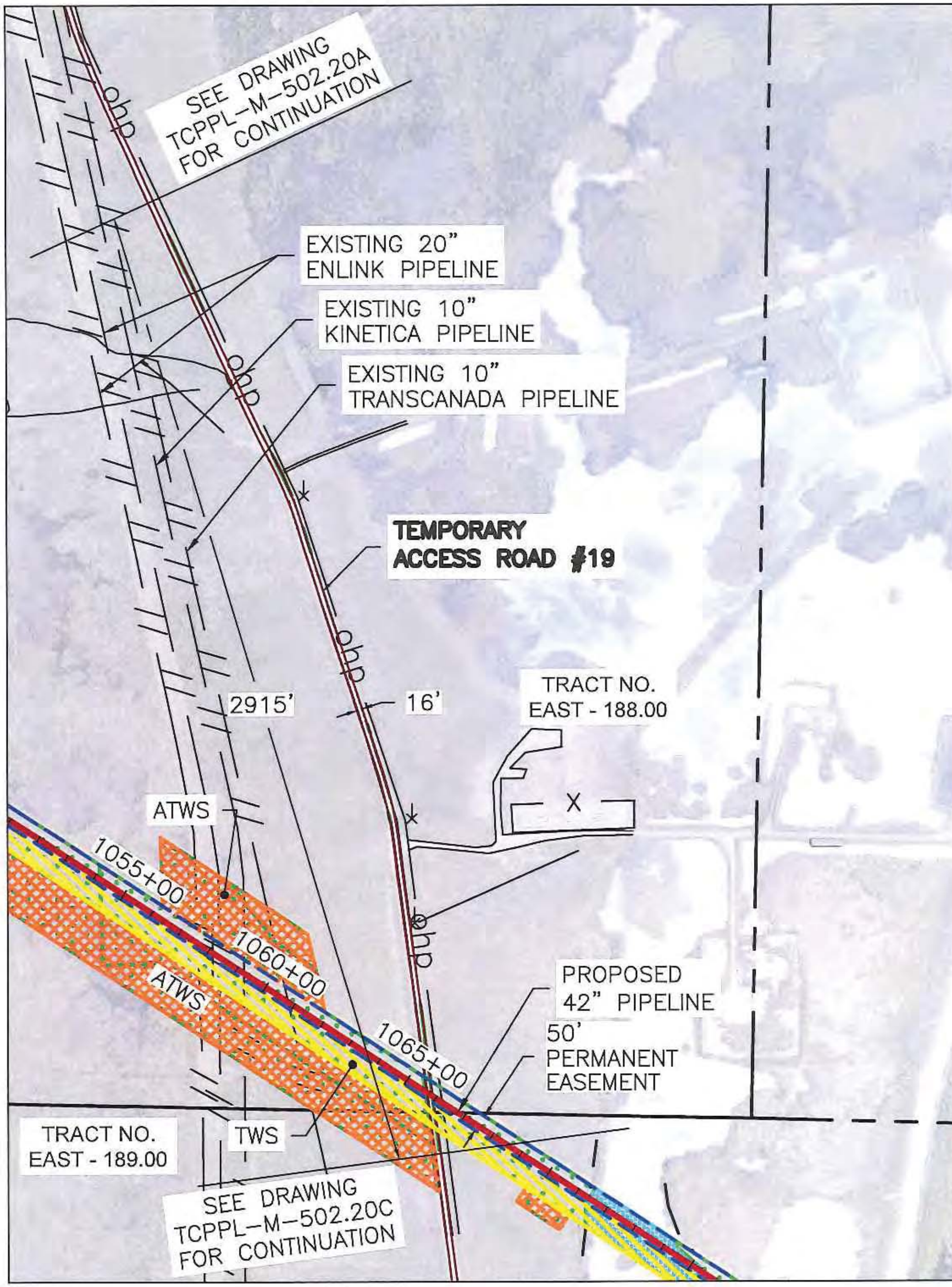

N

0 500 1000

1" = 500'

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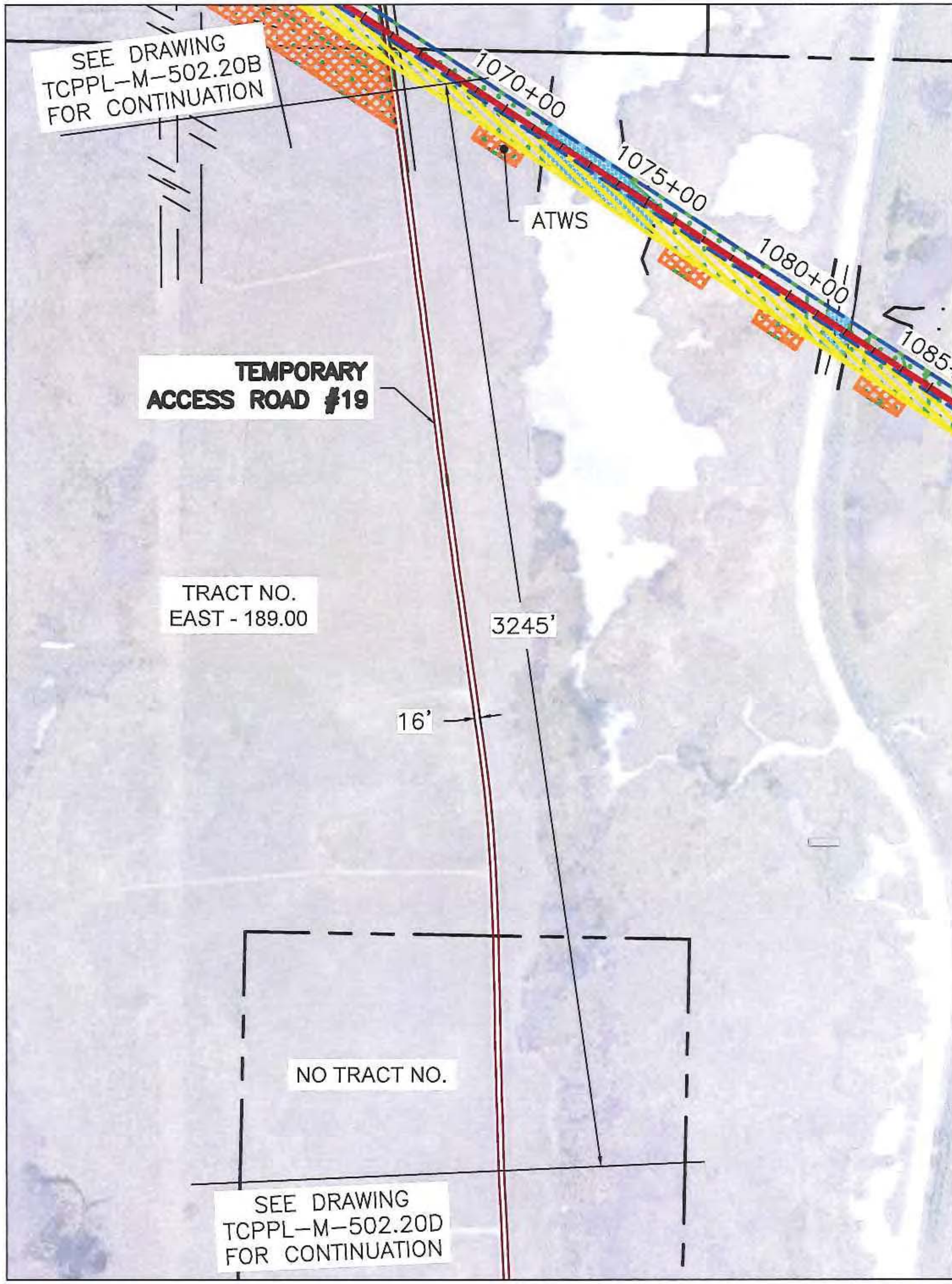

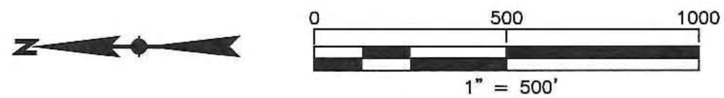

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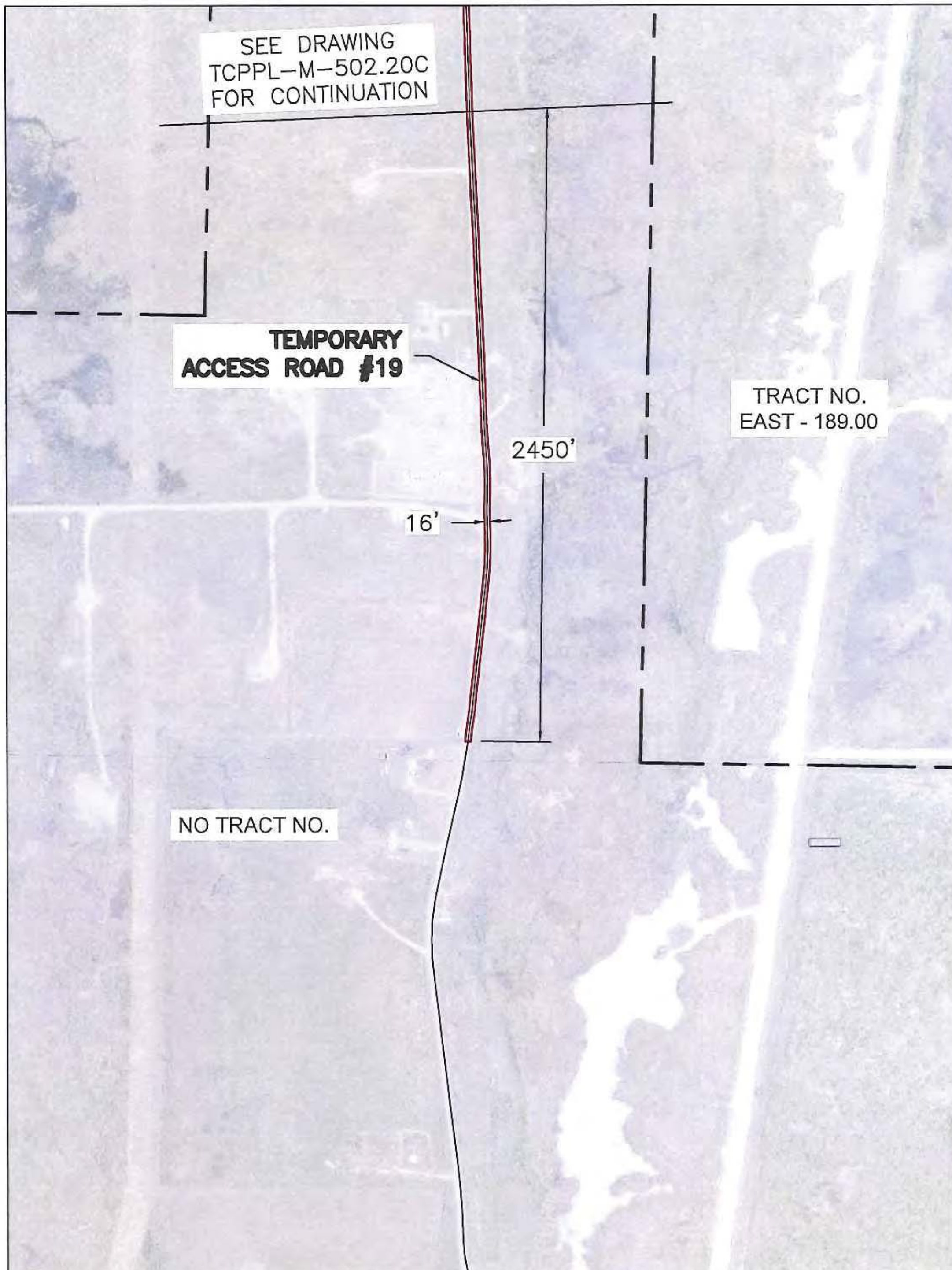

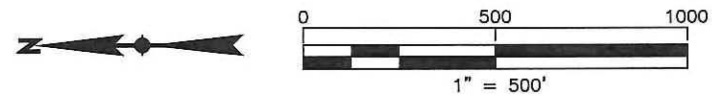

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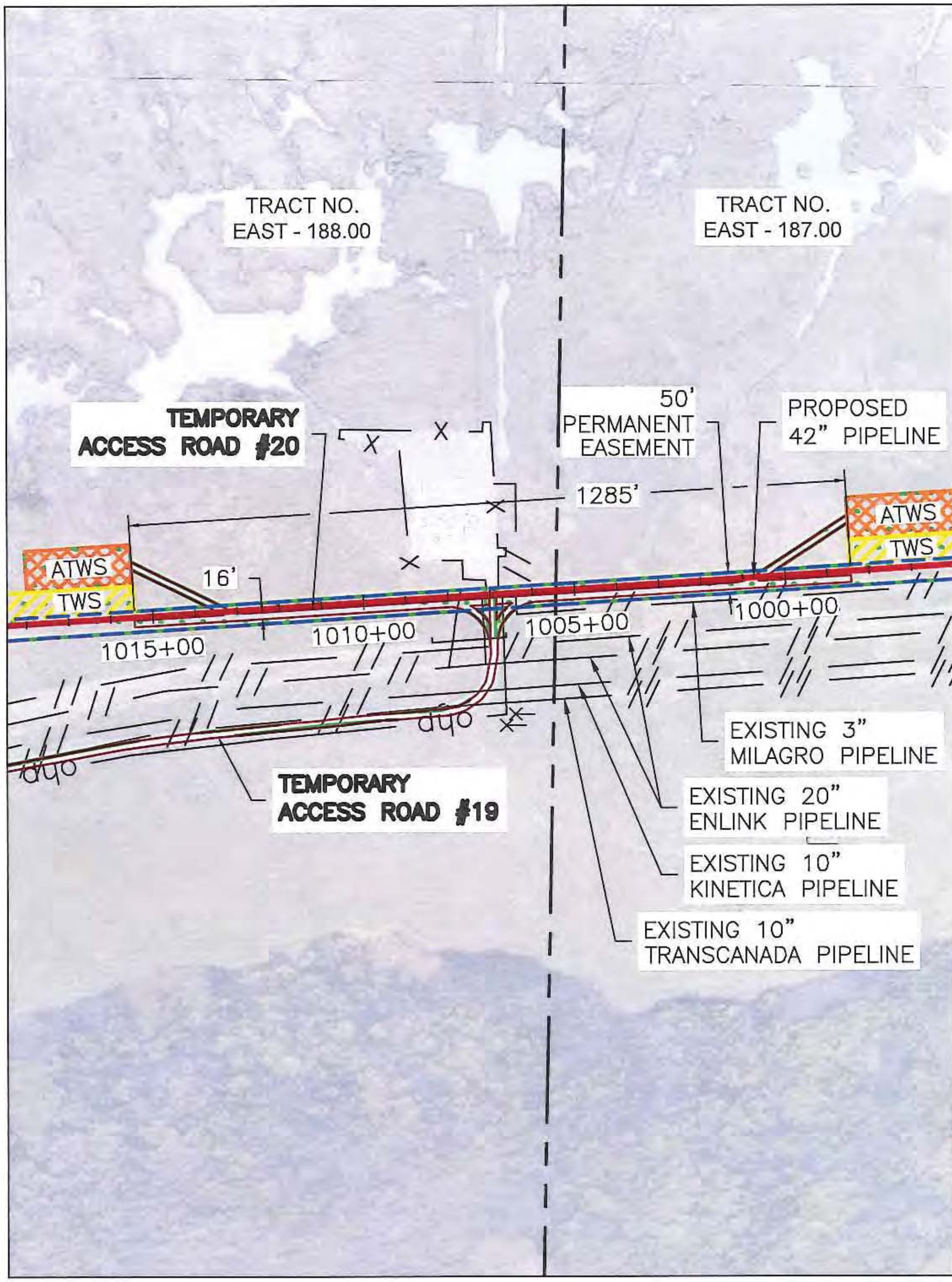
TRANSCAMERON PIPELINE PROJECT
EAST LATERAL ACCESS ROADS

CAMERON PARISH LOUISIANA

DATE:	SCALE:	DRAWN BY:	LOC. NO:	DRAWING NUMBER:	SHEET NO:	REV:
02/09/16	1"=500'	AS		TCPPL-M-502.20D	28	A



N

0 400 800

1" = 400'

ACCESS ROAD NAME	ACCESS ROAD #20
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	1,285
ACCESS ROAD WIDTH (FT)	16
ACCESS ROAD AREA (SQ FT)	19,190
ACCESS ROAD AREA (AC)	0.44
ACCESS ROAD AREA DISTURBED (SQ FT)	19,190*
ACCESS ROAD AREA DISTURBED (AC)	0.44*
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	15,991.67
ACCESS ROAD IMPROVEMENTS	CURRENTLY UNDISTURBED. REQUIRES 16 FOOT WIDE MATTING ENTIRE LENGTH.

* AREA DISTURBED BY ACCESS ROAD INCLUDES AREA WITHIN PERMANENT EASEMENT.

REV. LEVEL	DATE	BY	DESCRIPTION	CK.	APP.
A	02/23/16	AS	ISSUED FOR PERMIT	TCB	DK

REVISIONS

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CAMERON PARISH — LOUISIANA

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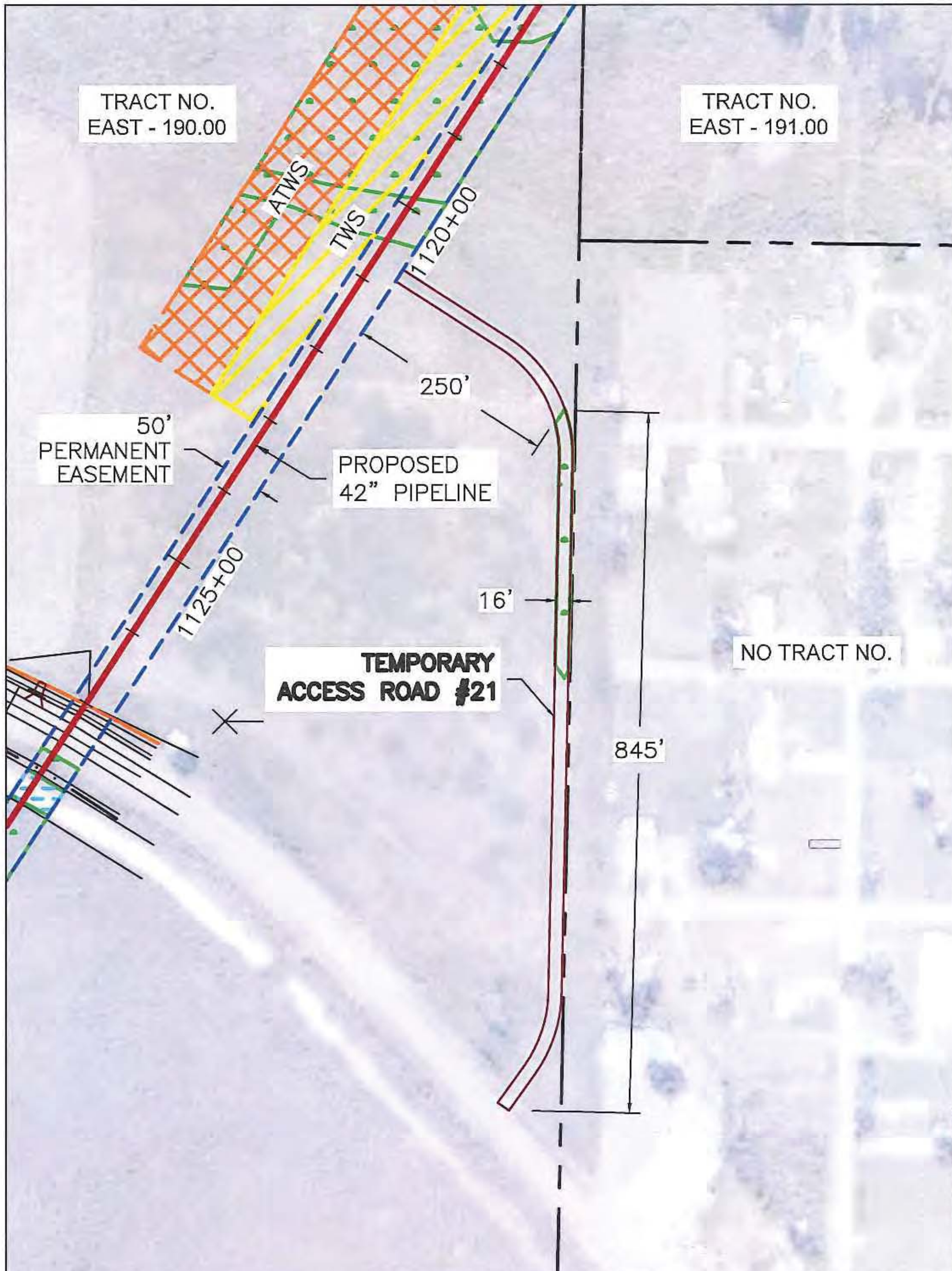

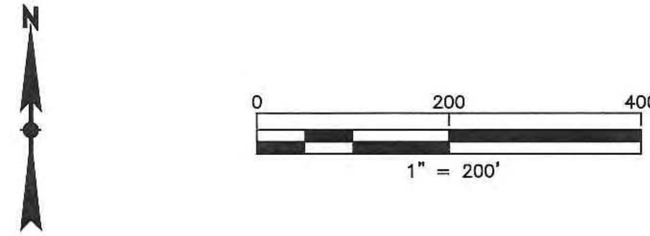

ACCESS ROAD NAME	ACCESS ROAD #21
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	1,095
ACCESS ROAD WIDTH (FT)	16
ACCESS ROAD AREA (SQ FT)	17,500
ACCESS ROAD AREA (AC)	0.40
ACCESS ROAD AREA DISTURBED (SQ FT)	17,500
ACCESS ROAD AREA DISTURBED (AC)	0.40
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	14,583.33
ACCESS ROAD IMPROVEMENTS	CURRENTLY UNDISTURBED. REQUIRES 16 FOOT WIDE MATTING ENTIRE LENGTH.

REV. LEVEL	DATE	BY	DESCRIPTION	CK.	APP.
A	02/23/16	AS	ISSUED FOR PERMIT	TCB	DK

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CAMERON PARISH — LOUISIANA

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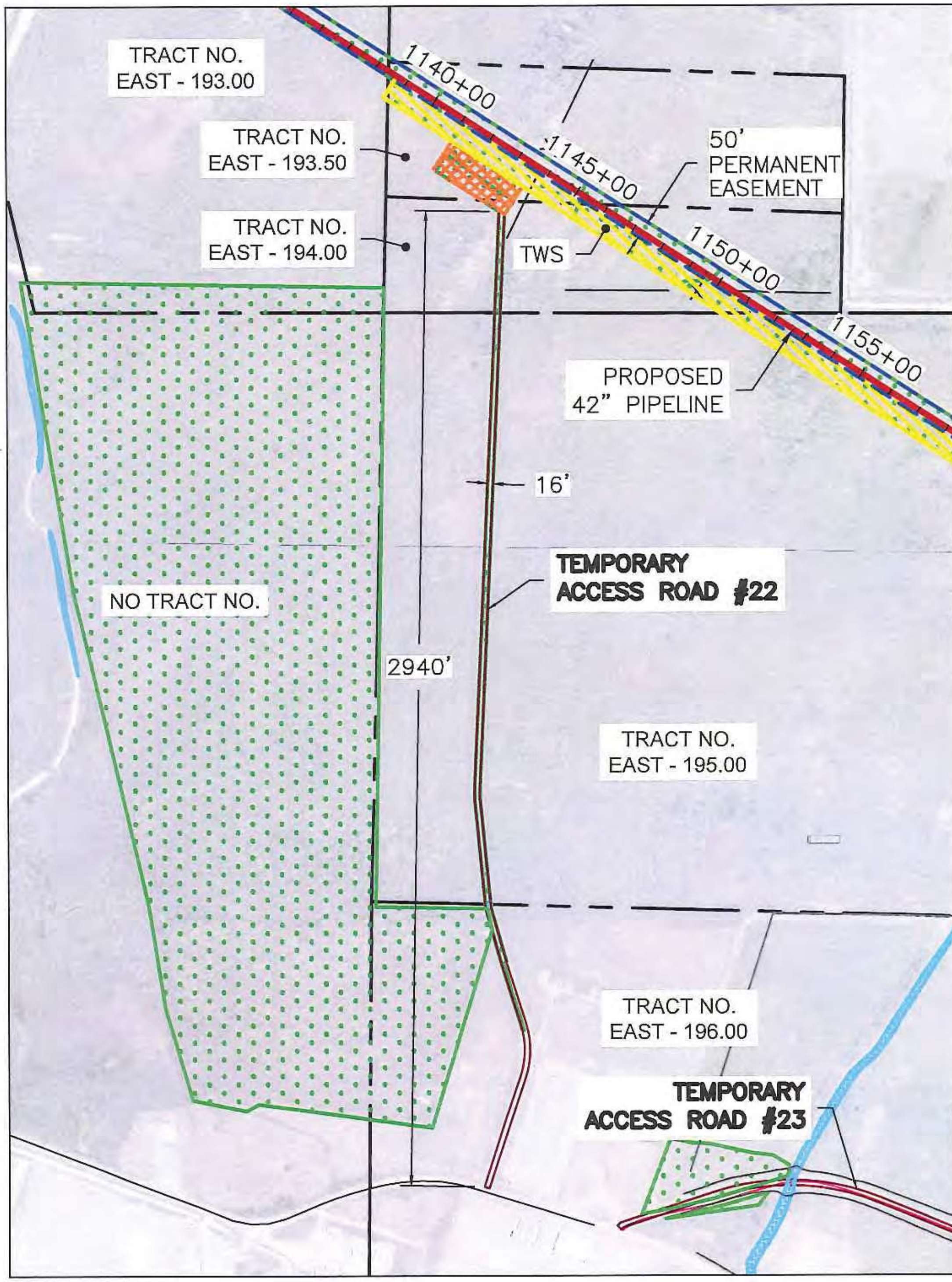

0 500 1000

1" = 500'

ACCESS ROAD NAME	ACCESS ROAD #22
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	2,940
ACCESS ROAD WIDTH (FT)	16
ACCESS ROAD AREA (SQ FT)	47,045
ACCESS ROAD AREA (AC)	1.08
ACCESS ROAD AREA DISTURBED (SQ FT)	47,045
ACCESS ROAD AREA DISTURBED (AC)	1.08
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	39,204.17
ACCESS ROAD IMPROVEMENTS	CURRENTLY UNDISTURBED. REQUIRES 16 FOOT WIDE MATTING ENTIRE LENGTH.

REV. LEVEL	DATE	BY	DESCRIPTION	CK.	APP.
A	02/23/16	AS	ISSUED FOR PERMIT	TCB	DK

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CAMERON PARISH LOUISIANA

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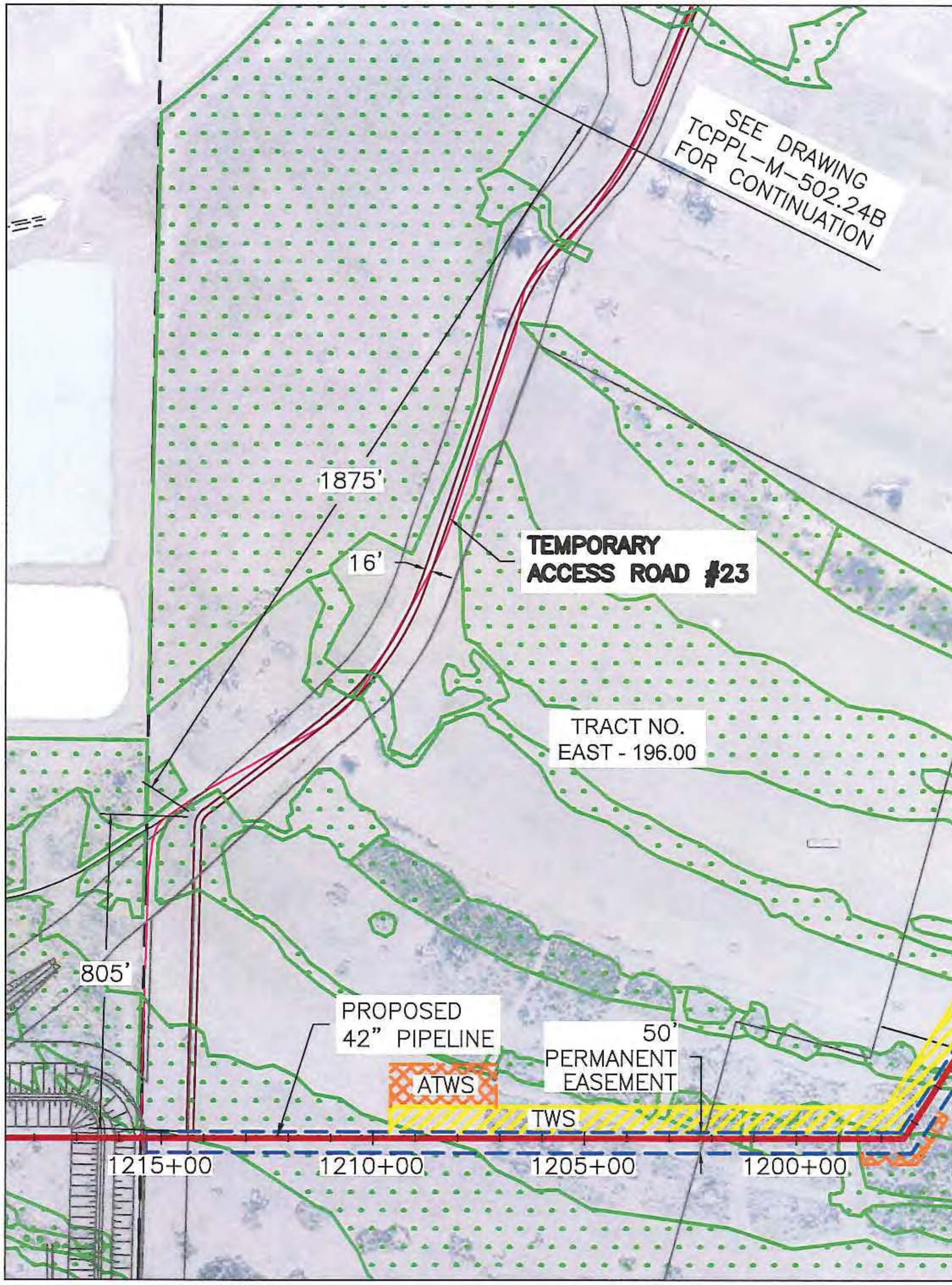

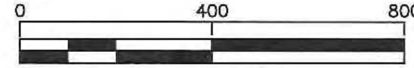

ACCESS ROAD NAME	ACCESS ROAD #23
ACCESS ROAD CLASS	TEMPORARY
ACCESS ROAD LENGTH (FT)	4,750
ACCESS ROAD WIDTH (FT)	16
ACCESS ROAD AREA (SQ FT)	76,015
ACCESS ROAD AREA (AC)	1.75
ACCESS ROAD AREA DISTURBED (SQ FT)	0.00
ACCESS ROAD AREA DISTURBED (AC)	0.00
ACCESS ROAD PERMANENT FILL (CU FT)	0.00
ACCESS ROAD TEMPORARY FILL (CU FT)	0.00
ACCESS ROAD IMPROVEMENTS	EXISTING CONDITIONS ARE SUITABLE, NO IMPROVEMENTS NECESSARY.

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A	02/23/16	AS	ISSUED FOR PERMIT	TCB	DK

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EAST LATERAL ACCESS ROADS

CAMERON PARISH — LOUISIANA

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02/09/16	1"=400'	AS		TCPPL-M-502.24A	32	A

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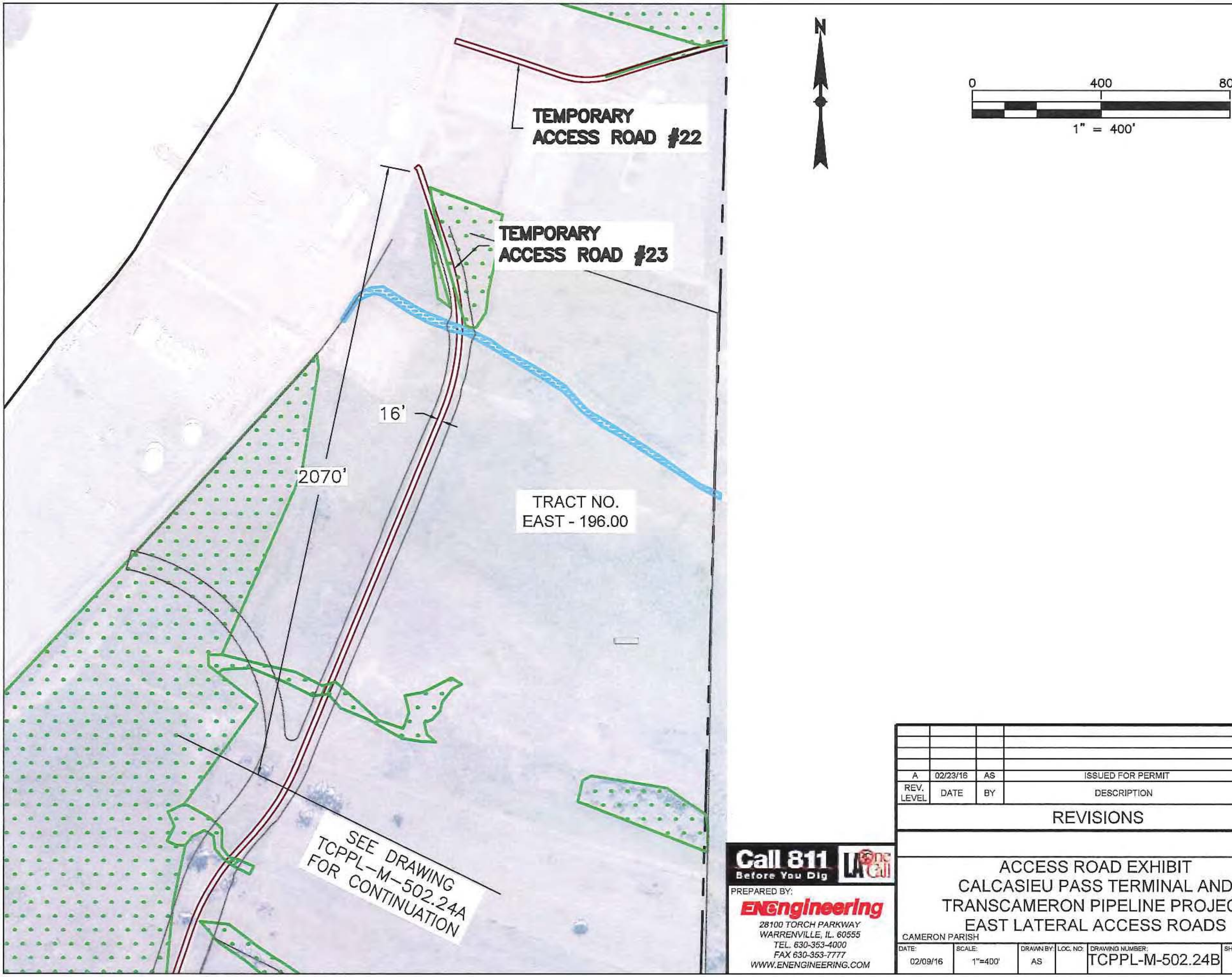

A	02/23/16	AS	ISSUED FOR PERMIT	TCB	DK
REV. LEVEL	DATE	BY	DESCRIPTION	CK.	APP.

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EAST LATERAL ACCESS ROADS

CAMERON PARISH LOUISIANA

DATE:	SCALE:	DRAWN BY:	LOC. NO:	DRAWING NUMBER:	SHEET NO:	REV:
02/09/16	1"=400'	AS		TCPPL-M-502.24B	33	A

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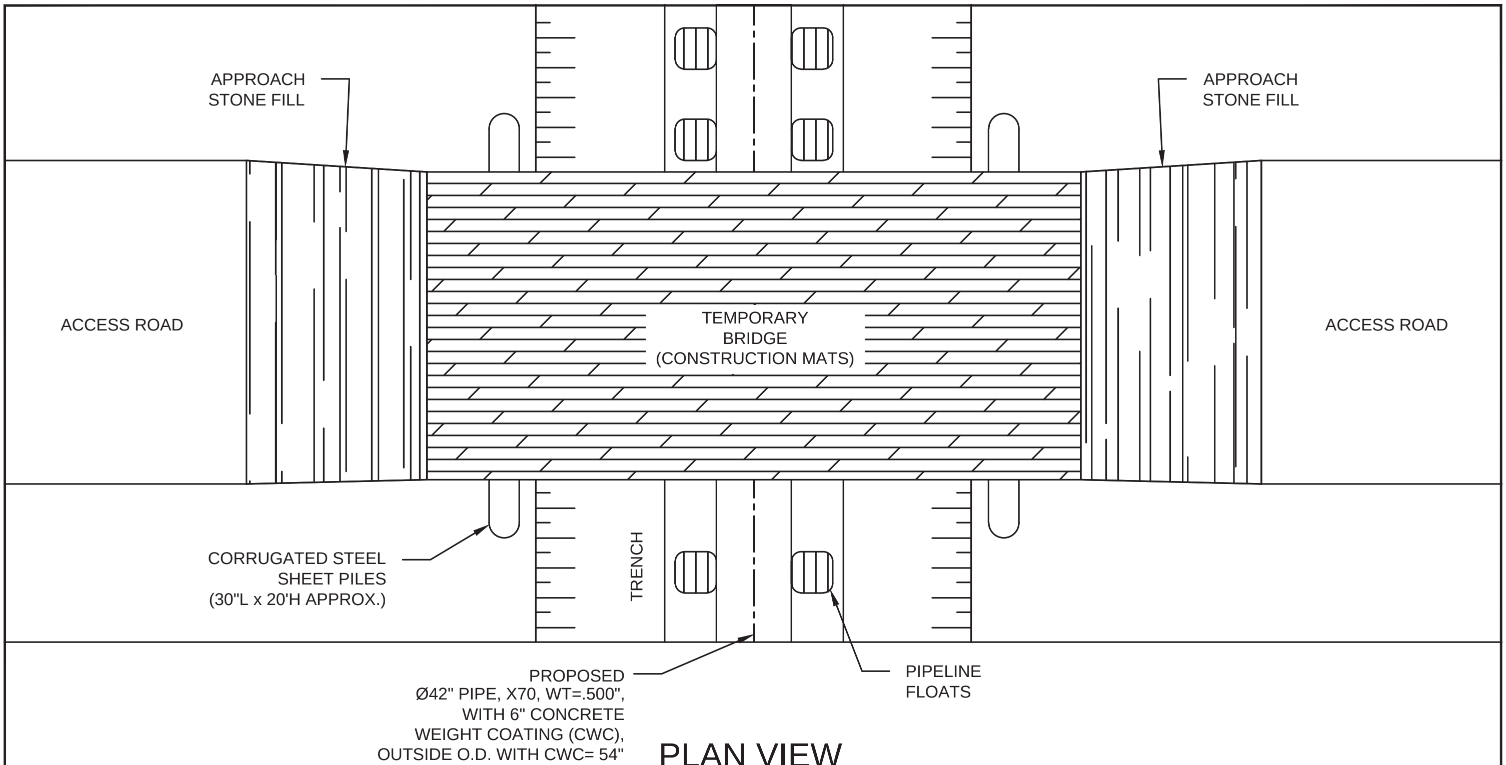
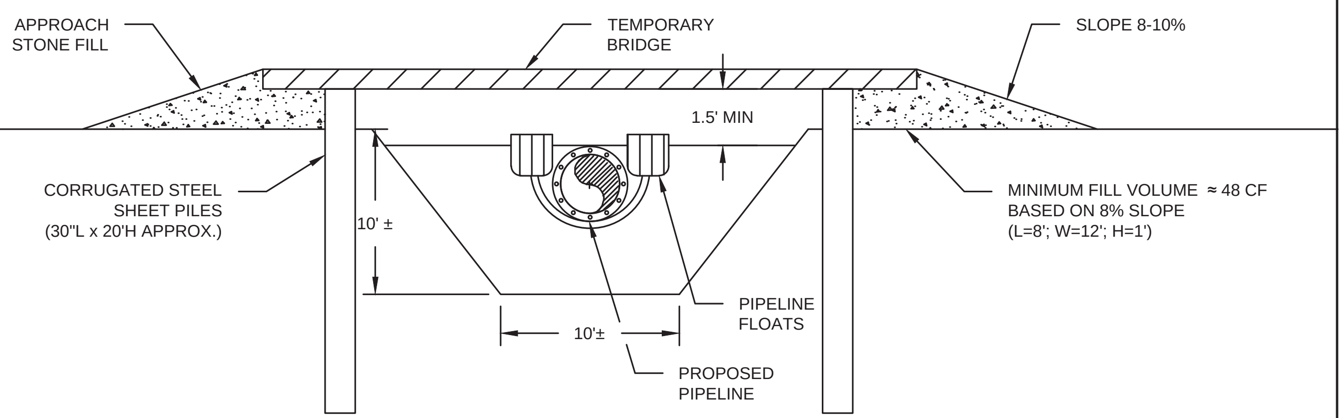


PLAN VIEW
NOT TO SCALE



PROFILE VIEW
NOT TO SCALE

LOCATION STA. WEST LATERAL	
33+80	396+00
121+75	507+90
147+50	630+50
173+80	676+00
205+40	738+65
226+50	
295+20	
343+00	

LOCATION STA. EAST LATERAL	
185+40	833+10
224+00	937+50
236+50	1065+50
257+40	
679+00	
778+10	
802+90	
818+50	

FIGURE 1.3-15e
TYPICAL ACCESS ROAD CROSSING
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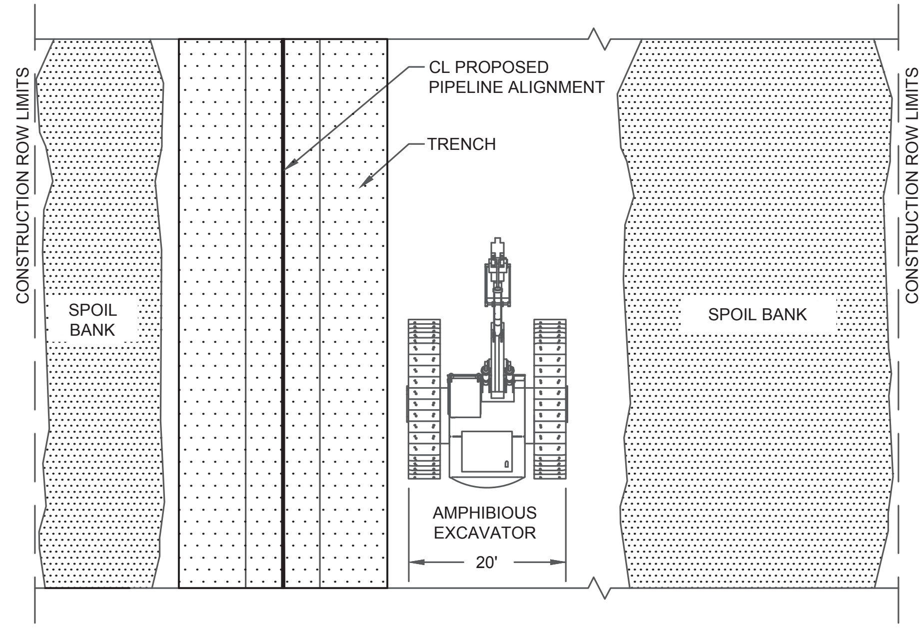
FIGURE 1.3-15e	NTS	07/29/2015	01/15/2016	KBI

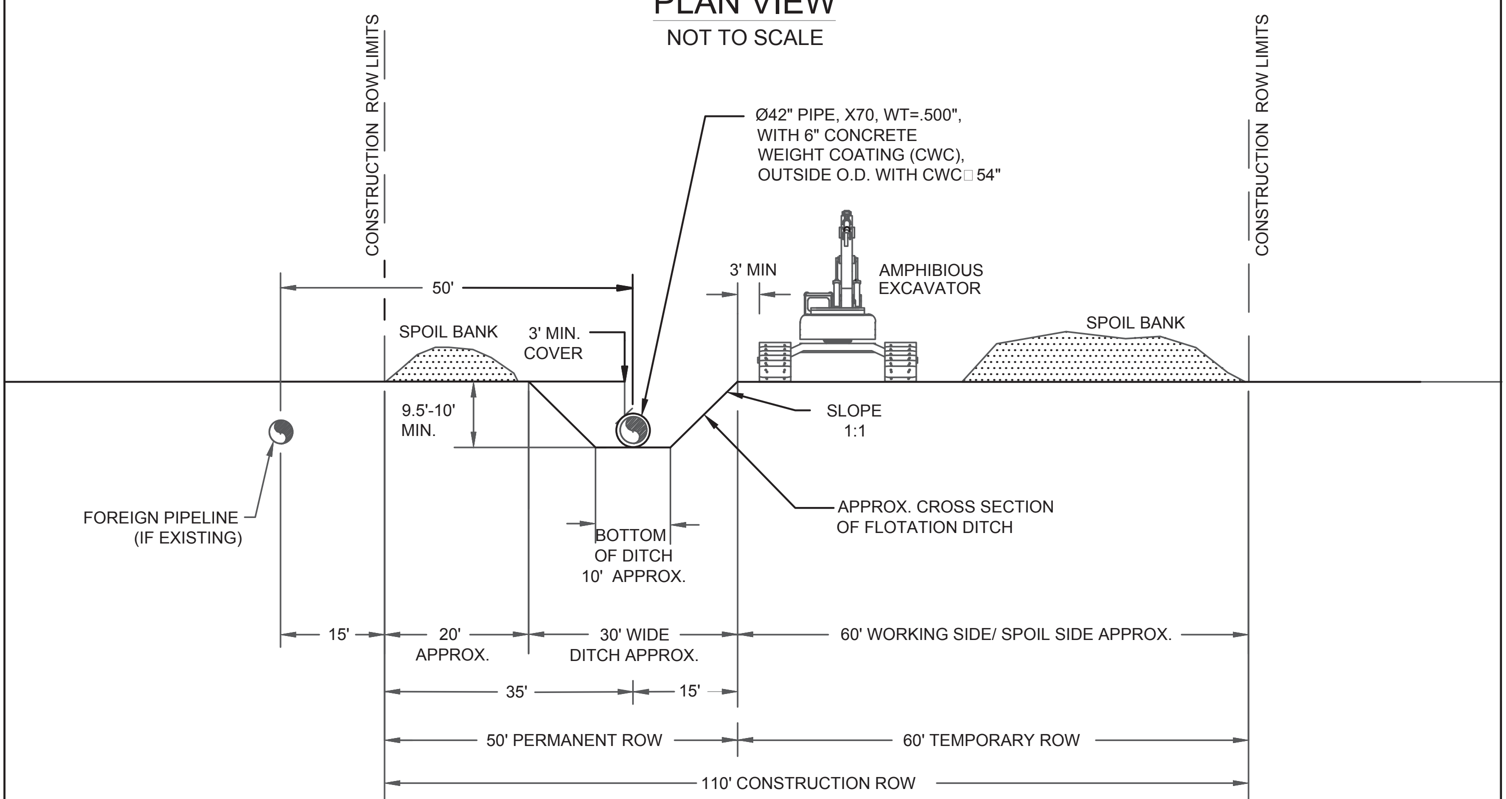
APPENDIX C

TYPICAL CONSTRUCTION RIGHT-OF-WAY CONFIGURATIONS



PLAN VIEW

NOT TO SCALE



PROFILE VIEW

NOT TO SCALE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY (ROW) WILL TYPICALLY BE 110 FEET WIDE CONSISTING OF 50 FEET PERMANENT EASEMENT AND UP TO 60 FEET OF TEMPORARY WORKSPACE. ATWS WILL BE NECESSARY AT FOREIGN PIPELINE, GRAVEL ROAD, CANAL CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES.
2. RESTRICT ROOT GRUBBING TO TRENCH AREA.
3. TOPSOIL SALVAGE IS NOT REQUIRED IN SATURATED SOIL.
4. UTILI□ES AMPHIBIOUS EXCAVATORS AND SUPPORT EQUIPMENT.
5. KEEP SOIL PILES CLEAN OF ALL CONSTRUCTION DEBRIS.
6. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS.
7. FABRICATE PIPE IN ATWS STAGING AREAS.
8. BACKFILL TRENCH WITH NATIVE MATERIAL AS EXCAVATED. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING.

FIGURE 1.3-15a(1)
TYPICAL PUSH SECTION ROW
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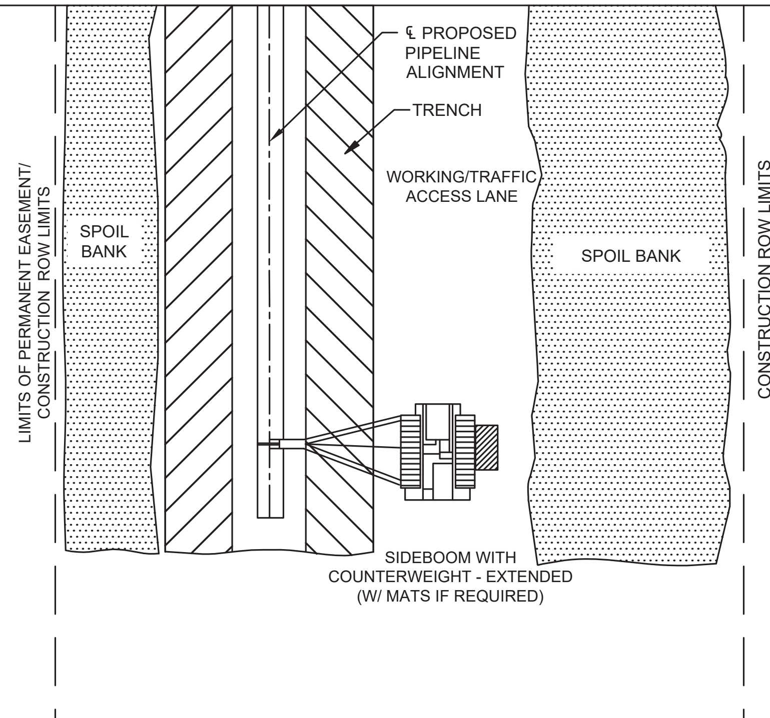
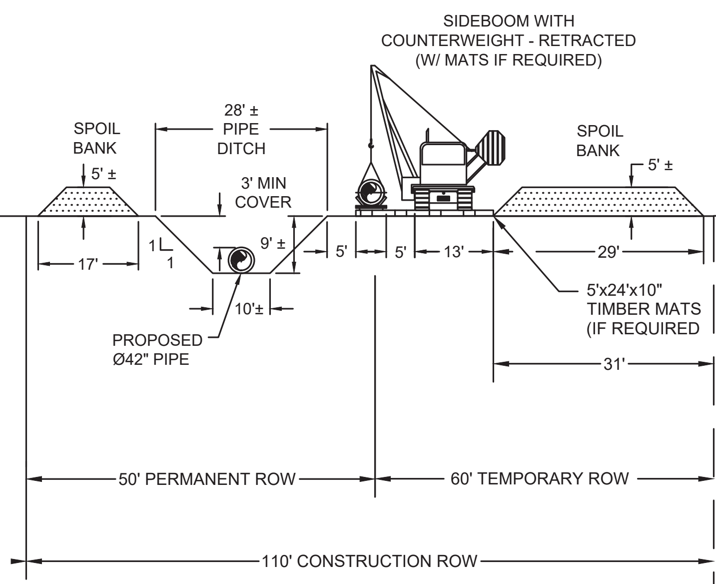
FIGURE 1.3-15a(1)	NTS	07/27/2015	7/30/2015	KBI



WORKSPACE DETAIL

NOT TO SCALE



DITCH DETAIL

NOT TO SCALE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY (ROW) WILL TYPICALLY BE 110 FEET WIDE CONSISTING OF 50 FEET PERMANENT EASEMENT AND UP TO 60 FEET OF TEMPORARY WORKSPACE. ATWS WILL BE NECESSARY AT FOREIGN PIPELINE, GRAVEL ROAD, CANAL CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES.
2. RESTRICT ROOT GRUBBING TO TRENCH AREA.
3. KEEP SOIL PILES CLEAN OF ALL CONSTRUCTION DEBRIS.
4. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS.
5. FABRICATE PIPE IN ATWS STAGING AREAS.
6. BACKFILL TRENCH WITH NATIVE MATERIAL AS EXCAVATED. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING.
7. SELECTION OF CONSTRUCTION METHOD WILL BE BASED ON CONTRACTOR PREFERENCE AND SITE CONDITIONS AT THE TIME OF CONSTRUCTION.

FIGURE 1.3-15a(2-1)
TYPICAL UPLANDS CONSTRUCTION ROW
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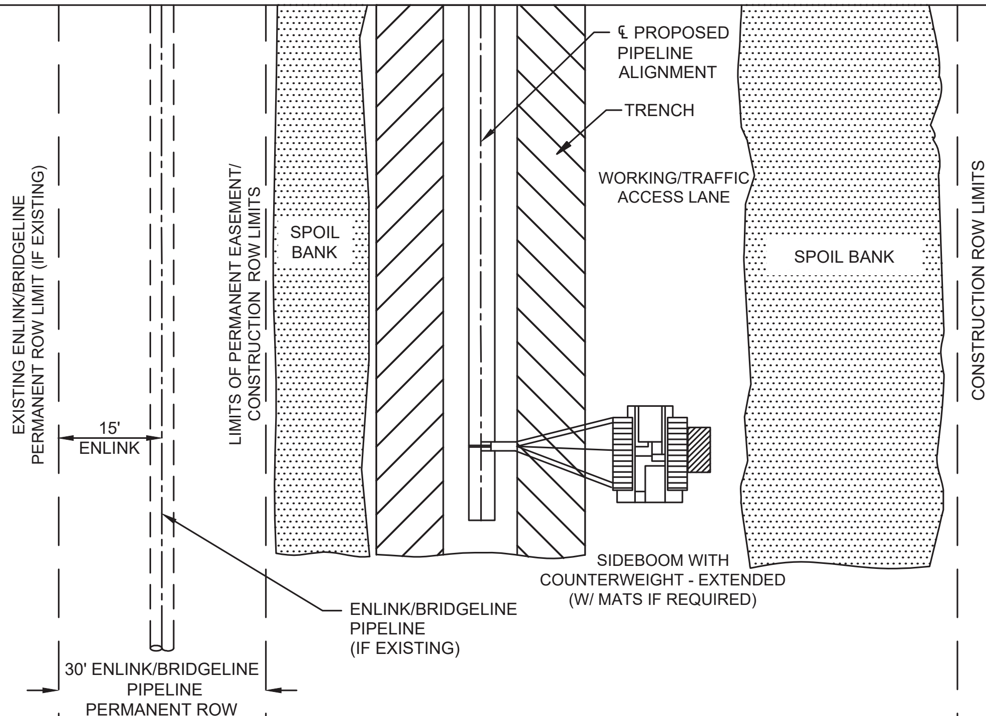
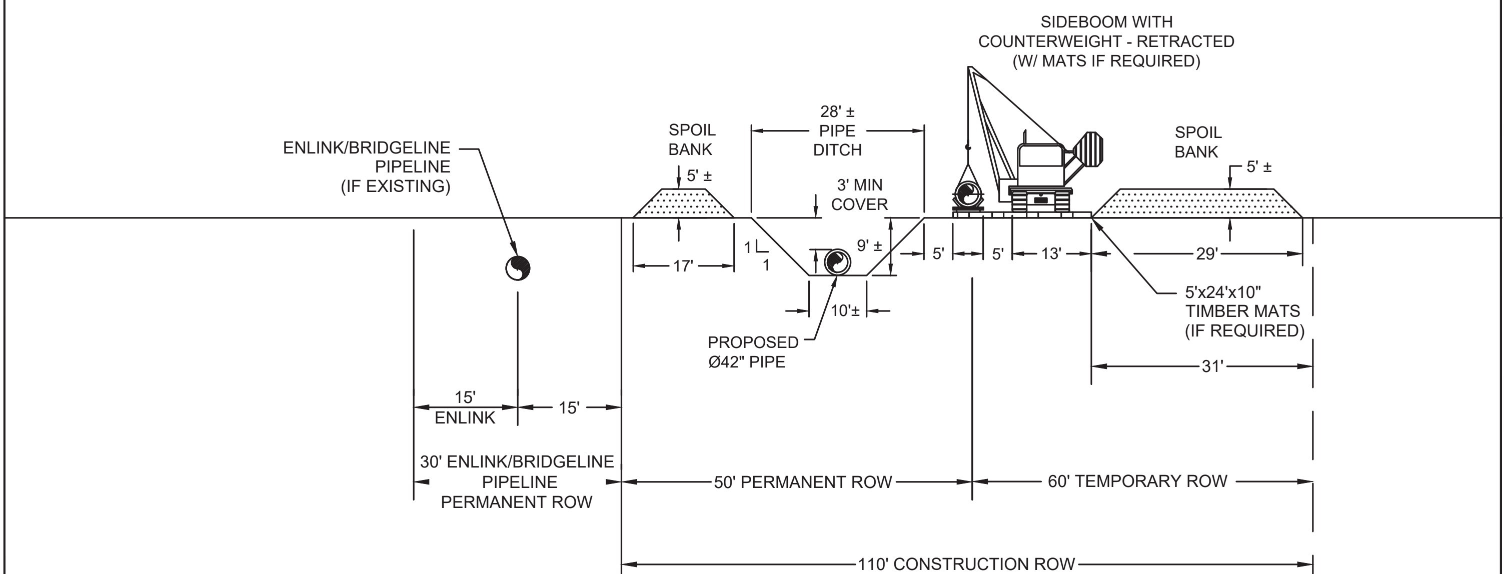
FIGURE 1.3-15a(2-1)	NTS	10/16/2015	01/28/16	KBI



WORKSPACE DETAIL

NOT TO SCALE



DITCH DETAIL

NOT TO SCALE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY (ROW) WILL TYPICALLY BE 110 FEET WIDE CONSISTING OF 50 FEET PERMANENT EASEMENT AND UP TO 60 FEET OF TEMPORARY WORKSPACE. ATWS WILL BE NECESSARY AT FOREIGN PIPELINE, GRAVEL ROAD, CANAL CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES.
2. RESTRICT ROOT GRUBBING TO TRENCH AREA.
3. KEEP SOIL PILES CLEAN OF ALL CONSTRUCTION DEBRIS.
4. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS.
5. FABRICATE PIPE IN ATWS STAGING AREAS.
6. BACKFILL TRENCH WITH NATIVE MATERIAL AS EXCAVATED. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING.
7. SELECTION OF CONSTRUCTION METHOD WILL BE BASED ON CONTRACTOR PREFERENCE AND SITE CONDITIONS AT THE TIME OF CONSTRUCTION.

FIGURE 1.3-15a(2-2)
TYPICAL CONSTRUCTION ROW - UPLANDS PARALLEL FOREIGN PIPELINE
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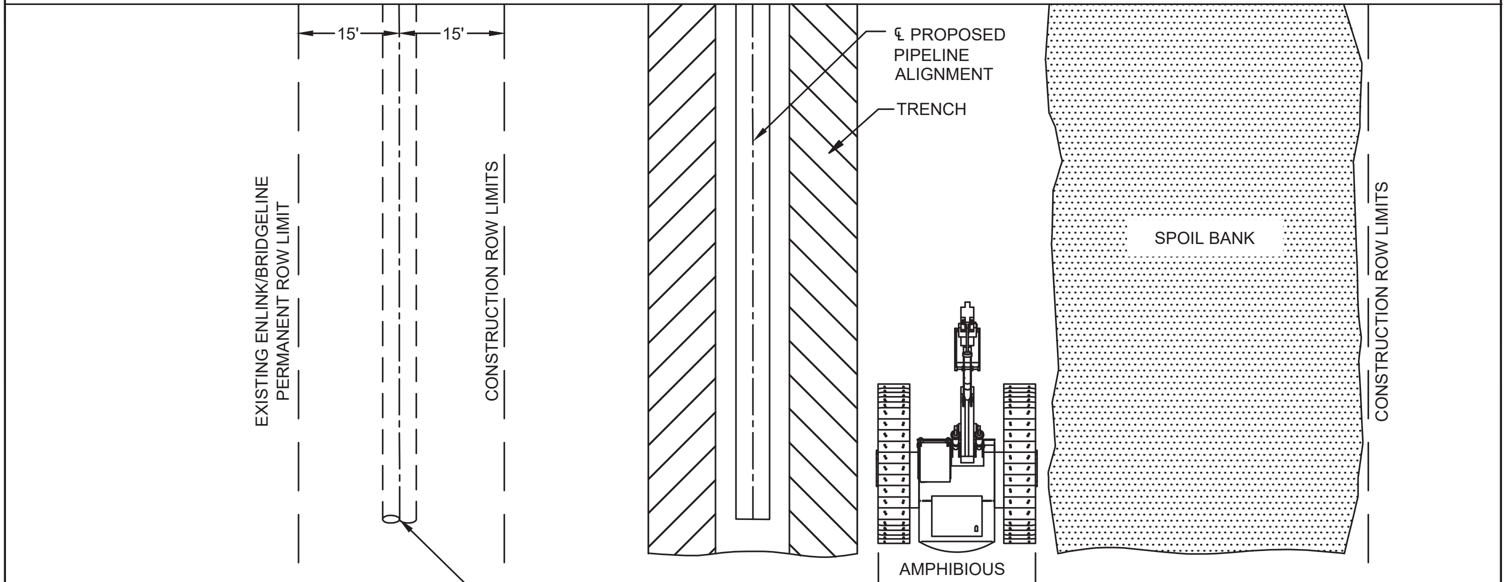
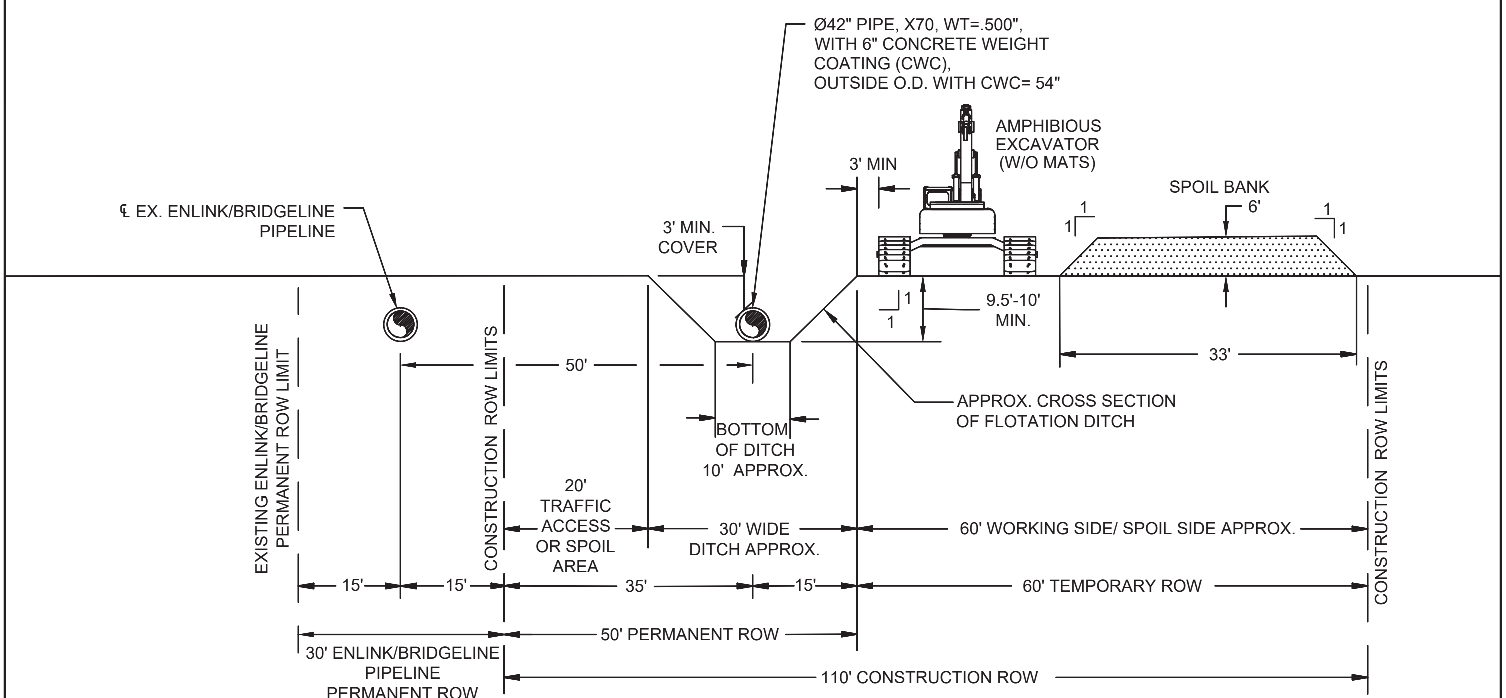
FIGURE 1.3-15a(2-2)	NTS	10/16/2015	01/28/16	KBI



PLAN VIEW
NOT TO SCALE



PROFILE VIEW
NOT TO SCALE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY (ROW) WILL TYPICALLY BE 110 FEET WIDE CONSISTING OF 50 FEET PERMANENT EASEMENT AND UP TO 60 FEET OF TEMPORARY WORKSPACE. ATWS WILL BE NECESSARY AT FOREIGN PIPELINE, GRAVEL ROAD, CANAL CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES.
2. RESTRICT ROOT GRUBBING TO TRENCH AREA.
3. TOPSOIL SALVAGE IS NOT REQUIRED IN SATURATED SOIL.
4. UTILIZES AMPHIBIOUS EXCAVATORS AND OTHER SUPPORT EQUIPMENT.
5. KEEP SOIL PILES CLEAN OF ALL CONSTRUCTION DEBRIS.
6. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS.
7. FABRICATE PIPE IN ATWS STAGING AREAS.
8. BACKFILL TRENCH WITH NATIVE MATERIAL AS EXCAVATED. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING.

FIGURE 1.3-15a(3)
TYPICAL PUSH SECTION ROW (PARALLEL TO EX. ENLINK/BRIDGELINE PIPELINE)
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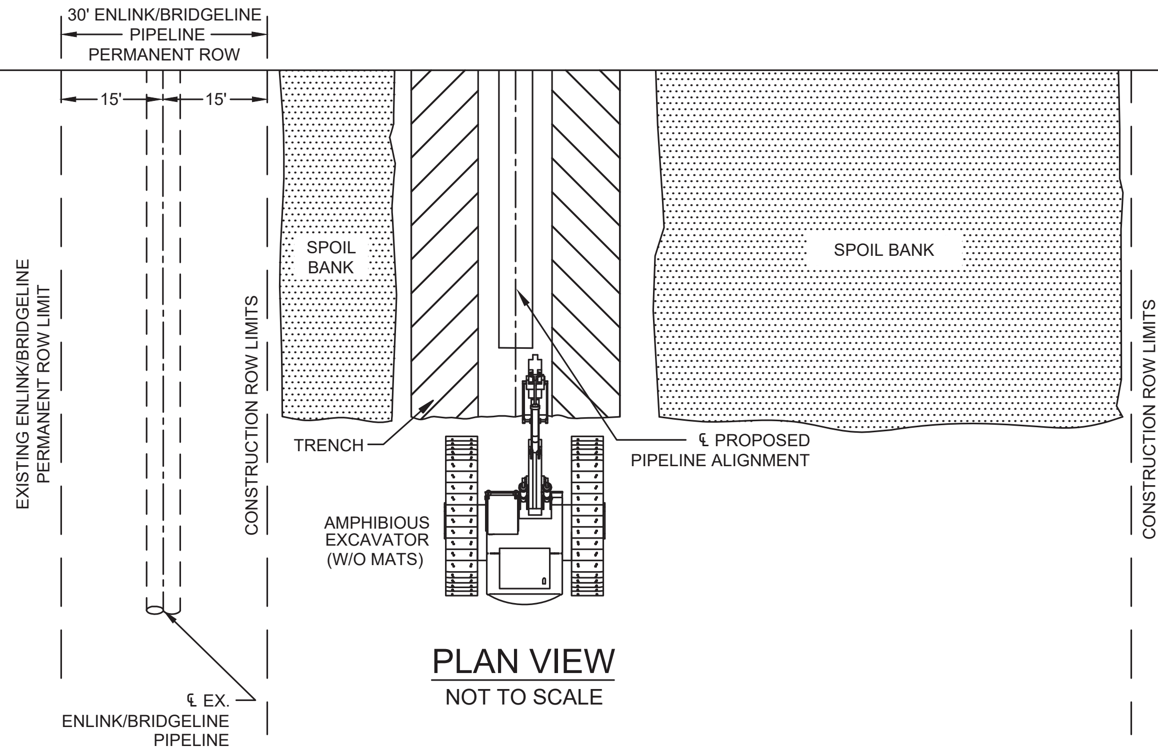
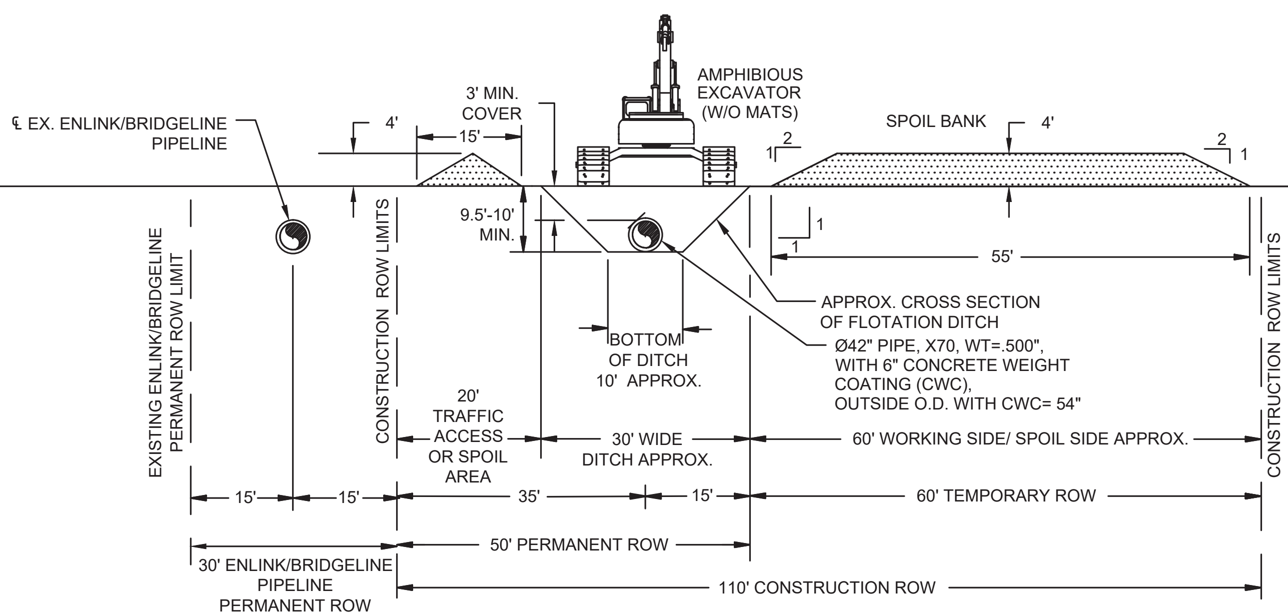
FIGURE 1.3-15a(3)	NTS	07/27/2015	01/13/15	KBI



PLAN VIEW
NOT TO SCALE



PROFILE VIEW
NOT TO SCALE

NOTES:

1. CONSTRUCTION RIGHT-OF-WAY (ROW) WILL TYPICALLY BE 110 FEET WIDE CONSISTING OF 50 FEET PERMANENT EASEMENT AND UP TO 60 FEET OF TEMPORARY WORKSPACE. ATWS WILL BE NECESSARY AT FOREIGN PIPELINE, GRAVEL ROAD, CANAL CROSSINGS AND OTHER SPECIAL CIRCUMSTANCES.
2. RESTRICT ROOT GRUBBING TO TRENCH AREA.
3. TOPSOIL SALVAGE IS NOT REQUIRED IN SATURATED SOIL.
4. UTILIZES AMPHIBIOUS EXCAVATORS AND OTHER SUPPORT EQUIPMENT.
5. KEEP SOIL PILES CLEAN OF ALL CONSTRUCTION DEBRIS.
6. LEAVE GAPS IN SPOIL PILES AT OBVIOUS DRAINAGES. DO NOT PUSH UPLAND SOILS INTO CREEKS OR WETLANDS.
7. FABRICATE PIPE IN ATWS STAGING AREAS.
8. BACKFILL TRENCH WITH NATIVE MATERIAL AS EXCAVATED. AVOID SCALPING VEGETATED GROUND SURFACE WHEN BACKFILLING.

FIGURE 1.3-15a(4)
TYPICAL PUSH SECTION ROW (PARALLEL TO EX. ENLINK/BRIDGELINE PIPELINE)
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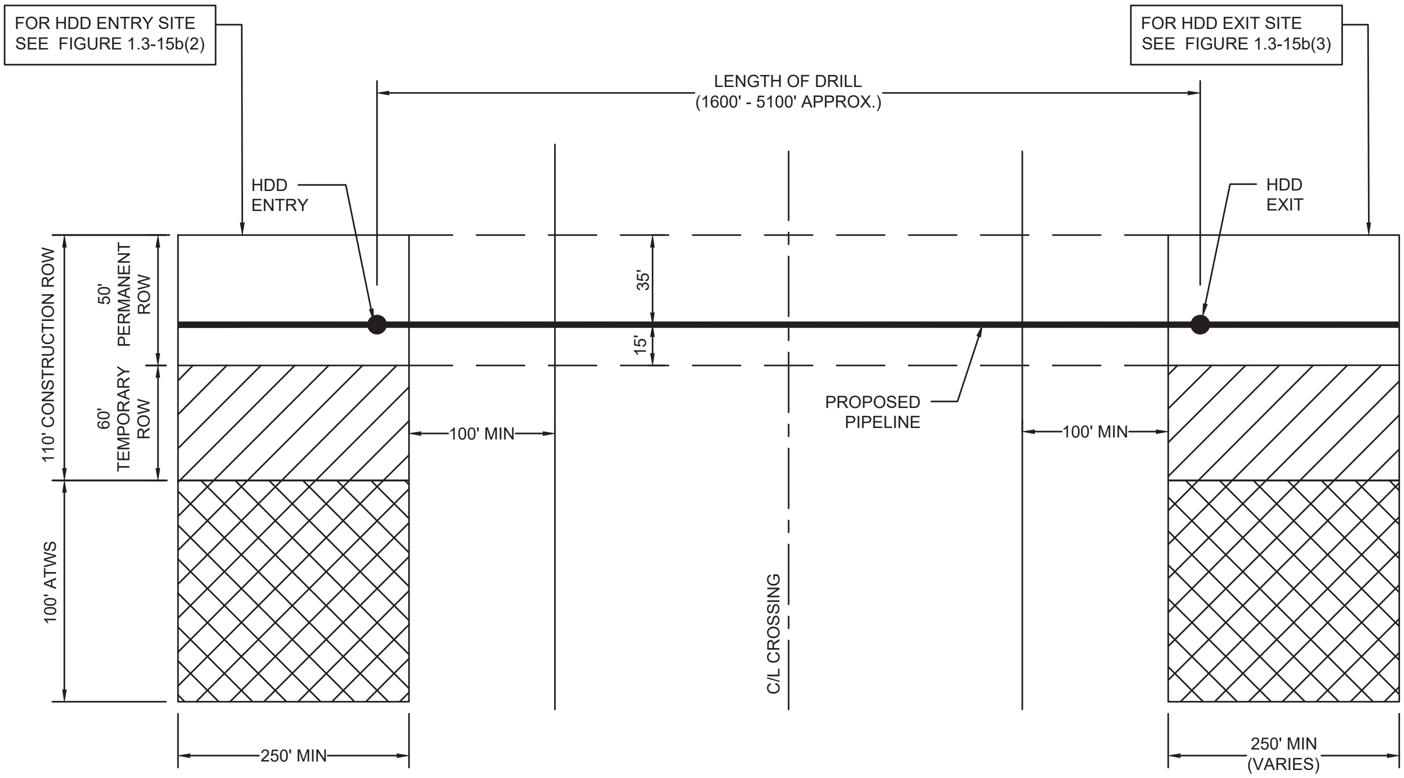
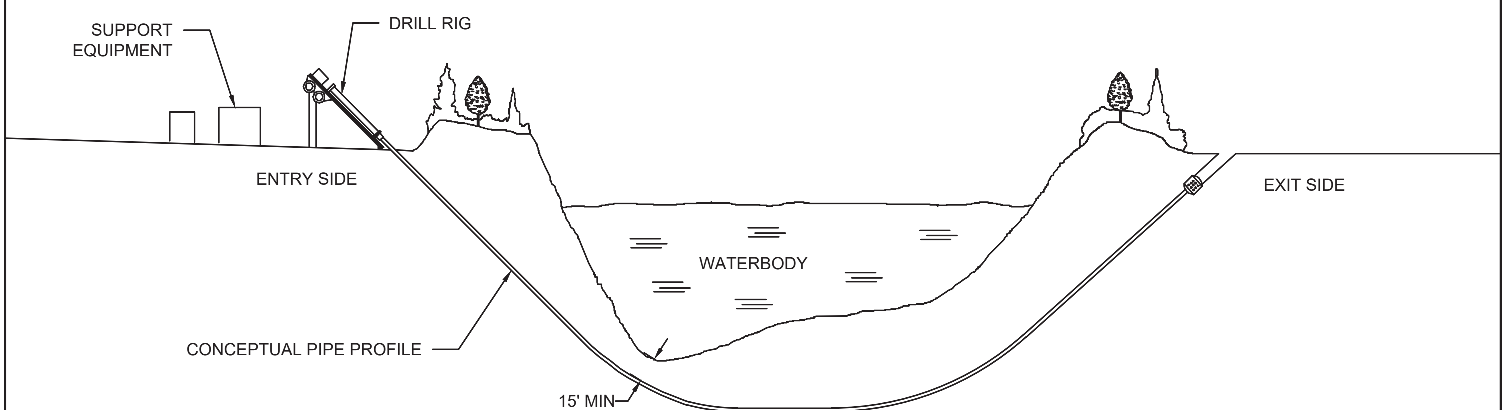
FIGURE 1.3-15a(4)	NTS	07/27/2015	01/28/16	KBI



PLAN VIEW

NOT TO SCALE



PROFILE VIEW

NOT TO SCALE

FIGURE 1.3-15b(1)
TYPICAL HDD CONSTRUCTION ROW
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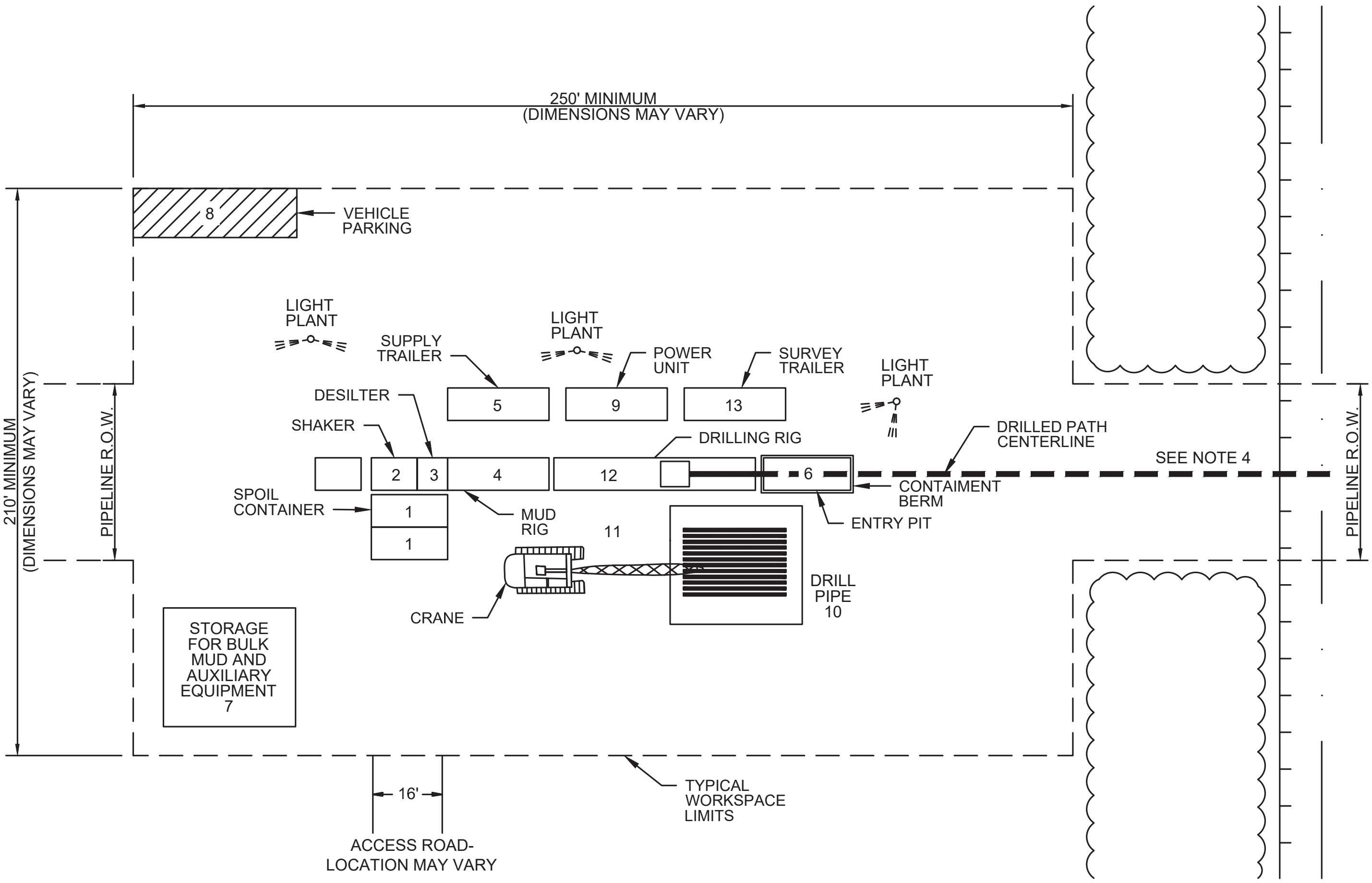
FIGURE 1.3-15b(1)	NONE	07/29/2015	12/21/2015	KBI



EQUIPMENT:
1. SPOIL CONTAINER: 8' x 20'
2. SHAKER: 8' x 12'
3. DESILTER: 8' x 8"
4. MUD RIG: 8.5' x 45'
5. SUPPLY TRAILER: 8' x 25'
6. ENTRY PIT: 10' x 30'
7. STORAGE: 30' x 30'
8. VEHICLE PARKING: 15' x 50'
9. POWER UNIT: 8.5' x 40'
10. DRILL PIPE: 30' x 40'
11. CRANE: 10' x 20'
12. DRILLING RIG: 8.5' x 53'
13. SURVEY TRAILER: 8' x 25'

NOTES:
1. EQUIPMENT ORIENTATION MAY VARY DEPENDING ON CONTRACTOR OR SITE CONDITIONS.
2. EQUIPMENT TO BE SUPPORTED ON THE GROUND SURFACE OR TIMBER MATS AS CONDITIONS DICTATE.
3. SILT FENCE, BERMS AND/OR STRAW BALE BARRIER TO BE USED AS REQUIRED TO PREVENT IMPACTS FROM OCCURRING OUTSIDE OF PROJECT LIMITS.
4. HAND CLEARED ACCESS PATH WILL BE USED TO OBTAIN WATER FROM SOURCE WHERE PERMITTED.

ENTRY SITE PLAN

SCALE: N.T.S.

FIGURE 1.3-15b(2)
TYPICAL HDD ENTRY SITE
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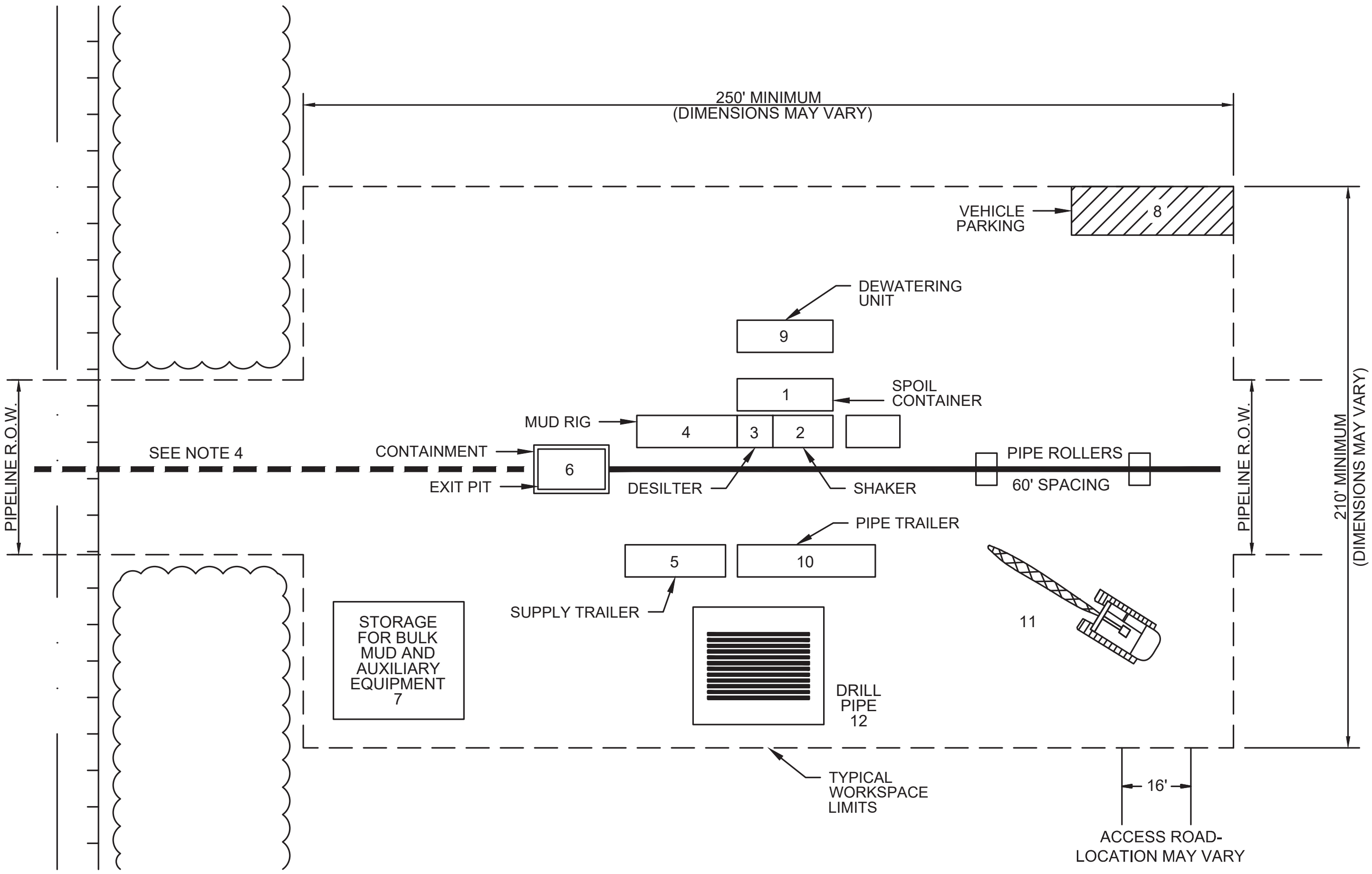
CAMERON PARISH, LOUISIANA

DRAWING NUMBER:	SCALE:	DATE:	REV:	DRAWN BY:
FIGURE 1.3-15b(2)	NONE	12/23/15	01/21/16	MFL



EQUIPMENT:

1. SPOIL CONTAINER: 8' x 20'
2. SHAKER: 8' x 12'
3. DESILTER: 8' x 8"
4. MUD RIG: 8.5' x 45'
5. SUPPLY TRAILER: 8' x 25'
6. EXIT PIT: 10' x 30'
7. STORAGE: 30' x 30'
8. VEHICLE PARKING: 15' x 50'
9. DEWATERING UNIT 15' x 50'
10. PIPE TRAILER 8' x 40'
11. CRANE: 10' x 20'
12. DRILL PIPE: 30' x 40'

NOTES:

1. EQUIPMENT ORIENTATION MAY VARY DEPENDING ON CONTRACTOR OR SITE CONDITIONS.
2. EQUIPMENT TO BE SUPPORTED ON THE GROUND SURFACE OR TIMBER MATS AS CONDITIONS DICTATE.
3. SILT FENCE, BERMS AND/OR STRAW BALE BARRIER TO BE USED AS REQUIRED TO PREVENT IMPACTS FROM OCCURRING OUTSIDE OF PROJECT LIMITS.
4. HAND CLEARED ACCESS PATH WILL BE USED TO OBTAIN WATER FROM SOURCE WHERE PERMITTED.

EXIT SITE PLAN

SCALE: N.T.S.

FIGURE 1.3-15b(3)
TYPICAL HDD EXIT SITE
CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

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28100 TORCH PARKWAY
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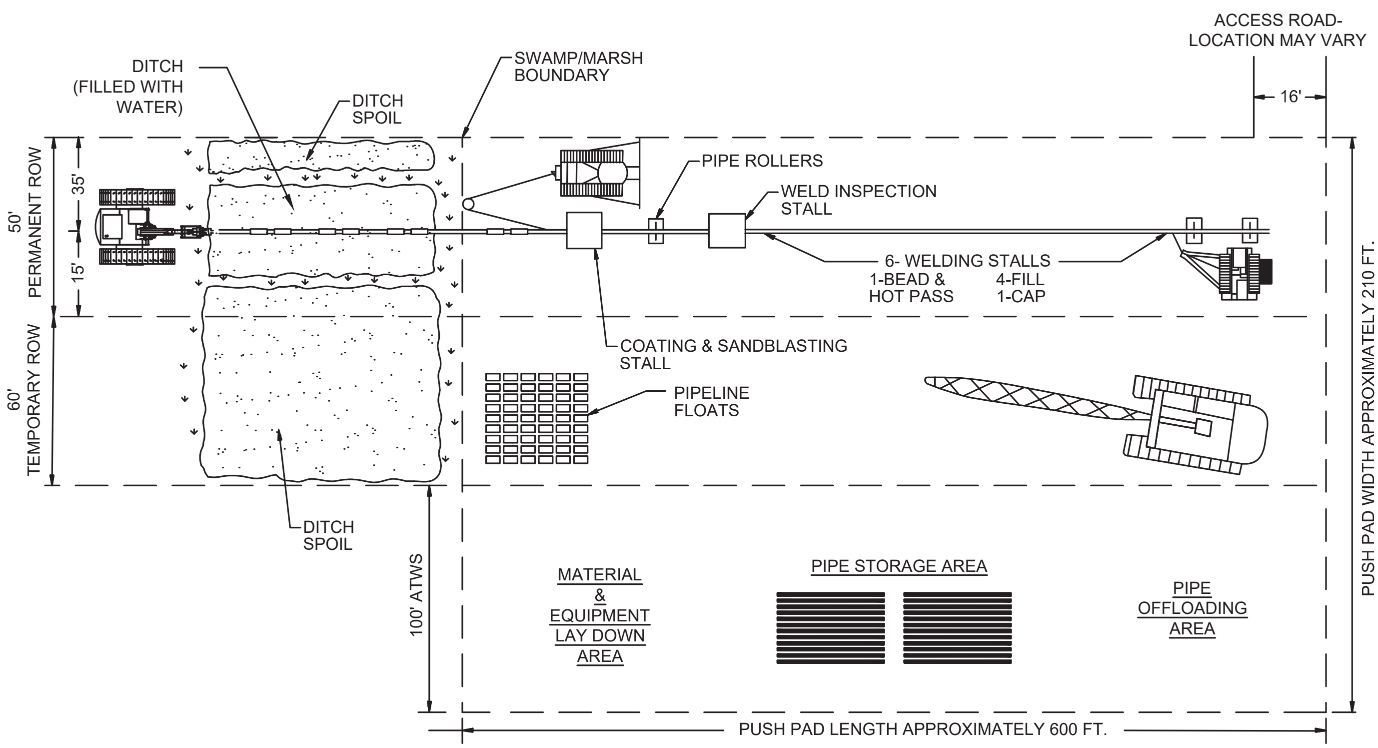
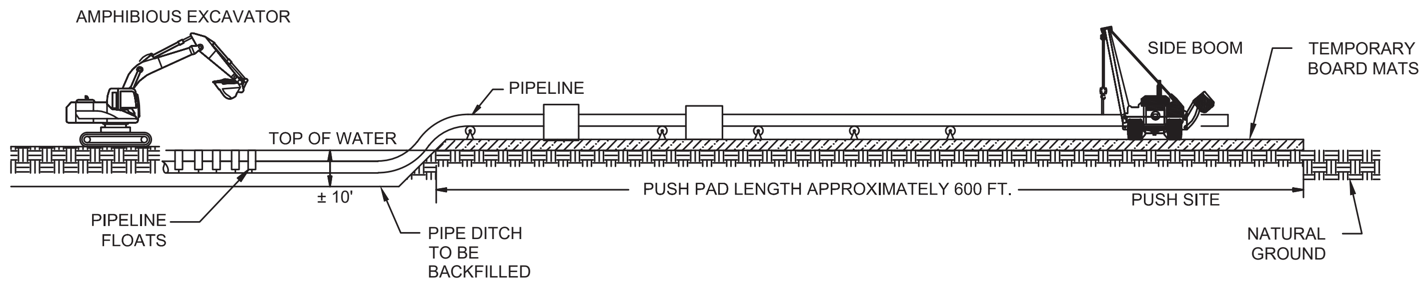
CAMERON PARISH, LOUISIANA

DRAWING NUMBER:	SCALE:	DATE:	REV:	DRAWN BY:
FIGURE 1.3-15b(3)	NONE	12/23/15	01/06/16	KJP



PLAN VIEW

NOT TO SCALE



SIDE VIEW

NOT TO SCALE

LOCATION OF PUSH SITES

WEST LATERAL MP	EAST LATERAL MP
0.01	0.99
7.45	2.77
10.70	7.83
17.48	10.04
	18.79
	19.75
	21.16

NOTES:

1. WORKSPACE SHOWN IS TYPICAL FOR MARSH-TYPE CONSTRUCTION.
2. AS THE PIPE IS WELDED, THE BULLDOZER PULLS THE STRING INTO THE DITCH.
3. TIMBER MATS ARE REQUIRED.

FIGURE 1.3-15c
TYPICAL PUSH SITE (WETLAND CROSSING)
CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

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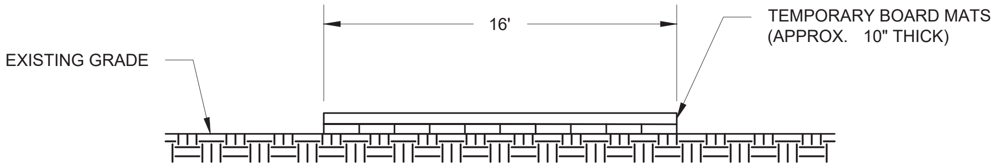
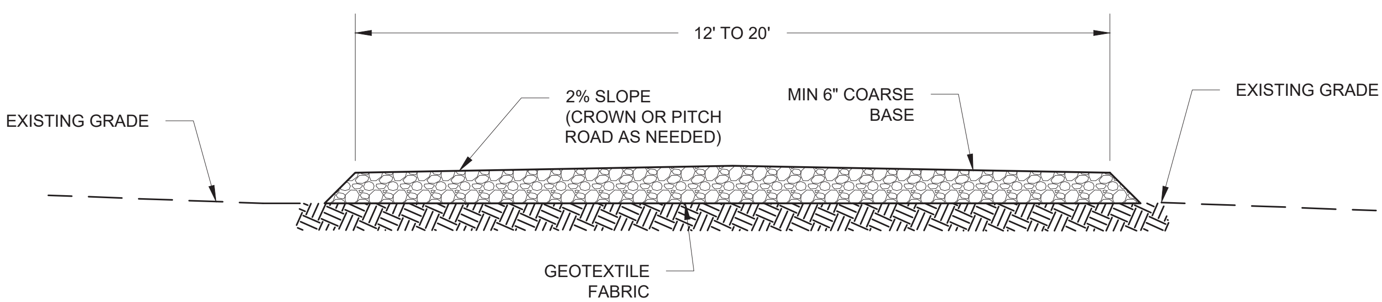
CAMERON PARISH, LOUISIANA

DRAWING NUMBER:	SCALE:	DATE:	REV:	DRAWN BY:
FIGURE 1.3-15c	NONE	07/28/2015	01/28/16	KBI



TYPICAL TEMPORARY ACCESS ROAD CROSS SECTION

NOT TO SCALE



TYPICAL PERMANENT ACCESS ROAD CROSS SECTION

NOT TO SCALE

FIGURE 1.3-15d(1)
TYPICAL TEMPORARY ACCESS ROAD AND PERMANENT ACCESS ROAD CROSS SECTION
CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

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FIGURE 1.3-15d	NONE	07/28/2015	01/28/16	KBI

APPENDIX D

HORIZONTAL DIRECTIONAL DRILL CONTINGENCY PLAN

VENTURE GLOBAL LNG

Horizontal Directional Drilling Contingency Plan

Calcasieu Pass Terminal and TransCameron Pipeline Project

Submitted By:

EN Engineering

Warrenville, Illinois

August 17, 2015

ENengineering

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TRANSCAMERON PIPELINE, LLC
CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
HDD CONTINGENCY PLAN

1.0 PURPOSE AND NEED

As part of the Calcasieu Pass Terminal and TransCameron Pipeline Project (Project) TransCameron Pipeline, LLC (TransCameron Pipeline) proposes to use the Horizontal Directional Drilling (HDD) method to install pipe across various large spans of wetlands, waterbodies, roads, utilities and other obstacles obstructing the proposed pipeline alignment. The HDD method of installation reduces disturbances during pipeline construction by passing underneath sensitive features at the surface. The HDD method avoids disturbance to the bed and bank of a waterbody being crossed, keeps sensitive environmental resources and vegetation intact, and/or allows for a highway or other fixed feature to be crossed while avoiding open cut excavation between the drill entry and exit points. However, if a natural fracture or an unconsolidated area in the ground is encountered during drilling, an unexpected release of drilling mud could occur. For consistency within this HDD Contingency Plan, an unexpected release of drilling fluid will be referred to as an inadvertent return. Due to the potential of inadvertent returns, it is important to have a thought out plan in place to establish the proper procedures and responsibilities of onsite personnel.

The objective of this HDD Contingency Plan is 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 TransCameron Pipeline will determine when a proposed HDD crossing is unsuccessful and must be abandoned.

2.0 HDD PROCESS

2.1 DRILLING BASICS

The HDD Method is a technically advanced process involving specialized equipment and skilled operators. The primary environmental risk associated with this construction method comes from the potential for inadvertent release of drilling mud. The supervision of inadvertent release monitoring is the responsibility of both the drilling HDD Contractor and TransCameron Pipeline.

Minimal, consistent loss of drilling mud typically occurs during the HDD operation when layers of loose sand, gravel, or fractured rock are encountered and drilling mud fills voids in those sub-surface materials. However, a significant loss of returning drill mud and a reduction in drilling pressure indicates that excessive seepage is occurring outside of the drill hole.

2.2 DRILLING MUD AND DRILLING MUD SYSTEM

The HDD Method uses drilling mud consisting primarily of water and bentonite, a naturally occurring clay. Drilling mud removes the cuttings from the drill hole, stabilizes the walls of the drill hole, and acts as a coolant and lubricant to the drill bit during the drilling process. The drilling mud mixture consists of 1 to 5 percent bentonite clay and from 0 to 40 percent inert solids from the drill hole cuttings, with the remainder being water.

The drilling mud is prepared in a mixing tank using both new and clean recycled drilling mud. The mud is pumped at rates of 200 gallons per minute (gpm) to 1,000 gpm through the center of the drill pipe to the drilling tools. Return flow is through the annulus created between the wall of the drill hole and the drill pipe. During the pilot hole drilling operation, the cuttings are returned to a small excavation at the entry point called the entry pit. From the entry pit, the returned mud is pumped to the mud processing equipment. Typically, shaker screens, desanders, desilters, and centrifuges process and remove increasingly finer cuttings from the drilling mud. The clean mud is recycled to the mixing tank for reuse in the borehole. The cuttings removed by the cleaning process are disposed of at a site approved to accept this type of material.

3.0 DRILLING MUD RELEASE

3.1 PREVENTION

The HDD method is typically used to avoid congested areas and/or to avoid disturbance of sensitive surface features, including wetlands and waterbodies. HDD does, however, present potential for surface disturbance through inadvertent drilling mud releases. Drilling mud releases are typically caused by blockage of the return flow path around the drill pipe where pressurization of the drilling mud rises above the containment capability of the overburden soil material. Pressurized drilling mud follows the path of least resistance, which may result in the drilling mud flowing to the ground surface should the annulus around the drill pipe become plugged. Releases may follow fractures in bedrock or other voids in the strata that allow the mud to penetrate the surface.

3.1.1 Suitable Material and Adequate Criteria

Prevention of drilling mud seepage is a major consideration in determining the profile of the HDD crossing. The primary factors in selecting the pipeline crossing profile include the type of soil and rock in the geological material and the depth of cover material. Cohesive soils, such as clays, dense sands and competent rock are considered ideal materials for horizontal drilling. The depth of adequate overburden is also considered.

The areas that present the highest potential for drilling mud seepage are the drill entry and exit points where the overburden depth is minimal. At both the entry and exit points, above ground containment containers will provide temporary storage for the inadvertently released drilling mud or seepage until it can be pumped back into the drilling system.

3.1.2 Pipeline Geometry

The geometry of the pipeline profile can also affect the potential for drilling fluid seepage. In a profile which forces the pipe to make compound or excessively tight radii turns, downhole pressures can build up, thereby, increasing the potential for drilling fluid seepage. The profiles for the proposed crossings minimize this potential, with very smooth and gradual vertical curves. HDD design and planning minimizes the potential for pressure buildup caused by pipeline geometry.

3.1.3 General Observations Regarding Inadvertent Returns

The risk of HDD inadvertent returns can also be reduced by evaluating these subsurface conditions prior to construction that could be conducive to inadvertent returns or drill failure:

- Highly permeable soil such as gravel;
- Soil test bore holes in close proximity to the drill path;
- Presence of rock joints or other subsurface fractures;
- Considerable differences in the elevations of HDD entry and exit points; and
- Disturbed soil, such as fill.

3.1.4 Responsibility of Drilling HDD Contractor

Project specifications will require that the HDD Contractor be fully qualified and experienced with HDD construction. The HDD Contractor will be responsible for monitoring down-hole drilling fluid pressures and drilling fluid flows and keeping these parameters within safe limits. The HDD Contractor will also be responsible for complying with all permit requirements, technical specifications, and this HDD Contingency Plan. The HDD Contractor will be required to submit a detailed pre-construction contingency plan that supplements this plan. The plan should include measured design considerations that the HDD Contractor made in their HDD design to mitigate inadvertent returns. General HDD activities will be conducted consistent with TransCameron Pipeline's Storm Water Pollution Prevention Plan (SWPPP).

3.1.5 Training

Prior to the start of construction, the Construction Manager and EI will verify that the construction field crew members receive the following site-specific training:

- Review provisions of this HDD Contingency Plan, equipment maintenance and site-specific permit and monitoring requirements;
- Review location of sensitive environmental resources at the site and relevant permit conditions; review inspection procedures for inadvertent return prevention and be familiar with containment equipment and materials;
- Review HDD Contractor/crew obligation to temporarily suspend forward progress of the drilling upon first evidence of the occurrence of an inadvertent return and to report any inadvertent returns to the EI;
- Review operation of the control equipment and the location of control materials, as necessary and appropriate; and,
- Review protocols for reporting observed inadvertent returns and communication with appropriate regulatory agencies.

3.2 DETECTION AND MONITORING PROCEDURES

The HDD Contractor, Construction Inspector and Environmental Inspector (EI) will perform continuous monitoring of the HDD operation to ensure adequate protection/controls have been installed. As noted, field personnel will be trained regarding their responsibility to promptly report inadvertent releases to the EI onsite.

The HDD Contractor will provide a trained operator with experience in HDD techniques to monitor drilling fluid returns at the drilling mud return pits. If the EI or operator identifies seepage of drilling fluid, the EI has the authority to halt construction until the seepage is controlled and corrective action taken. The EI will be responsible for reporting any drilling fluid seepage or spill in monitoring reports and notifying the appropriate agencies as discussed below.

3.2.1 Monitoring procedures will include:

1. Inspection along the drill path;
2. Continuous examination of drilling mud pressure gauges and return flows to the surface pits; and
3. Monitoring of drilling status information regarding drilling conditions and drill profile alignments.

3.2.2 If a release occurs in a wetland or waterbody:

1. The drilling mud will be contained where practicable;
2. Continue inspection to determine any potential for movement of released drilling mud within the wetland or waterbody;
3. Collect drilling mud returns at the location for future analysis, if required; and
4. EI to provide photographic documentation and other documentation of the release (TransCameron Pipeline will keep photographs of release events on record).

Throughout the drilling and inspection effort, the HDD Contractor, Construction Inspector and EI will work together to avoid any drilling operation shut-downs. Avoiding shut-downs increases the likelihood of a successful drill and can limit the timeframe of potential inadvertent returns.

4.0 NOTIFICATION PROCEDURES

If monitoring indicates a release is occurring or has occurred, the HDD Contractor will begin containment immediately while the Construction Inspector or EI will notify TransCameron Pipeline construction management personnel immediately.

TransCameron Pipeline will notify the appropriate agencies (see appendix for contact information) immediately upon discovery of an inadvertent wetland or waterbody release, detailing the location and nature of the release, corrective actions being taken, and whether the release poses any threat to public health and safety.

5.0 CORRECTIVE ACTION

In the event that an inadvertent return is observed or suspected during an HDD crossing, it will be assessed to determine the amount of drilling mud (or slurry) being returned and the potential for the inadvertent return to reach the ground, wetland, or waterbody. Response measures will vary based on the location of inadvertent return as described below. At a minimum, the following containment, response, and clean-up equipment will be available at each bored crossing location at the time such crossing occurs:

- sand bags
- silt fence;
- plastic sheeting;
- turbidity barriers;
- shovels, pails;
- push brooms;
- squeegees;
- pumps and sufficient hose;
- mud storage tanks; and
- Vacuum truck on 24-hour call (a vacuum truck may be on site to haul return mud back to the recirculating tank.)

TransCameron Pipeline will address an inadvertent release immediately upon discovery. The following measures will be implemented to minimize or prevent further release, contain the release, and clean up the affected area.

5.1 HDD ENTRY AND EXIT LOCATIONS

There is a greater potential for drilling fluid seepage at the entry and exit locations than other areas along the HDD. In the contingency planning for the pipeline crossing, drilling fluid seepage at the entry and exit locations has been considered, and preventative actions have been developed. To contain and control drilling fluid seepage on the land area, there will be earth-moving equipment such as backhoes or small bulldozers, portable pumps, sandbags, and straw bales available at each of the drilling sites. Any drilling fluid seepage will first be contained and isolated using sandbag berms, straw bales, silt screens or other suitable structures. For larger returns, a sump may need to be excavated for containment purposes. Once the return is effectively contained, pumps or vacuum trucks will be used to remove accumulated drilling fluid and, if practical, return it to the active drilling fluid system.

If public health and safety are threatened by an inadvertent release, drilling operations will be shut down until the threat is eliminated.

5.2 WATERBODY OR WETLAND RELEASE

Straw bales and silt fences will also be on site readily available for upland and wetland containment situations. Sufficient spill-absorbent material will be on-site in the event of an inadvertent return. All inadvertent returns will be immediately contained and reported as required.

Should an inadvertent return occur within waterway, HDD Contractor will notify appropriate parties and evaluate the potential impact of the return on a site-specific basis in order to determine an appropriate course of action. In general, TransCameron Pipeline does not believe that it is environmentally beneficial to try to contain and collect drilling fluid returns in a waterway. HDD drilling fluids are nontoxic, and discharge of the amounts normally associated with inadvertent returns do not pose a threat to public health and safety. Placement of containment structures and attempting to collect drilling fluid within a waterway often result in greater environmental impact than allowing the drilling fluid returns to dissipate naturally.

The HDD Contractor will be responsible for using a drilling fluid with the appropriate viscosity, maintaining the appropriate amount of pressure, and for establishing and maintaining containment measures at each drill endpoint. If an inadvertent return is observed or suspected within a wetland or waterbody, the following measures will be implemented:

5.2.1 Wetland Locations

- Temporarily suspend forward drilling and promptly notify the Construction Manager and EI.
- Notification of an inadvertent return to the appropriate Regulatory Agencies listed in the appendix of this HDD Contingency Plan. As long as such notification is possible (e.g., there is phone service) and it does not interfere with response activities, the Regulatory Agencies mentioned above shall be notified within two (2) hours of the inadvertent return event.
- The Construction Manager and EI will evaluate wetland inadvertent returns and, in consultation with TransCameron Pipeline and Regulatory Agencies, implement appropriate response and cleanup measures. Inadvertent return slurries in or adjacent to wetlands will be removed to the extent practical and the area restored to its previous condition. Efforts to contain and recover slurry in wetlands may result in further disturbance by equipment and personnel, and possibly offset the benefit gained in removing the slurry. Because it is difficult to predict the effect of an inadvertent return and attempts to recover the slurry, any inadvertent returns within a wetland will be evaluated on a case-by-case basis, and an appropriate level of response will be implemented with the intent to minimize any further impact to the area.
    - If the amount of the inadvertent return slurry is too small to allow the practical physical collection from the affected area, it will be diluted with fresh water and/or the fluid will be allowed to dry and dissipate naturally.
    - If the amount of the slurry exceeds that which can be contained with hand-placed barriers, small collection sumps (less than 5 cubic yards) may be used to remove the slurry.
    - If the amount of the slurry exceeds that which can be contained and collected using small sumps, drilling operations will be suspended until the inadvertent return can be brought under control. Suspending drilling operations immediately is not ideal because the loss of pressure in the borehole could result in a collapse of the borehole.
    - The slurry will be stored in a temporary holding tank or other suitable structure, for reuse or disposal.

Secondary containment will be used for portable equipment brought onto the project site (such as portable pumps). Secondary containment will consist of spill basins large enough to contain the equipment or earthen berms designed to encompass the equipment, lined with polyethylene sheeting. After the inadvertent release is stabilized and any required removal is completed, document post-cleanup conditions with photographs and prepare incident report describing time, place, actions taken to remediate inadvertent release, and measures implemented to prevent recurrence, in accordance with SWPPP. Incident reports will be provided to TransCameron Pipeline and distributed to appropriate Regulatory Agencies.

If public health and safety are threatened, drilling mud circulation pumps will be turned off. This measure will be taken as a last resort because of the potential for drill hole to collapse resulting from loss of down-hole pressure. If monitoring indicates that the intake water quality at adjacent or downstream user locations is impacted to the extent that it is no longer suitable for treatment, alternative water sources (i.e., trucked or bottled water) will be provided to impacted users. TransCameron Pipeline will assist agencies with any sampling they may require.

5.2.2 Waterbody Locations

- Temporarily suspend forward progress and notify the Construction Manager and EI. The EI will monitor the extent of the slurry plume.
- Notification of an inadvertent return to the appropriate Regulatory Agencies listed in the appendix of this HDD Contingency Plan. As long as such notification is possible (e.g., there is phone service) and it does not interfere with response activities, the Regulatory Agencies mentioned above shall be notified within two (2) hours of the inadvertent return event.
- Initiate containment measures and recovery of the slurry as appropriate. Containment is not always feasible for waterway inadvertent returns. However, conditions will be assessed as to whether hand-placed containment, recovery or other measures, such as silt curtains and turbidity barriers, would be effective and beneficial at the specific inadvertent return location. Returns will be contained using sandbags and contained mud recovered by pumping or other means effectively removing the mud to the best extent practical.
- Evaluate the current drill profile (e.g., drill pressures, pump volume rates, drilling mud consistency) to identify means to prevent further inadvertent return events. Drilling operations will be suspended if the return poses a threat to human health and safety or the environment.
- Once the return is mitigated and controlled, forward progress of the drilling may resume.

5.3 UNCONTROLLABLE RELEASE

If an inadvertent release of drilling mud exceeds that which can be contained and controlled either because of volume or rate, HDD activities will cease. An evaluation will provide the probable cause of the release and the stage of the drill installation. Based on the evaluation, the measures described in the following paragraphs will be implemented.

Depending on the current stage of the installation, the HDD Contractor may choose to plug the hole near the fracture with heavyweight material (i.e., sawdust, nut shells, bentonite pellets, or other commercially available non-toxic product). If the inadvertent release of drilling mud occurs while drilling the pilot hole, the HDD Contractor may choose to back out of the hole by a predetermined distance and then create a new hole by drilling out of the original hole. Therefore, Procedures 1 or 2 listed below could occur in either order.

1. Plug the fissures/fracture, then:
   a) Pump sealers such as sawdust, nutshells, bentonite pellets, or other commercially available non-toxic products into the drill hole;
   b) Let set for an appropriate period of time (dependent upon sealant used); and
   c) Resume HDD construction activities.
2. If a fissure/fracture cannot be plugged, then, if practical:
   a) Remove drill pipe from the existing drill hole to a point where a new drill path can be attempted by drilling out of the existing hole and creating a new hole. The original hole will be abandoned and filled with bentonite and cuttings. The cuttings that are returned to the hole should only be equal to those removed from the hole. The return should not be under high pressure, therefore additional releases would not be anticipated.
   b) Resume HDD construction activities.
3. If the original drill path cannot be utilized:
   a) Abandon the original drill hole by pumping bentonite and cuttings downhole, then seal the top 5 vertical feet with grout. Grouting abandoned drill holes is an industry standard practice and serves to prevent the abandoned hole from disrupting groundwater flow.
   b) Move the drill rig to a new, adjacent location.
   c) Verify that the new, adjacent location meets the requirements of all applicable project permits and approvals. If the new, adjacent location does not meet the requirements of all applicable project permits and approvals, operations will cease until new permits and approvals are received.
   d) Design an alternative alignment for the re-drill.
   e) Begin HDD re-drill activities.

If all HDD attempts fail, then the crossing will be constructed using an alternative method after all necessary permits and approvals have been received. Failure is defined in Section 6.0.

6.0 HDD FAILURE AND ABANDONMENT CRITERIA

TransCameron Pipeline considers the failure criteria described below as sufficient reason to abandon the HDD process and install the crossing using an approved alternative method.

6.1 PILOT HOLE STEP FAILURE

The HDD installation method will be considered a failure if there are two unsuccessful attempts at completing the pilot hole. If this happens, the HDD Contractor will demobilize its equipment from the site after approval from TransCameron Pipeline.

6.2 HOLE OPENING STEP FAILURE

The HDD installation method will be considered a failure if there is one unsuccessful attempt at opening the hole to the required diameter, as long as the failure does not include losing parts of the hole opening tool or loss of the entire hole opening tool downhole. The HDD Contractor will then be allowed 7 working days to attempt to retrieve the missing tool or parts from the hole and continue the hole opening process. If failure occurs, the HDD Contractor will demobilize its equipment from the site after approval from TransCameron Pipeline.

6.3 PULLBACK STEP FAILURE

The HDD installation method will be considered a failure if there is one unsuccessful attempt at completing the pullback, unless the pipe can be removed from the hole. In the latter case, a second attempt will be made after the hole has been reopened and reconditioned with any necessary hole opening passes as determined jointly by the HDD Contractor and TransCameron Pipeline. If failure occurs, the HDD Contractor will demobilize its equipment from the site after approval from TransCameron Pipeline.

6.4 MECHANICAL BREAKDOWN FAILURE

The HDD installation method will be considered a failure if, at any point during the HDD, the HDD Contractor has a major mechanical breakdown and after either repairing or replacing the broken drilling rig or vital ancillary equipment, the drill pipe, hole opening tool, or pipeline cannot be rotated or pulled. If failure occurs, the HDD Contractor will demobilize its equipment from the site after approval from TransCameron Pipeline.

7.0 HDD ABANDONMENT APPROVALS

TransCameron Pipeline will provide on-site inspection during the HDD process to keep adequate documentation, daily progress reports, as-built information, etc., and will describe the events leading up to the HDD failure. TransCameron Pipeline will submit this documentation to the appropriate agencies notifying them of the HDD failure and TransCameron Pipeline's schedule for implementing the approved alternate crossing method as described in Section 8.0. The HDD Contractor will not demobilize until TransCameron Pipeline's approval has been received. The alternative crossing method will not be implemented until TransCameron Pipeline has received confirmation that the FERC and U.S. Army Corps of Engineers (USACE) have received the documentation of HDD failure.

8.0 HDD CONTINGENCY

If HDD failure occurs, TransCameron Pipeline will construct the proposed pipeline facilities across both wetland/ waterbody complexes using the open cut trenching method that is described in TransCameron Pipeline's Project-specific *Wetland and Waterbody Construction and Mitigation Procedures* and is the approved method for crossings outside of the designated HDD areas. Push-pull/float installation will be used where hydrological conditions and sufficient pipeline length make this approach feasible.

TransCameron Pipeline will ensure that the necessary authorizations have been obtained from the appropriate federal (FERC/USACE) and state agencies prior to the implementation of any alternative crossing methods.

9.0 REGULATORY CONTACTS

Agency Notification Requirements

1. U.S. Army Corps of Engineers –
   Safety, Security, and Occupational Health — Phone Number: 504-862-2207
   Construction Division — Phone Number: 504-862-2235

2. Louisiana Department of Environmental Quality –
   Southwest Regional Office (Billy Eakin) — Phone Number: 337-491-2667

3. Louisiana Department of Natural Resources –
   Pipeline Incidents Hotline — Phone Number: 225-342-5505

4. Federal Energy Regulatory Commission –
   Hotline: — Phone Number: 202-502-8390

APPENDIX E

COMPENSATORY MITIGATION PLAN AND BENEFICIAL USE OF DREDGED MATERIAL PLAN

VENTURE GLOBAL LNG

CALCASIEU PASS

TransCameron PIPELINE

Applicants:
Venture Global Calcasieu Pass, LLC
TransCameron Pipeline, LLC

Revised Draft
Compensatory Mitigation Plan
and
Beneficial Use of Dredged Material Plan

Prepared by
Natural Resource Group
an ERM Group Company
August 2017

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PREFACE

Venture Global Calcasieu Pass, LLC (Venture Global Calcasieu Pass) and TransCameron Pipeline, LLC (TransCameron Pipeline) (referred to separately as Applicant or collectively as Applicants)[1,2] have submitted a formal application to the Federal Energy Regulatory Commission (FERC) for authorization under the Natural Gas Act (NGA) to construct and operate natural gas liquefaction, storage, and export facilities (Terminal) as well as a pipeline lateral (East Lateral Pipeline) and appurtenant facilities (Pipeline System). This proposed development is collectively referred to as the Calcasieu Pass Terminal and TransCameron Pipeline Project or the Project. As part of the Project, the Applicants will dredge an area along the Calcasieu Ship Channel to facilitate marine transportation of the liquefied natural gas (LNG); they will also dredge and fill areas on which the Terminal, some Terminal construction support facilities, and some portions of the Pipeline System will be located.

The Applicants have each filed a joint permit application (JPA) for a Clean Water Act (CWA) Section 404/River and Harbors Act of 1899 (RHA) Section 10 permit and a Coastal Use Permit (CUP) from the U.S. Army Corps of Engineers (USACE), New Orleans District and the Louisiana Department of Natural Resources (LDNR), Office of Coastal Management (OCM), respectively. Pursuant to both state and federal law, mitigation is required to address the unavoidable impacts of the dredging and filling activities in wetlands and coastal waters. The Applicants' proposed mitigation is described in this revised Draft Compensatory Mitigation Plan, which also incorporates the Applicants' Beneficial Use of Dredged Material (BUDM) Plan.

The Project will result in unavoidable permanent impacts on approximately 143.2 acres of wetlands and waters associated with the land-based Terminal development. Of these 143.2 acres, approximately 18.6 acres are relatively low quality tidally influenced estuarine wetlands (16.4 acres), waters (1.3 acres), and mudflats (0.9 acre), while approximately 124.6 acres are generally low quality non-tidal cattle-grazed wetlands (123.4 acres) and waters (1.2 acres). With respect to the Pipeline System, the majority of construction-related impacts to wetlands and waters are considered temporary and will be mitigated through restoration to preconstruction conditions to the extent practicable. However, construction of the meter station at milepost (MP) 0.0 and two permanent access roads will result in 1.4 acres of permanent impacts on non-tidal wetlands. In total, the Project will permanently impact 144.6 acres of wetlands, waters, and mudflats, of which 126.0 acres are non-tidal and 18.6 acres are tidal. The Project will also result in unavoidable impacts on approximately 65.9 acres of submerged lands that will be dredged to facilitate LNG carrier maneuvering and berthing.

The Applicants are proposing a combination of mitigation banking and permittee-responsible marsh creation/restoration as the means of compensating for the Project's unavoidable permanent impacts on wetlands, waters, and mudflats. The banking will mitigate impacts to non-tidal wetlands; the marsh creation/restoration will primarily mitigate impacts to tidal wetlands, tidal mudflats, and waters (both tidal and non-tidal). The banking will take place at the South Fork Coastal Mitigation Bank (SFCMB), operated by Delta Land Services and located about 20 miles north of the Terminal. The marsh creation/restoration will take place at

[1] As used herein, the term "Applicant" means Venture Global Calcasieu Pass, LLC when referring to the Terminal and Marine Facilities components of the proposed development and TransCameron Pipeline, LLC when referring to the Pipeline System components. The term "Applicants" refers to both companies collectively. Each Applicant has independently completed and submitted the joint permit application form seeking authorization for its respective proposed work. This JPA Narrative is a document shared between the Applicants to describe the collective works.

[2] Venture Global Calcasieu Pass, LLC and TransCameron Pipeline, LLC are wholly owned subsidiaries of Venture Global LNG, Inc.

the East Cove Unit of the Cameron Prairie National Wildlife Refuge (CPNWR), managed by the U.S. Fish and Wildlife Service (FWS) and located about four miles north of the Terminal.

During Terminal construction, sufficient dredged material from the Calcasieu Ship Channel will be transported to the CPNWR to create/restore the appropriate offset acreage of marsh. In addition to providing compensatory wetlands mitigation, this will constitute beneficial use of dredged material, as defined by the LDNR. The remainder of the dredged material will be placed in a nearshore area about two miles southwest of the Terminal. While this placement will afford some protection for the recently restored West Beach, the Applicants anticipate that the LDNR's beneficial use requirement will be satisfied by making an appropriate volume-based contribution to the Coastal Resources Trust Fund, in accordance with Louisiana Administrative Code (LAC), Title 43, Part I, Section 723.H.

The proposed mitigation is consistent with the Louisiana Comprehensive Master Plan for a Sustainable Coast and will result in a positive impact on the ecological value of the Louisiana Coastal Zone. The proposed mitigation efforts will be undertaken in the same hydrologic basin as the Project-related impacts and will produce better than in-kind mitigation for these impacts.

The Applicants will incur a significant incremental expense to deliver dredged material to the marsh creation/restoration site(s) at the CPNWR rather than place it closer to the Terminal. The same marsh creation/restoration would otherwise require the use of federal and state funding to obtain the necessary substrate material; as such this revised Draft Compensatory Mitigation Plan allows for more public funding to be allocated to other Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) efforts, resulting in increased benefits to Louisiana's wetland resources. The SFCMB has sufficient available and appropriate credits to offset the unavoidable loss of the 124.8 acres of non-tidal wetlands that will be permanently impacted by the Project. Purchase of credits is proposed as the means to offset these impacts. The Applicants' delivery of dredged material to the CPNWR and subsequent marsh creation/restoration will be designed and measured to offset the unavoidable loss of the 18.6 acres of tidal features (wetlands, waters, and mudflats) and the 1.2 acres of non-tidal waters that will be permanently impacted by the Project (19.8 acres in total).

Through use of the interim Louisiana Rapid Assessment Methodology (LRAM), the Applicants estimate that the 19.8 acres of permanently impacted tidal wetlands/waters/mudflats and non-tidal waters will be replaced at a 1.72:1 ratio. This corresponds to 34.1 acres of marsh creation/restoration at the CPNWR, assuming a 20-year monitoring period. Under this scenario, approximately 179,000 cubic yards of dredged material would be required. However, to maximize the wetlands creation/restoration mitigation acreage and the volume of dredged material delivered to the CPNWR for this purpose, and in return for a reduced monitoring period of 5 years, the Applicants propose to deliver about 716,000 cubic yards of dredged material to the CPNWR to create/restore about 136.4 acres of wetlands.

Applying Project cost estimates for pumping of dredged material to the CPNWR, which accord with the USACE's unit pricing for pumping of dredged material (USACE, 2010b), the Applicants' supply of dredged material for 136.4 acres of marsh restoration incurs an incremental cost of between about $10 million and $13 million compared with material placement at or near the Terminal location. If a banking option were available to compensate for the loss of 19.8 acres of tidal wetlands/waters/mudflats and non-tidal waters, which these 136.4 acres are intended to offset, the comparative banking cost would likely be considerably less than the cost of marsh creation/restoration. The Applicants submit that the financial value of the dredged material provision to the CPNWR is even greater than this, because this private contribution of dredged material will allow marsh restoration in the region to advance independently of any constraints imposed by government funding cycles and amounts.

While the delivery of approximately 716,000 cubic yards of dredged material to the CPNWR will enable the Applicants to provide compensatory mitigation for permanent impacts on tidal features (wetlands/waters/mudflats) and non-tidal waters, the transportation of additional volumes to the CPNWR for beneficial use of dredged material (BUDM) is precluded by the significantly higher cost associated with delivery to this location rather than a site closer to the Terminal. The 716,000 cubic yards of dredged material proposed for delivery to the CPNWR represents sandy/silty material that would be removed first, can be pumped through a long-distance pipeline, and has acceptable substrate characteristics for marsh creation/restoration. Based on the Applicant's geotechnical studies and feedback from prospective dredging contractors, much of the approximately 4,284,000 cubic yards of remaining material to be dredged would be heavy clay that is not compatible with long-distance transportation by pipeline. Significant cost constraints and technical impracticalities prohibit the delivery of these additional volumes to the CPNWR. With an absence of other feasible beneficial use locations for this material, nearshore disposal, with a corresponding Coastal Resources Trust Fund contribution of $4.28 million, is the proposed course of action.

1.0 INTRODUCTION

The Applicants propose to convey, liquefy, store, and export natural gas. Venture Global Calcasieu Pass proposes to construct and operate the Terminal on the Calcasieu Ship Channel in Cameron Parish, Louisiana. The Terminal will be located on a portion of an 828.6-acre property for which Venture Global Calcasieu Pass has secured long-term lease agreements (Venture Global Property). The facilities to be located at this location include a liquefaction plant, two LNG storage tanks, two LNG berthing docks (Marine Facilities), an electric generation facility, and appurtenant structures. TransCameron Pipeline is proposing the development of the Pipeline System, consisting of one 42-inch-diameter, 23.4-mile-long natural gas pipeline (East Lateral Pipeline), appurtenant aboveground facilities, and two permanent access roads. The East Lateral Pipeline will bring feed gas to the Terminal from interconnection points with existing pipelines in Cameron Parish. The location and footprint of the Terminal and Pipeline System are depicted on Figure 1.

The Applicants submitted a formal application to the FERC on September 4, 2015 for approval under the NGA. The Applicants have each filed a JPA for a CWA Section 404/RHA Section 10 permit and a CUP from the USACE, New Orleans District and the LDNR/OCM, respectively. The Applicants anticipate that the FERC authorization to site, construct, and operate the facilities will be issued by fourth quarter 2017. Construction is scheduled to commence shortly thereafter and last for about 35 months, with a full facility in-service target date no later than the fourth quarter 2020.

1.1 PURPOSE

With respect to waters of the United States and state-defined wetlands, compensatory mitigation is required to offset the unavoidable, permanent losses that will occur from dredge and fill activities associated with construction of the Terminal, Marine Facilities, and Pipeline System. These losses are considered with respect to both functional value and acreage reduction. The Applicants are proposing a combination of mitigation banking and permittee-responsible marsh creation/restoration as the means of compensating for the Project’s unavoidable permanent impacts on wetlands, waters, and mudflats. The banking will mitigate impacts to non-tidal wetlands; the marsh restoration will primarily mitigate impacts to tidal wetlands, tidal mudflats, and waters (both tidal and non-tidal). The banking will take place at the SFCMB, operated by Delta Land Services and located about 20 miles north of the Terminal. The marsh creation/restoration will take place at the East Cove Unit of the CPNWR, managed by the FWS and located about four miles north of the Terminal.

This revised Draft Compensatory Mitigation Plan is a component of the JPA submitted by each Applicant to the LDNR/OCM and the USACE New Orleans District. The JPAs provide justification and analysis of the Project’s design elements, alternatives, and impacts. This revised Draft Compensatory Mitigation Plan addresses the mitigation of unavoidable permanent impacts on wetlands and waterbodies. It also serves as the BUDM Plan in accordance with LAC, Title 43, Part I, Section 723.H.

1.2 REGULATORY BASIS

Pursuant to both state and federal law, mitigation is required to address dredge/fill impacts in wetlands and coastal waters.[3]

Under USACE regulations, compensatory mitigation must be used to offset those unavoidable permanent impacts on waters of the United States that are authorized through the issuance of Department of the Army (DA) permits, pursuant to Section 404 of the CWA and/or Sections 9 or 10 of the RHA.[4] The USACE regulations set forth three types of compensatory mitigation: permittee-responsible mitigation, mitigation banking, and in-lieu fee (ILF) mitigation.[5] When evaluating compensatory mitigation options, the USACE will consider what is "environmentally preferable,"[6] and retains the discretion "to determine the appropriateness and practicability of any compensatory mitigation required for DA permits."[7]

Under LDNR regulations, compensatory mitigation is required to offset those unavoidable impacts on state wetlands that are authorized through the issuance of a CUP, pursuant to LAC, Title 43, Part I, Section 724.A. LDNR regulations also require beneficial use of material dredged from marine transportation projects.[8] LDNR regulations provide for permittee-responsible mitigation, mitigation banking, ILF mitigation, and such other mitigation as may be approved by the LDNR.[9] The LDNR regulations authorize "other compensatory mitigation options determined to be appropriate by the secretary."[10] The required BUDM can be used to satisfy mitigation requirements.[11]

This revised Draft Compensatory Mitigation Plan is consistent with the requirements and objectives of the USACE and the LDNR. The Applicants' intent to purchase bank credits to offset permanent impacts on non-tidal wetlands, in combination with permittee-responsible marsh creation/restoration at the CPNWR to offset permanent impacts on tidal wetlands, tidal mudflats, and waters (both tidal and non-tidal), will result in no, or minimal, impact on the environment and in no "net loss of coastal ecological value."[12] Similarly, the Applicants' revised Draft Compensatory Mitigation Plan will achieve the USACE's "fundamental objective" of using

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3 See Title 33 Code of Federal Regulations (CFR) § 332.3; LAC 43:I. 724.A.

4 33 CFR 332.1(a) and 332.2(a)(1).

5 33 CFR 332.1(a)(1). "Permittee-responsible mitigation" means an aquatic resource restoration, establishment, enhancement, and/or preservation activity undertaken to provide compensatory mitigation for which the permittee retains full responsibility. 33 CFR § 332.2. "Mitigation bank" means a site, or suite of sites, where resources (e.g., wetlands, streams, riparian areas) are restored, established, enhanced, and/or preserved for the purpose of providing compensatory mitigation for impacts authorized by DA permits. 33 CFR § 332.2. "In-lieu fee program" means a program involving the restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for DA permits. 33 CFR § 332.2.

6 33 CFR § 332.3(a)(1). According to USACE regulations, the district engineer determines the compensatory mitigation to be required in a DA permit, "based on what is practicable and capable of compensating for the aquatic resource functions that will be lost as a result of the permitted activity." In making this determination, the district engineer "must assess the likelihood for ecological success and sustainability, the location of the compensation site relative to the impact site and their significance within the watershed, and the costs of the compensatory mitigation project." Id. Moreover, "[r]estoration should generally be the first option considered because the likelihood of success is greater and the impacts on potentially ecologically important uplands are reduced compared to establishment, and the potential gains in terms of aquatic resource functions are greater, compared to enhancement and preservation." 33 CFR § 332.3(a)(2).

7 USACE, Final Rule, 73 Fed. Reg. 19,632 (2008).

8 LAC 43:I.723.H.1.a.

9 LAC 43:I.724.

10 LAC 33:I.724.E.1.d.

11 LAC 33:I.707.B and LAC 33.I.723.H.3.a.

12 See LAC 43.I.724.B.1.c.

compensatory mitigation to offset environmental losses from unavoidable impacts on waters of the United States.[13]

This revised Draft Compensatory Mitigation Plan complies with USACE and LDNR mitigation requirements and their regulatory bases.

1.3 SITE DESCRIPTION

The Project has three distinct components: the Terminal, the Marine Facilities, and the Pipeline System, as further summarized below. The Terminal and Marine Facilities will be located on a portion of the 828.6-acre Venture Global Property (see Figure 2). The Venture Global Property consists of largely undeveloped land on the east side of the Calcasieu Ship Channel, with the southernmost boundary located approximately 500 feet north of the Gulf of Mexico in Cameron Parish, Louisiana. It is bordered by the Calcasieu Ship Channel to the west, a parish road (Davis Road) and commercial waterfront businesses to the north, private property used for raising cattle to the east, and the Cameron Jetty Pier Facility and state lands along the Gulf of Mexico shoreline to the south. The Pipeline System will extend about 23.4 miles eastward from the east edge of the Venture Global Property to a point of interconnect with two existing transmission pipeline systems.

Terminal

Terminal development includes the construction of a marine berm on the west side of the Terminal Site, a steel pile floodwall on the east, north, and south sides, and placement of fill material to achieve a uniform grade elevation inside the wall/berm. Facilities to be located inside the wall/berm include a liquefaction plant, two LNG storage tanks, an electric generation facility, and appurtenant structures. Marine Facilities, to be located outside and adjacent to the western berm, include two LNG berthing docks within a dredged and excavated berthing area. The Terminal also includes two permanent access roads (Northwest Access Road and Northeast Access Road) and an administration/security building complex located outside the berm. The Terminal Site as defined in this revised Draft Compensatory Mitigation Plan includes the walled/bermed area, ramps for the access roads across the berm and wall, and the administration/security building complex located outside the berm. A separate restricted access service road, the Southwest Service Road, will be constructed between the Northeast Access Road and Cameron Parish's Jetty Pier Facility south of the Terminal Site. This gravel road will border the east and south perimeter wall and provide restricted access to/from the Jetty Pier Facility.

In addition to the permanent operational area occupied by the Terminal described above, certain areas will be utilized to provide temporary support during construction. These include several temporary workspaces (TWS) and two temporary access roads (DeHyCo Access Road and Martin Access Road) located outside the perimeter berm but on the Venture Global Property.

Venture Global Calcasieu Pass has secured agreements to temporarily use five existing marine industrial yards for construction support. Four of these construction support facilities are located on the Calcasieu Pass Channel in the vicinity of the Venture Global Property and are identified as the Martin Support Facility, DeHyCo Support Facility, Baker Hughes Support Facility, and Liberty Support Facility. They will be variously used for the receipt and storage of

[13] 33 CFR 332.3(a).

bulk materials, large equipment, and other supplies delivered by barge during construction. In addition, one or more temporary concrete batch plants will be installed at one or more of these facilities.

A fifth construction support facility (Mudd Support Facility) will be located at an existing marine industrial yard on the west bank of the Calcasieu Ship Channel, opposite the Terminal. This facility will be used for construction worker parking and as a point of embarkation/debarkation for these workers crossing the Calcasieu Ship Channel via a private ferry service. The reciprocal point of embarkation/debarkation of the east side of the Calcasieu Ship Channel will be at one of the four Construction Support Facilities on the Calcasieu Pass Channel.

Marine Facilities

Creation of the berthing area will require dredging and excavation to a depth of -44.3 feet North American Vertical Datum of 1988 (NAVD 88) (-42 feet Mean Low Gulf [MLG]) from near the Federal Navigation Channel's eastern limit within the Calcasieu Ship Channel to a line eastward of the existing shoreline. The berthing area will include a turning basin and two LNG carrier loading docks. The docks will be constructed as steel-pile supported structures and will collectively include 2 loading platforms, 8 breasting dolphins, 12 mooring dolphins, and 6 intermediate walkway supports.

Pipeline System

The Pipeline System consists of the East Lateral Pipeline, appurtenant aboveground facilities (meter station and mainline valves), and permanent access roads. The East Lateral Pipeline is a 42-inch-diameter steel pipeline extending in length eastward for about 23.4 miles from the Terminal to a point of interconnect with two existing transmission pipeline systems. In water-saturated or inundated areas, the steel pipe will be installed with a 6-inch-thick concrete coating to achieve negative buoyancy, giving an overall outside diameter of 54 inches. The pipeline will be installed using a combination of horizontal directional drill (HDD), push, and upland trenching methods. To support pipeline construction, 22 temporary access roads, 2 permanent access roads, and 1 temporary contractor yard will be required. The permanent access roads will also provide operational access to the meter station and stand-alone mainline valve.

2.0 AVOIDANCE AND MINIMIZATION

Avoidance and minimization of impacts on resource areas have been principal factors in Project planning. Multiple site locations and layouts were examined to identify the most suitable location to construct the Terminal. The proposed Terminal location minimizes loss and fragmentation of high quality habitat, while offering the necessary frontage on the Calcasieu Ship Channel. The Terminal will be situated within previously disturbed habitat affected by a road, cattle grazing, oil and gas activities, and construction and maintenance of the Calcasieu Ship Channel, including dredged material disposal. The lateral pipeline will be substantially collocated with existing linear rights-of-way to minimize impacts on undisturbed natural communities. As described in the revised JPA Narrative, the Project has been reconfigured since the original JPA was filed in August 2015 and permanent wetland impacts have been reduced from 215.0 acres to 144.6 acres.

The Terminal location was chosen based on sufficient property size and waterfront area, distance from residential areas, proximity to the coastal shoreline (which favors the beneficial use of dredged material for shoreline and/or marsh improvement projects), and minimization of impacts on higher quality wetland habitat. Further analysis of alternative locations is contained in the revised JPA Narrative. Wetland delineations performed within the Venture Global Property indicate the presence of generally low quality estuarine and palustrine wetlands. The layout of the Terminal Site was designed to avoid 281.9 acres (60 percent) of wetlands and waterbodies by placing facilities in a compact and efficient layout.

The proposed East Lateral Pipeline is collocated with existing pipelines, electric transmission lines, and/or roads for approximately 86 percent of its length. The pipeline will be constructed using HDD and “push method” techniques to avoid or minimize wetland and waterbody impacts. The HDD method eliminates surface impacts along the pipeline route between the drill entry and exit points; the push method reduces impacts because pipe joints are stored and welded at staging areas rather than parallel to the trench as in conventional methods, thereby reducing equipment use and traffic flow along the right-of-way. As a result of the reduced space demands, the push method allows a reduction in the width of the construction right-of-way compared with conventional methods in comparable conditions, in this case a decrease from 125 to 110 feet. This combination of collocation, construction right-of-way width reduction, HDD, and push method construction minimizes habitat fragmentation and impacts on wetlands and waters.

Since the original JPA was filed in August 2015, the Pipeline System has been reduced from 42.7 miles to 23.4 miles through removal of the previously proposed West Lateral Pipeline and permanent wetland impacts have been reduced from 2.8 acres to 1.4 acres. The locations and footprints of the pipeline temporary workspaces, contractor yard, and temporary access roads were optimized to minimize the spatial extent and impacts of these temporary features. For example, several potential contractor yard locations were originally evaluated, of which one was selected, using wetland impact minimization as a principal selection criterion. The impacts associated with installation of the pipeline itself are considered temporary and, following construction, preconstruction conditions will be restored to the extent practicable.[14]

The proposed locations and footprints of the Pipeline System’s permanent facilities were optimized to minimize impacts by collocating near existing pipeline-related facilities operated by others. The nearby collocation minimizes fragmentation of wetlands and waterbodies to the greatest extent practicable. Mitigation of the unavoidable impacts attributed to the Pipeline System’s permanent facilities is included in this revised Draft Compensatory Mitigation Plan.

3.0 WETLANDS AND ESSENTIAL FISH HABITAT

On behalf of the Applicants, Natural Resource Group, LLC, an ERM Group Company (NRG/ERM) and SWCA Environmental Consultants performed wetland delineations of the Venture Global Property in several separate mobilizations between October 2014 and February 2016. Wetland delineations were similarly conducted in several separate mobilizations by

[14] In accordance with LDNR standard procedures and the Project-specific Wetland and Waterbody Construction and Mitigation Procedures (based on FERC Procedures), the Applicants will restore temporarily disturbed locations to preconstruction conditions, as assessed and to the level determined appropriate after one full growing season following the end of construction disturbance. Areas not deemed sufficiently restored will either be reworked and monitored by the Applicants, under agreement with the LDNR and other pertinent federal and state agencies, or will be quantified and post-construction mitigation will be agreed upon in coordination with the appropriate agencies.

NRG/ERM on the East Lateral Pipeline route between December 2014 and April 2016.[15] All delineation surveys were conducted in accordance with the routine determination procedures described in the USACE Wetland Delineation Manual (1987 Manual) (USACE, 1987) and Regional Supplement to the USACE Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region, Version 2 (Regional Supplement) (USACE, 2010a). The results of the wetland delineations were submitted to the USACE New Orleans District with successive requests for Jurisdictional Determination.

3.1 VENTURE GLOBAL PROPERTY

Approximately 471.8 acres of jurisdictional wetlands, waters, and mudflats were identified within the 828.6-acre Venture Global Property. In designing the Terminal layout to minimize environmental impacts, approximately 281.9 acres of the wetlands, waters, and mudflats will be avoided, resulting in a total impact of approximately 190.0 acres for these features, of which 46.7 acres will be temporarily affected and 143.3 acres will be permanently affected. Based on the Cowardin classification system, the wetland types identified included estuarine emergent, estuarine scrub-shrub, estuarine mosaic, palustrine forested, palustrine emergent, and palustrine scrub-shrub. The wetlands were generally identified as being of low quality due to previous disturbance associated with altered hydrology, fill activities, adjacent development, oil and gas exploration and production (wells, well pads, access roads, etc.), and cattle grazing. The delineated wetlands, waters, and mudflats within the Venture Global Property are depicted on Figure 2. A summary of these features, including classifications, surveyed acreages, and impact details for the Terminal and Marine Facilities, is presented in Table 1.

Of the wetlands and waters affected by development of the Terminal and Marine Facilities, approximately 17.4 acres of medium-quality tidal saline marsh fronting the Calcasieu Ship Channel are eligible for consideration as essential fish habitat (EFH) for red drum, reef fish, coastal migratory pelagics, and shrimp due to tidal hydrologic connectivity with mapped EFH areas (National Marine Fisheries Service [NMFS], 2015).

West of the existing shoreline, approximately 65.9 acres of non-vegetated open water will be affected by dredging of the LNG carrier berthing area and turning basin. This area includes a portion of the Calcasieu Ship Channel that is mapped as EFH for red drum, reef fish, coastal migratory pelagic species, and shrimp. The NMFS and the Gulf of Mexico Fisheries Management Council cooperatively manage these species groups and their habitat under fisheries management plans.

The wetland delineations of the Venture Global Property indicate plant communities with a diversity of fresh, intermediate, brackish, and salty prairie species. The observed vegetation was categorized into five habitat types based on the following factors:

- location with respect to Davis Road;
- species salinity tolerances;

[15] Under separate cover, the Applicants submitted five Wetland and Waterbody Delineation Reports - dated June 16, 2015; June 30, 2015; August 25, 2015; March 7, 2016; and May 11, 2016 - to the USACE, New Orleans District, Surveillance and Enforcement Division. The same information, with additional mapping as requested by the USACE, was submitted on October 18, 2016. The USACE issued a Preliminary Jurisdictional Determination for the Project on January 9, 2017.

TABLE 1

Calcasieu Pass Terminal and TransCameron Pipeline Project
Summary of Wetland and Waterbody Impacts

Facility	Wetland Type	Permanent Impacts (acres)
VENTURE GLOBAL PROPERTY		
Tidal Wetlands and Waters		
Terminal Site	Estuarine Emergent	2.40
	Estuarine Scrub-Shrub	0.68
	Mudflats	0.30
	Waters	0.06
Marine Facilities (area removed by excavation)	Estuarine Emergent	6.59
	Estuarine Scrub-Shrub	6.76
	Mudflats	0.63
	Onshore Waters	0.14
	Calcasieu Ship Channel Waters	1.06
Tidal Subtotal		**18.63**
Non-tidal Wetlands and Waters		
Terminal Site	Estuarine Emergent	11.77
	Estuarine Scrub-Shrub	0.03
	Estuarine Mosaic	14.02
	Palustrine Emergent	61.20
	Palustrine Scrub-Shrub	28.90
	Waters	1.18
Martin Access Road	Estuarine Emergent	0.72
	Palustrine Emergent	0.07
Northeast Access Road	Estuarine Emergent	0.46
	Palustrine Emergent	2.65
	Palustrine Scrub-Shrub	0.02
	Waters	0.06
Southwest Service Road	Estuarine Emergent	0.23
	Estuarine Mosaic	0.07
	Palustrine Emergent	0.17
Marine Facilities (area removed by excavation)	Estuarine Emergent	3.08
Non-tidal Subtotal		**124.63**
PIPELINE SYSTEM		
Non-tidal Wetlands		
Aboveground Facilities	Estuarine Scrub-Shrub	1.24
	Palustrine Emergent	0.12
Non-tidal Subtotal		**1.36**
PROJECT SUMMARY		
Tidal Wetlands Total		**16.43**
Tidal Waters Total		**1.26**
Tidal Mudflats Total		**0.93**
Tidal Features Total		**18.62**
Non-tidal Wetlands Total		**124.75**
Non-tidal Waters Total		**1.24**
Non-tidal Features Total		**125.99**
PROJECT TOTAL		**144.61**

- defined habitat types where the same species have been observed and recorded elsewhere by research scientists and governmental agencies;
- tidal influence from the Calcasieu Ship Channel and tropical storm tides; and
- localized watershed rainfall.

The five habitat types are:[16]

- tidal, brackish-saline herbaceous-scrub marsh;
- non-tidal brackish-saline, herbaceous-scrub marsh;
- non-tidal, herbaceous-scrub, salty prairie;
- non-tidal, fresh-intermediate, herbaceous-scrub marsh; and
- non-tidal, fresh-intermediate forested wetland.

The vegetation was categorized using salinity tolerances and habitat information from Radford et al. (1968), Chabreck and Condrey (1979), Stutzenbaker (1999), Allain and Sylva (2007), Flora of North America (2015), Louisiana Natural Heritage Program (2015), and the Natural Resources Conservation Service (2015).

Davis Road is a public road running north-south through the western side of the Venture Global Property. The road acts as a hydrologic and tidal barrier; therefore, only the marsh lying west of Davis Road is influenced by diurnal tides. Davis Road was constructed at an elevation greater than the mean high water and impedes a diurnal tidal exchange eastward. There are three corrugated metal pipe culverts beneath Davis Road: one is gated (Cameron Parish Drainage District No. 3), preventing flow eastward but allowing flow westward; the other two are not gated and have been observed without water flow.[17]

Given the hydrologic barrier afforded by Davis Road and landscape position, the salinity tolerances of species recorded east of Davis Road are influenced by storm-induced saltwater ponding rather than tidal effects. This ponding causes increased soil salinity by evaporation in some areas, whereas the soil salinity in other areas is diluted by rainfall runoff. These conditions create a spatially diverse mix of two common coastal southwestern Louisiana habitats as described below.

- The non-tidal brackish-saline herbaceous-scrub marsh east of Davis Road is subject to sporadic tropical storm surges resulting in saltwater ponding and potential minor inflows from one-way flap-gated water control structures designed to release water. In addition, areas supporting this habitat type within the Venture Global Property are at a higher elevation than the average daily mean high tide. Therefore, storm-induced saline water ponding within this area causes saline elements to eventually become concentrated by evapotranspiration and then to be diluted by rainfall events. The non-tidal brackish-saline herbaceous-scrub marsh east of Davis Road has been

[16] The vegetation and landscape-based habitat descriptions enable descriptive habitat analysis beyond the Cowardin classifications. Generally, the tidal brackish-saline marsh, the non-tidal brackish-saline marsh, and the herbaceous-scrub salty prairie habitats align with an estuarine classification, whereas the non-tidal fresh-intermediate herbaceous-scrub marsh aligns with the palustrine marsh and transitions between palustrine and estuarine classifications under the Cowardin classification.

[17] Water flow between the east and west sides of Davis Road was observed at open culverts on June 23, 2015. At the southern and middle culverts, no water was observed flowing under the road. However, at the northern gated culvert, water was observed flowing westward through the flap gate.

classified as such based on the habitat descriptions and salinity tolerances of species listed in brackish and salt marsh, tidal flat, and interior salt flats.

- The non-tidal herbaceous-scrub salty prairie, non-tidal fresh-intermediate herbaceous-scrub marsh, and non-tidal fresh-intermediate forested wetland habitat types within the Venture Global Property are subject to sporadic tropical storm tides and rainfall runoff from adjacent ridges. The longitudinal ridges and swales lying east to west allow for the reduction of salinities and establishment of fresh-intermediate marsh species. The non-tidal herbaceous-scrub salty prairie designation applies to the descriptions of several habitat types with similar species and salinities, including interior salt flat, coastal dune grassland, saline prairie, coastal dune shrub, salty prairie, and coastal prairie. The non-tidal fresh-intermediate herbaceous-scrub marsh designation reflects increased species diversity, lower salinity tolerances, landscape positioning (swales), and localized rainwater runoff. The non-tidal fresh-intermediate herbaceous-scrub marsh designation applies to the descriptions of upland, fresh marsh, intermediate marsh, coastal dune grassland, coastal dune shrub thicket, and coastal prairie.

3.2 PIPELINE SYSTEM

Along the East Lateral Pipeline, a total of 356.8 acres of waters and wetlands are located within the construction limits. Pipeline construction will result in 1.4 acres of permanent impact on wetlands associated with aboveground facilities and access roads.

4.0 COMPENSATORY MITIGATION AND BENEFICIAL USE

Compensatory mitigation is required to offset the acreage and/or functional loss of wetlands and waters permanently affected by the Project.[18] A summary of permanent acreage impacts by habitat type and proposed mitigation is presented in Table 2.

[18] 33 CFR §§ 332.1(a) and 332.2(a)(1).

TABLE 2
Permanent Impact Acres by Habitat Type

Habitat Type	Permanent Impacts (Acres)	Proposed Mitigation
Estuarine Emergent Wetlands (Tidal)	9.0	
Estuarine Scrub-Shrub Wetlands (Tidal)	7.4	
Mudflats (Tidal)	0.9	
Waters (Tidal and Non-Tidal)	2.5	
Subtotal:	**19.8**	Marsh Restoration at CPNWR
Estuarine Emergent Wetlands (Non-Tidal)	16.3	
Palustrine Emergent Wetlands (Non-Tidal)	64.3	
Estuarine Mosaic Wetlands (Non-Tidal)	14.1	
Subtotal:	**94.7**	Fresh-Intermediate Marsh Credits at SFCMB
Estuarine Scrub-Shrub Wetlands (Non-Tidal)	1.2	
Palustrine Scrub-Shrub Wetlands (Non-Tidal)	28.9	
Subtotal:	**30.1**	Coastal Prairie Credits at SFCMB
Tidal Wetlands Total:	**16.4**	
Non-Tidal Wetlands Total:	**124.8**	
Tidal Mudflats / Tidal & Non-Tidal Waters Total:	**3.4**	
Project Total:	**144.6**	

Mitigation for impacts on wetlands and waters can be accomplished through mitigation banks, ILF programs, and/or permittee-responsible mitigation. There is currently a lack of regional mitigation banks with the existing or forecasted ability to provide tidal marsh credits and the provision of credits for other wetland types affected by the Project is subject to the development schedules of both the banks and the Project being compatible.[19] The ILF program in the Project vicinity is reported to have limited capacity to mitigate for unavoidable impacts.

The Applicants are proposing the purchase of mitigation bank credits to compensate for the unavoidable loss of non-tidal wetlands, which comprise 124.8 acres of the Project's 146.6 acres of permanently impacted wetlands, waters, and mudflats. Currently, sufficient appropriate credits are available at the SFCMB, located in Cameron Parish about 20 miles north of the Project, which is in the primary service area of the bank. The Applicants have established a binding agreement with the bank's owner, Delta Land Services, such that the required credits for non-tidal wetlands are available for purchase. However, with respect to tidal wetlands, which account for 16.4 acres of the Project's 146.6 acres of permanently impacted wetlands, waters, and mudflats, neither the SFCMB nor any other regional mitigation bank has the existing or forecasted ability to provide appropriate credits. Similarly tidal waters and tidal mudflats, which account for 1.3 acres and 0.9 acre of the Project's permanent impacts respectively, cannot be mitigated through existing or forecasted regional banking options. As such, the Applicants are proposing permittee-responsible mitigation to offset the permanent loss of the 16.4 acres of tidal wetlands, 1.3 acres of tidal waters, and 0.9 acre of tidal mudflats; in addition, permittee-responsible mitigation will be used to offset the permanent loss of 1.2 acres of non-tidal waters. This amounts to 19.8 acres of impacts that will be offset by permittee-responsible mitigation.

[19] 33 CFR § 332.1(a)(1); LAC 33:I.724.E.1.

To offset the permanent loss of the 19.8 acres of tidal wetlands, tidal mudflats, and waters (both tidal and non-tidal), as described above, the Applicants are proposing that a portion of the material dredged from the Calcasieu Ship Channel during construction of the Marine Facilities be delivered to the East Cove Unit of the CPNWR to create/restore an appropriate offset acreage of marsh. In this way, the dredged material will be used beneficially to create and restore better than in-kind[20] compensation for impacts on wetlands, waters, mudflats, and EFH. The remainder of the material dredged from the Calcasieu Ship Channel during construction of the Marine Facilities will be placed in a nearshore area off the West Beach and about one to two miles southwest of the Terminal, affording some protection for the recently restored beach.

This revised Draft Compensatory Mitigation Plan is consistent with the requirements and objectives of the LDNR and USACE. Implementation of the Applicants' revised Draft Compensatory Mitigation Plan will ensure no "net loss of coastal ecological value,"[21] will produce no or minimal environmental impacts, and will provide for creation and restoration of higher quality marsh to offset some or all the Project's unavoidable permanent impacts on waters of the United States, which are characteristically low quality cattle-grazed wetlands and waters. Further, this revised Draft Compensatory Mitigation Plan achieves the USACE's "fundamental objective" to offset environmental losses resulting from unavoidable impacts on waters of the United States authorized by DA permits.[22] Accordingly, the Applicants request that the LDNR and USACE approve this revised Draft Compensatory Mitigation Plan.

4.1 MITIGATION ALTERNATIVES SELECTION AND REVIEW PROCESS

The Applicants concurrently studied three mitigation alternatives for offsetting unavoidable permanent impacts on wetlands and waterbodies: mitigation bank credit purchases, ILF payments, and permittee-responsible marsh creation/restoration. The Applicants' studies to date have indicated that one regional mitigation bank (SFCMB) currently offers suitable and sufficient credits to address a significant portion of the Project's compensatory mitigation requirements. To the extent that mitigation banking can be used to provide compensatory mitigation, the Applicants intend to pursue this option and provide additional mitigation, as required, through permittee-responsible marsh creation/restoration. Each of the three mitigation options and the Applicant's corresponding evaluation are discussed in more detail below.

Mitigation Bank Credit Purchases

Based on search parameters that include geographic location, watershed compatibility, wetland types, and potential credit availability, the Applicants identified three mitigation banks for further consideration: SFCMB, Aurore Ranch, and Mangrove Bayou.

- The SFCMB, which is located 20 miles from the Project can offer suitable compensation for a significant portion of the Project-related impacts based on current credit availability and wetland type compatibility. The SFCMB and the Terminal are located in the Coastal Zone and within the Lower Calcasieu Watershed (U.S. Geological Survey Hydrologic Unit Code 08080206). The SFCMB can provide coastal prairie and fresh/intermediate marsh credits, which are considered in-kind

[20] "In-kind" means a resource of a similar structural and functional type to the affected resource. 33 CFR § 332.2.

[21] LAC 43:I.724.B.1.c.

[22] 33 CFR § 332.2(a)(1).

compensation for permanent impacts on the non-tidal wetlands east of Davis Road at the Terminal location and at the aboveground facility sites on the Pipeline System.[23]

- The Aurore Ranch mitigation bank is currently approved by the USACE and has available intermediate marsh credits. The bank is located approximately 75 miles east of the Terminal and is within a different hydrologic basin. However, the Project is considered within the primary service area of the bank; therefore, the bank may be a viable mitigation option for a portion of the required credits. However, the bank does not currently have the capacity to handle all the required credits.

- The Mangrove Bayou mitigation bank is still in the proposal stage and may, pending approval and construction, provide brackish marsh credits. The Mangrove Bayou mitigation bank is located approximately 11 miles northeast of the Terminal Site, adjacent to Calcasieu Lake. The Project is within the same primary service area and hydrologic basin as the bank. Due to the uncertain approval and construction schedule, this mitigation bank is currently deemed an unreliable mitigation option.

Other mitigation banks were identified, but were not considered further due to their location outside the Project's hydrologic basin and/or the Coastal Zone. No geographically relevant mitigation banks were identified with currently available or proposed tidal marsh credits.

ILF Payments

The use of ILF payments was considered as a compensatory mitigation alternative. The Rules and Procedures for Mitigation outlined at LAC 43:I.724 state that compensatory mitigation may be accomplished by monetary contribution to the affected parish or Louisiana Wetlands Conservation and Restoration Fund (ILF/Coastal Mitigation Account) if more suitable options are not available to produce the required habitat benefits. The amount of the monetary contribution is determined by the LDNR/OCM and is derived from a formula for the average cost

[23] Because of the historical existence of prairie habitat in the Project area, it is acceptable to consider coastal prairie credits as "in-kind" for a large portion of the Project impacts. The Western Gulf Coastal Plains Level 3 Ecoregion (WGCP3) is part of the Great Southwest Prairies region (wherein both the Project and SFCMB are also located). This region of Louisiana was historically dominated by species of grasses, graminoids (e.g., grass-like forms, sedges, and rushes), and forbs (e.g., broadleafs, composites, and legumes).

Much of the historic Cajun prairie was converted for agricultural production. Today, many agricultural areas remain in production or have been abandoned. The Venture Global Property, within which the Terminal will be located, has been managed as unimproved pasture with heavy cattle grazing. Heavy grazing pressure and the lack of quality cover burns has selected for many scrub-shrub species. Once shrub species are established, they shade out grass species that provide fuel for producing quality cover burns. Had the impact area been maintained with moderate grazing pressure and rotational prescribed fire, the community would show a greater presence of coastal prairie species with high conservation values. However, many of the historic prairie species of high conservation status have been selected against and the plant community is dominated by prairie species with low to moderate conservation status.

The majority of the Project area is typified by gently undulating ridge-swale topography. Historically, the ridges and swales generally consisted of upland and lowland high conservation prairie species, respectively. The Venture Global Property likely resembled a prairie-marsh savannah with few trees on the Hackberry soils at higher elevations, a coastal prairie and high marsh community on the Mermentau soils at mid elevations, and fresh, intermediate, and brackish marsh wetlands on Creole soils in the swales at the lowest elevations. The hydrology was most likely driven primarily by rainfall, high water tables, and limited tidal action originating from natural drainage patterns.

Today, portions of the Venture Global Property are comprised of dredged material and a majority of the area is impounded by Davis Road. The hydrology east of the road has been manipulated with a forced drainage electrical pump and gravity drain, flap-gated culvert that only allows water to flow out of the impact area. During heavy rains, the remaining swale depressions fill with fresh water. Alternately, the depressions are filled with brackish to saline waters during tropical storm events.

Based on previous federal and state permitted actions and site conditions, the Applicants understand that coastal prairie and fresh/intermediate marsh are suitable in-kind mitigation for the fresh-intermediate and salty prairie habitats occurring within the impact area.

per acre of marsh habitat based on similar projects (i.e., CWPPRA projects), with the addition of a market factor.

The Applicants understand that ILF mitigation is currently unavailable to compensate for the Project impacts. However, publically available correspondence related to the Port Cameron, LLC project, together with agency discussions, indicate that the LDNR and the USACE are working to expand the ILF program; therefore, ILF mitigation may be a viable option in the future.

In the event that ILF mitigation becomes available, the Applicants reserve the right to use the state program in-lieu of the revised Draft Compensatory Mitigation Plan described herein. However, the Applicants believe that the impacts from the proposed plan will result in no "net loss of coastal ecological value." The Applicants also believe that the proposed plan will not lead to environmental losses resulting from unavoidable impacts. As such, this revised Draft Compensatory Mitigation Plan satisfies both USACE and LDNR mitigation requirements.

An analysis of alternatives and compliance with the State of Louisiana's environmental protection mandates is provided in the JPA Narrative.

Permittee-Responsible Marsh Creation/Restoration

Based on an assessment of BUDM placement options, as described in Section 4.3, the Applicants concluded that the CPNWR represents the preferred location for marsh creation/restoration to offset losses of tidal wetlands, tidal mudflats, and waters (both tidal and non-tidal). No other on-shore site offers the same combination of suitable acreage, required habitat characteristics, relative proximity, property availability, and schedule compatibility.

During Project design, the Applicants conducted a spoil disposal cost comparison for different sites, volumes, and end uses and concluded that pumping spoil material to the CPNWR in quantities above those necessary to create/restore marsh to mitigate losses of tidal wetlands, tidal mudflats, and waters (both tidal and non-tidal) would be technically challenging and economically prohibitive, costing much more than other disposal options closer to the Terminal. The most cost effective, technologically feasible, and environmentally compatible approach, as proposed in this revised Draft Compensatory Mitigation Plan, is to place the remaining spoil material in a nearshore area off the West Beach along the Gulf shoreline, affording some protection for the recently restored beach.

4.2 PROPOSED MITIGATION

The Applicants are proposing a combination of mitigation banking and permittee-responsible marsh restoration as the means of compensating for the Project's unavoidable permanent impacts on wetlands and waters. The banking will mitigate impacts to non-tidal wetlands; the marsh restoration will mitigate impacts to tidal wetlands, tidal mudflats, and waters (both tidal and non-tidal). The banking will take place at the SFCMB, operated by Delta Land Services and located about 20 miles north of the Terminal. The marsh creation/restoration will take place at the East Cove Unit of the CPNWR, managed by the FWS and located about four miles north of the Terminal. Agency-designated beneficial use areas at this location are shown on Figure 3. The Applicants are also proposing that material dredged from the Calcasieu Ship Channel during Terminal construction be placed in a nearshore area off the nearby West Beach, affording some protection for the recently restored beach.

This revised Draft Compensatory Mitigation Plan will advance in coordination with participating agencies and under regulatory permit conditions; as such, the Applicants will make the appropriate contractual obligations, as outlined in LDNR and USACE regulations[24], to secure bank credits and undertake marsh creation/restoration.

The Applicants used the interim LRAM to determine functional quality and corresponding credit requirements for the wetland types and acreages permanently impacted by the Project. The banking credit requirements for the non-tidal wetland impacts are based on Delta Land Services' calculated credit acre values for the community types available at the SFCMB. The marsh restoration credit requirements for the CPNWR are based on a desk-top estimate of the functional quality of the existing and restored marsh at this location. The results of the overall analysis are summarized in Table 3.

TABLE 3

LRAM Assessment
Required Mitigation by Habitat and Mitigation Site

Impact by Habitat	Mitigation Site (Habitat Offset Type)	Permanent Impacts	LRAM Credits/Acre Offered	LRAM Credits Required	Mitigation Acres Required
Tidal Brackish-Saline Marsh, Tidal/Non-Tidal Waters & Tidal Mudflats	CPNWR (Brackish-Saline Marsh)	19.86	7.0	238.3	34.1[a]
Non-Tidal Emergent Wetlands and Mosaic	SFCMB (Fresh-Intermediate Marsh)	94.64	5.9	1,135.7	192.5
Non-Tidal Scrub-Shrub Wetlands	SFCMB (Coastal Prairie)	30.15	6.1	361.8	59.4
	Totals:	144.65		1,735.8	286.0

[a] 34.1 acres generated through marsh restoration at the CPNWR is the minimum mitigation offset and would require monitoring and maintenance over 20 years. However, the Applicants are proposing to increase the offset acreage by a multiple of 4, thereby generating 136.4 acres of marsh and reducing the period of monitoring and maintenance to 5 years.

During Terminal construction, sufficient dredged material from the Calcasieu Ship Channel will be transported to the CPNWR to create/restore the appropriate offset acreage of marsh. In addition to providing wetlands mitigation, this will constitute BUDM. The remainder of the dredged material will be placed in a nearshore area about one to two miles southwest of the Terminal. While this placement will afford some protection for the recently restored West Beach, the Applicants anticipate that the LDNR's beneficial use requirement will be satisfied by making an appropriate volume-based contribution to the Coastal Resources Trust Fund, in accordance with LAC, Title 43, Part I, Section 723.H.

Initial estimates indicate that approximately 2.0 million cubic yards (*in-situ*) of material will be excavated landward of the existing shoreline at the Terminal Site and approximately 2.8 million cubic yards (*in-situ*) of material will be dredged seaward of the existing shoreline to the eastern limit of the Calcasieu Ship Channel, to reach the required water depth of -44.3 NAVD 88 for the LNG carrier berthing area and turning basin. Therefore, factoring in an additional 200,000 cubic yards overdredge allowance, approximately 5.0 million *in-situ* cubic yards of material will be excavated or dredged to create the Marine Facilities.

[24] LAC 43:I.723.H.4.

Based on the interim LRAM and as indicated in Table 3, the Applicants estimate that the 19.8 acres of permanently impacted tidal wetlands, tidal mudflats, and waters (both tidal and non-tidal) would be replaced at a 1.72:1 ratio. This translates as 34.1 acres of marsh creation/restoration at the CPNWR, assuming a 20-year monitoring period. Under this scenario, approximately 179,000 cubic yards of dredged material would be required. However, to maximize the wetlands creation/restoration mitigation acreage and the volume of dredged material delivered to the CPNWR for this purpose, and in return for a reduced monitoring period of 5 years, the Applicants propose to deliver about 716,000 cubic yards of dredged material to the CPNWR to create/restore 136.4 acres of marshland.[25]

The Project's planned compensatory mitigation involving the provision of dredged material for permittee-responsible marsh creation/restoration, in combination with banking, is consistent with the Louisiana Coastal Master Plan (Coastal Protection and Restoration Authority, 2012) and focuses on replacing marsh within the same drainage basin in which the Project impacts are occurring.

For the permittee-responsible marsh restoration, the Applicants propose to utilize two areas within the west-central portion of the East Cove Unit of the CPNWR (see Figures 4 and 5). The specific locations of spoil deposition and the preliminary design of the marsh creation/restoration within these areas are based on the Applicant's evaluation of site conditions, as determined through preconstruction bathymetric, and magnetometer surveys, and the quantity of available and suitable dredged material, as determined through geotechnical surveys of the borrow area. Final design of the marsh creation area will be based in part on site-specific geotechnical investigations, which will be completed by the Applicants in 2017. Dredged material production will be balanced with the receipt capacity of the refuge site(s) and factored into development and execution of the Project's construction schedule. The Applicants will coordinate with the FWS and other participating agencies prior to construction to finalize specific placement details, including rates, locations, and depths. A preliminary marsh creation area design, including dredge pipeline alignment, containment berm construction details, and cross-sections depicting anticipated elevations of the marsh restoration area and containment berm is included in Figure 6.

Applying Project cost estimates for pumping of dredged material to the CPNWR, which accord with the USACE's unit pricing for pumping of dredged material (USACE, 2010b), the Applicants' supply of dredged material for 136.4 acres of marsh restoration incurs an incremental value of between about \$10 million and \$13 million compared with material placement at or near the Terminal location. If a banking option were available to compensate for the loss of the 19.8 acres of tidal wetlands, tidal mudflats, and waters (both tidal and non-tidal) that these 136.4 acres are intended to offset, the cost would likely be considerably less than marsh creation/restoration. The Applicants submit that the financial value of the dredged material provided to the CPNWR is even greater than this, because this private contribution of dredged material will allow regional marsh restoration to advance rather than being subject to potential delays associated with funding cycle alignment.

[25] Note that the preliminary design drawings in Figures 4, 5, and 6 indicate a dredged material delivery volume of 720,000 cubic yards and 137.0 acres of marsh creation/restoration; final numbers will be confirmed following agency review and completion of soil compaction analyses. In addition, Figure 5 indicates a total marsh restoration area of 145.3 acres, accounting for approximately 8.3 acres of existing isolated marsh fragments around which the 137.0 acres of new marsh will be developed.

Dredging during construction and long-term maintenance at the Terminal location will be primarily performed using a hydraulic cutter-suction dredge.[26] Some maintenance dredge material, depending on volume and frequency, may be removed by other methods and transported by hopper barge. For the spoil delivered to the CPNWR, a temporary slurry pipeline would be routed from the dredge area to the marsh restoration area(s) using a combination of floating, submerged, and land surface pipe sections (see Figures 4, 5, 7 and 8). From the dredging area, the pipeline route runs north within the Calcasieu Ship Channel and the East Fork of the Calcasieu River for about 5.9 miles to Calcasieu Lake, along the east and west banks of the channels with required crossings of the Federal Navigation Channel. The route runs east within Calcasieu Lake for about 2.9 miles along the south shoreline and then turns southeast into the CPNWR for about 0.6 mile. The overall route length is approximately 8.9 miles. Seven booster pumps on floating platforms will be located along the route during the project construction period. All impacts associated with the placement and operation of the slurry pipeline are expected to be temporary.

Based on geotechnical testing of sediment in the borrow area, site-specific bathymetry in the marsh restoration area, average existing marsh elevations surrounding the marsh restoration area (approximately 0.8 feet NAVD 88), and mean low and mean high water in the marsh restoration area (0.42 feet and 0.91 feet, respectively), the desired final elevation of placed materials is approximately 1.0 feet NAVD 88. The containment berms around the marsh restoration area will have a crest elevation of approximately 3.0 feet NAVD 88 and will be sourced from sediment within the marsh restoration area just inside the berm alignment. The borrow area for the berms will subsequently be filled with dredged material. Given the average depth of open water within the marsh restoration area, and the characteristics of borrow area sediment and the existing substrate of the marsh restoration area, a fill elevation of approximately 2.0 feet NAVD 88 will be required to meet the final design elevation of approximately 1.0 feet NAVD 88. The bathymetric profile within the potential placement area(s), as well as material settlement and consolidation conditions, will influence the actual volume of dredge material required.

Deposition of dredged materials and marsh creation/restoration involves a number of steps, including:

- Testing and analysis, including geotechnical and bathymetric surveys;
- Marsh creation/restoration site design and planning;
- Implementation and construction;
- Coordination with dredging contractors and agencies;
- Ecological management, including plantings if necessary;
- Long-term maintenance and monitoring; and
- Documentation and reporting.

The Applicants will complete geotechnical testing ahead of detailed marsh restoration design and will work closely with the FWS and permitting agencies during this phase to ensure consensus on design requirements. Currently, the Applicants do not anticipate the need for

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[26] Areas landward of the existing shoreline will be excavated using mechanical equipment and some portion of the excavated material may be reused at the Terminal. At depths below the reach of the mechanical equipment, the hydraulic cutter-suction dredge will remove the material to the dredging depth as shown in the JPA Drawings and described in the JPA Narrative.

active plantings during the initial restoration phase but will evaluate and act on the need for plantings during the subsequent monitoring period.

With respect to construction-related temporary impacts associated with the Terminal Facilities and Pipeline System, all disturbed areas will be restored to preconstruction conditions to the extent practicable and allowed to revegetate. Restoration of the temporarily affected areas will be monitored and the successful achievement of preconstruction conditions will be determined after one full growing season post construction. For locations where preconstruction conditions are not achieved after one full growing season, the Applicants will work with the LDNR to determine appropriate restoration measures.

Based on the above-referenced surveys, detailed engineering and environmental design, and ongoing agency feedback, the Applicants will prepare a Final Compensatory Mitigation Plan that will provide full details of the proposed compensatory mitigation. The plan will be structured according to the framework set forth in the USACE, New Orleans District's Compensatory Mitigation Standard Operating Procedures and will include the following sections as required by 33 Code of Federal Regulations 332.4(c)(2) through (c)14:

- Objectives;
- Site Selection;
- Site Protection Instrument;
- Baseline Information;
- Determination of Credits;
- Mitigation Work Plan;
- Maintenance Plan;
- Performance Standards;
- Monitoring Requirements;
- Long-Term Management Plan;
- Adaptive Management Plan;
- Financial Assurances; and
- Other Information.

4.3 PROPOSED BENEFICIAL USE

As described in Section 4.2, about 5,000,000 cubic yards of material will be dredged to create the Terminal's berthing area. The delivery of approximately 716,000 cubic yards of this material to the CPNWR will be required for the permittee-responsible restoration of 136.4 acres of marsh to offset the loss of 19.8 acres of tidal wetlands, tidal mudflats, and waters (both tidal and non-tidal). This constitutes BUDM, in accordance with LDNR policy and regulations.

Approximately 4,284,000 cubic yards of the dredged material will be placed nearshore along the West Beach and adjacent to the Calcasieu Bar Channel. The resultant submerged barrier will afford additional protection for the recently improved beach shoreline in this vicinity. This is the most cost effective and reliable approach, given the relatively short transportation delivery distance for the spoil. Preliminary design indicates that the material would be placed shoreward of the -12-foot contour. If the material were to be placed in a 2-foot-thick layer, the area of coverage would extend over about 1,328 acres (see Figure 9).

Based on the Applicant's geotechnical studies and feedback from prospective dredging contractors, much of the remaining approximately 4,284,000 cubic yards of material to be dredged will be heavy clay that is not compatible with long-distance transportation by pipeline. Significant cost constraints and technical impracticalities prohibit the delivery of these additional volumes to the CPNWR. With an absence of other feasible beneficial use locations for this material, nearshore disposal, with a corresponding Coastal Resources Trust Fund contribution of $4.28 million, is the proposed course of action.

4.3.1 Other Beneficial Use Options Considered But Not Selected

In addition to nearshore placement off the West Beach and marsh restoration at the CPNWR, the Applicants considered other spoil disposal options, with the potential to beneficially use the dredged material produced by the Project. These included government-sponsored marsh creation/restoration projects, for which the Applicants applied the BUDM screening criterion that such sites be within a 15-mile pumping radius of the dredge material source (as shown on Figure 1), precluding consideration of prospective sites farther afield (USACE, 2010b). The Applicants also searched for potential marsh creation/restoration locations on private lands located within a 2-mile radius of the dredge material source (see Figure 9). This search area is consistent with the expected pumping distance associated with the proposed nearshore placement of dredged material off the West Beach.

Four government-sponsored marsh creation/restoration project sites were identified within the 15-mile radius: Sabine Refuge Marsh Creation (CS-28); Cameron-Creole Watershed Grand Bayou Marsh Creation (CS-54); Oyster Lake Marsh Creation (CS-79); and No Name Bayou Marsh Creation (CS-78). The first two sites (Sabine Refuge Marsh Creation [CS-28] and Cameron-Creole Watershed Grand Bayou Marsh Creation [CS-54]) were found to be incompatible with the Applicants' revised Draft Compensatory Mitigation Plan due to being substantially complete and lacking available storage capacity, or to the sponsor's inability to obtain land control. The latter two sites (Oyster Lake Marsh Creation [CS-79] and No Name Bayou Marsh Creation [CS-78]) were initially proposed as the most viable options for beneficially using dredged sediments to supplement, as necessary, any compensatory mitigation realized through wetland banking. However, they have since secured additional government funding and have progressed through the planning stages to a point where the financial and procedural advantages of accepting spoil material from a privately funded source have been lessened considerably. These two potential marsh creation/restoration sites are discussed in more detail in Sections 4.3.2 and 4.3.3.

Based on the search for potential marsh creation/restoration locations on private lands, the Applicants identified one area for review: an expanse of degraded marshland, consisting primarily of open water, located on the west side of the Calcasieu Ship Channel opposite the Terminal Site. This area is discussed in more detail in Section 4.3.4.

4.3.2 Oyster Lake Marsh Creation and Nourishment

The Oyster Lake Marsh Creation and Nourishment Project is listed under the federal CWPPRA Project Priority List 25 as Project CS-79 and was approved in January 2016.[27] This

[27] See description of Oyster Lake Marsh Creation and Nourishment project at: http://www.mvn.usace.army.mil/Portals/56/docs/environmental/cwppra/PPL/PPL%2025/REGION4FSandPwpts3.pdf, at pp.19-24, and

marsh restoration area was identified in the 2012 Coastal Master Plan as Mud Lake Marsh Creation (004.MC.04) and is adjacent to the Oyster Bayou Marsh Creation Project (CS-59). The Oyster Lake Marsh Creation and Nourishment Project proposes to beneficially use material dredged from an offshore borrow site, a source also utilized by CS-59, to create and nourish a total of 660 acres of saline marsh in the open water areas of Oyster Bayou, located west of the Terminal.

4.3.3 No Name Bayou Marsh Creation Project (CS-78)

The No Name Bayou Marsh Creation Project (CS-78) received Phase 1 approval for engineering and design under the CWPPRA in January 2015.[28] The current CWPPRA Annual Plan for Fiscal Year (FY) 2017 indicates that the project is approved for engineering and design funding in FY 2017 and FY 2018.[29] The project proposes to create and/or nourish 533 acres of saline marsh in an area of open water and fragmented marsh south of Calcasieu Lake, using sediment from upland confined disposal facilities along the Calcasieu River. The project boundary is within both private and federal (National Wildlife Refuge) property, and is located approximately six pumping miles from the Project dredging footprint. This area was identified in the 2012 Coastal Master Plan as a portion of the Calcasieu Ship Channel Marsh Creation (004.MC.23).

4.3.4 Private Lands

With respect to private lands, the Applicants identified one area for review: an expanse of degraded marshland, consisting primarily of open water (about 50 acres), located on the west side of the Calcasieu Ship Channel opposite the Terminal Site. This area lies northwest of State Highway 82 and about 1.4 miles from the proposed source of dredged material (see Figures 1 and 9). Based on this proximity, BUDM at the private lands site would not present the same technical challenges or incur the same prohibitive cost associated with transporting material over eight miles to the CPNWR in volumes greater than the 716,000 cubic yards required to create/restore marsh for compensatory wetlands mitigation. However, the Applicants estimate that the private lands site could only accept about 262,000 cubic yards of dredged material, leaving about 4,022,000 cubic yards that would need to be placed elsewhere. Also, even if the landowner was willing to accept material, the pipeline carrying the material to the site would need to be routed overland across other private properties and State Highway 27. For these reasons, the Applicants consider nearshore placement to be the only viable disposal option for the dredged material not required for marsh creation/restoration at the CPNWR.

4.4 ESSENTIAL FISH HABITAT COMPENSATION

The Applicants have performed a Project-specific EFH assessment that is detailed in a consultation record that accompanies the revised JPA Narrative (see JPA Narrative appendix B). The EFH assessment was based on information provided directly by NMFS, publicly available scientific documents, and field surveys conducted on behalf of the Applicants.

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http://www.fws.gov/gisdownloads/R4/Louisiana%20ESO/Roy/PPL25%20Nominee%20FINAL%20information/PPL25%20Nominee%20Oyster%20Lake%20Marsh%20Creation%20FINAL%20Fact%20Sheet%20040115.docx.

[28] See CWPPRA funding vote, at pp. 1-4 http://www.mvn.usace.army.mil/Portals/56/docs/environmental/cwppra/TF%20Meeting%20Minutes/2015/MinutesTaskForce22Jan2015.pdf and report of CWPPRA Technical Committee at pp. 5 and 7-8, available at: http://www.mvn.usace.army.mil/Portals/56/docs/environmental/cwppra/TC%20Meeting%20Minutes/2015/MinutesTechComm11Dec2014.pdf.

[29] See CWPPRA 2017 Annual Plan at: http://coastal.la.gov/2017-annual-plan/.

Construction and operational maintenance of the LNG berthing area and turning basin at the Terminal location and installation of the Pipeline System have the potential to affect EFH.

For the Pipeline System, installation of the pipeline itself will result in only temporary impacts on wetlands and waterbodies, which will be returned to preconstruction conditions in accordance with applicable USACE and LDNR permit conditions and requirements. Although the temporary disturbance may affect potential EFH wetlands and waterbodies, any impacts will be minimized through the use of best management practices typical for pipeline construction.

The permanent facilities (meter station, mid-line mainline valve, and permanent access roads) associated with the Pipeline System will permanently affect 1.4 acres of wetland, of which 1.3 acres is estuarine scrub-shrub and potentially EFH.

Potential impacts on managed fishery species and prey are described in Appendix B of the JPA Narrative and are summarized below.

- Habitat Modification – Approximately 83.3 acres of EFH adjacent to and within the Calcasieu Ship Channel will be modified through offshore dredging and construction of the Terminal's marine facilities. This includes 14.0 acres of shoreline tidal wetlands that will be permanently converted to estuarine water column and deepwater benthic habitat, 3.4 acres of shoreline tidal wetlands that will be filled for construction of the marine berm, and 65.9 acres of existing estuarine water column and deepwater benthic habitat that will dredged but will constitute substantially the same EFH after dredging has been completed.

- Increased Turbidity – The Project has the potential to produce turbidity plumes during in-water work activities, including excavation and dredging for the Marine Facilities and construction of the Pipeline System. However, in the lower Calcasieu River, the waters are naturally turbid due to tidal action, ship traffic, and the current dynamics at the confluence of the Calcasieu Ship Channel and Calcasieu Pass. The Applicants will minimize the potential for harm to EFH by using construction methods and best management practices that enable compliance with turbidity thresholds specified in CWA permits and certifications. Regardless, this element of the Project is likely to have unavoidable, yet temporary, minor adverse effects on EFH.

- Temporary Loss of Benthic Invertebrates – Project activities will temporarily affect 65.9 acres of benthic habitat in the Calcasieu Ship Channel. Invertebrate food resources would be expected to recolonize within a few seasons. Because the effects are temporary and limited in spatial extent, this is expected to be a minor adverse impact on EFH.

Based on the information provided above, estuarine EFH, including the water column and benthic habitat, will be affected in the Calcasieu Ship Channel but the effects will either be temporary or neutral. Although the water depth will increase, benthic substrate will offer fundamentally similar habitat pre- and post-dredging and will be recolonized. Similarly, for the East Lateral Pipeline, estuarine wetland and benthic habitat EFH will be affected but the impacts will dissipate after pipeline installation.

Within the Venture Global Property, impacts on the generally low quality tidal wetlands west of Davis Road will be permanent. Here, pre- and post-construction EFH acreage will be similar, but the tidal wetlands will be replaced with open water, offering different habitat characteristics.

With respect to the Pipeline System, permanent impacts on tidal estuarine wetlands will occur at the meter station at MP 0.0 and in association with the permanent access road for this facility. About 1.4 acres of estuarine scrub-shrub and estuarine emergent wetland will be affected by these facilities.

This revised Draft Compensatory Mitigation Plan facilitates the creation/restoration of EFH in the form of high quality estuarine marsh at the CPNWR and provides more than adequate ecological compensation for the losses described herein. Therefore, no substantial adverse effects on EFH are expected.

5.0 SUMMARY

In summary, the Applicants are proposing a combination of mitigation banking and permittee-responsible marsh creation/restoration as the means of compensating for the Project's unavoidable permanent impacts on wetlands, waters, and mudflats. The banking will cover impacts to non-tidal wetlands; the marsh restoration will primarily cover impacts to tidal wetlands, tidal mudflats, and waters (both tidal and non-tidal). The banking will take place at the SFCMB, operated by Delta Land Services and located about 20 miles north of the Terminal. The marsh creation/restoration will take place at the East Cove Unit of the CPNWR, managed by the FWS and located about four miles north of the Terminal.

During Terminal construction, sufficient dredged material from the Calcasieu Ship Channel will be transported to the CPNWR to create/restore the appropriate offset acreage of marsh. In addition to providing compensatory wetlands mitigation, this will constitute beneficial use of dredged material, as defined by the LDNR. The remainder of the dredged material will be placed in a nearshore area about two miles southwest of the Terminal. While this placement will afford some protection for the recently restored West Beach, the Applicants anticipate that the LDNR's beneficial use requirement will be satisfied by making an appropriate volume-based contribution to the Coastal Resources Trust Fund, in accordance with LAC, Title 43, Part I, Section 723.H.

The proposed mitigation is consistent with the Louisiana Comprehensive Master Plan for a Sustainable Coast and will result in a positive impact on the ecological value of the Louisiana Coastal Zone. The proposed mitigation efforts will be undertaken in the same hydrologic basin as the Project-related impacts and will produce better than in-kind mitigation for these impacts.

The Applicants will incur a significant incremental expense to deliver dredged material to the marsh creation/restoration site(s) at the CPNWR rather than place it closer to the Terminal. The same marsh creation/restoration would otherwise require the use of federal and state funding to obtain the necessary substrate material; as such this revised Draft Compensatory Mitigation Plan allows for more public funding to be allocated to other CWPPRA efforts, resulting in increased benefits to Louisiana's wetland resources.

6.0 REFERENCES

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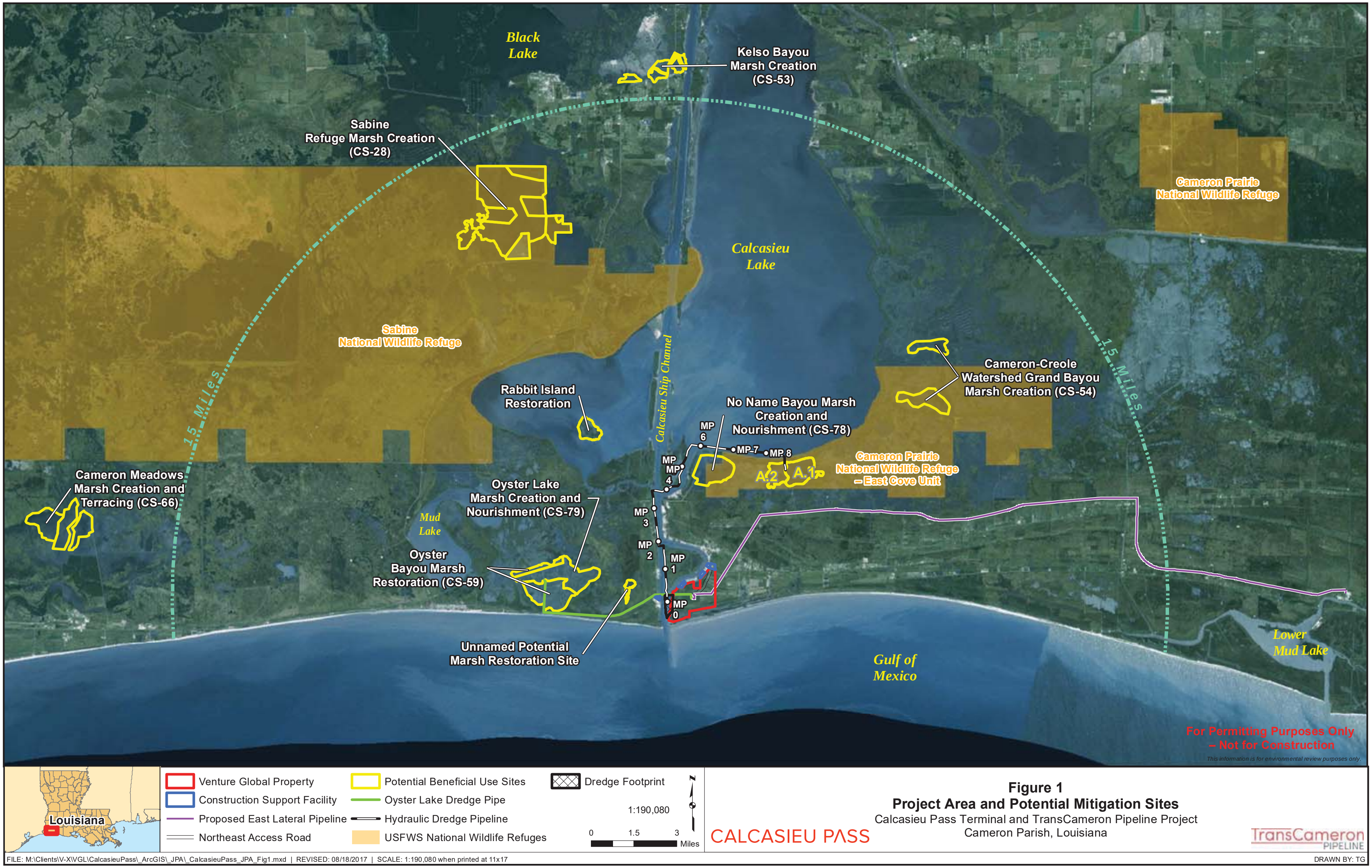
Figures


Black Lake
Kelso Bayou Marsh Creation (CS-53)
Sabine Refuge Marsh Creation (CS-28)
Cameron Prairie National Wildlife Refuge
Calcasieu Lake
Sabine National Wildlife Refuge
15 Miles
Calcasieu Ship Channel
Cameron-Creole Watershed Grand Bayou Marsh Creation (CS-54)
Rabbit Island Restoration
No Name Bayou Marsh Creation and Nourishment (CS-78)
Cameron Prairie National Wildlife Refuge – East Cove Unit
Cameron Meadows Marsh Creation and Terracing (CS-66)
Oyster Lake Marsh Creation and Nourishment (CS-79)
Mud Lake
Oyster Bayou Marsh Restoration (CS-59)
Unnamed Potential Marsh Restoration Site
Gulf of Mexico
Lower Mud Lake
For Permitting Purposes Only – Not for Construction
This information is for environmental review purposes only.
Louisiana
Venture Global Property
Construction Support Facility
Proposed East Lateral Pipeline
Northeast Access Road
Potential Beneficial Use Sites
Oyster Lake Dredge Pipe
Hydraulic Dredge Pipeline
USFWS National Wildlife Refuges
Dredge Footprint
1:190,080
0 1.5 3 Miles
Figure 1
Project Area and Potential Mitigation Sites
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
CALCASIEU PASS
TransCameron PIPELINE
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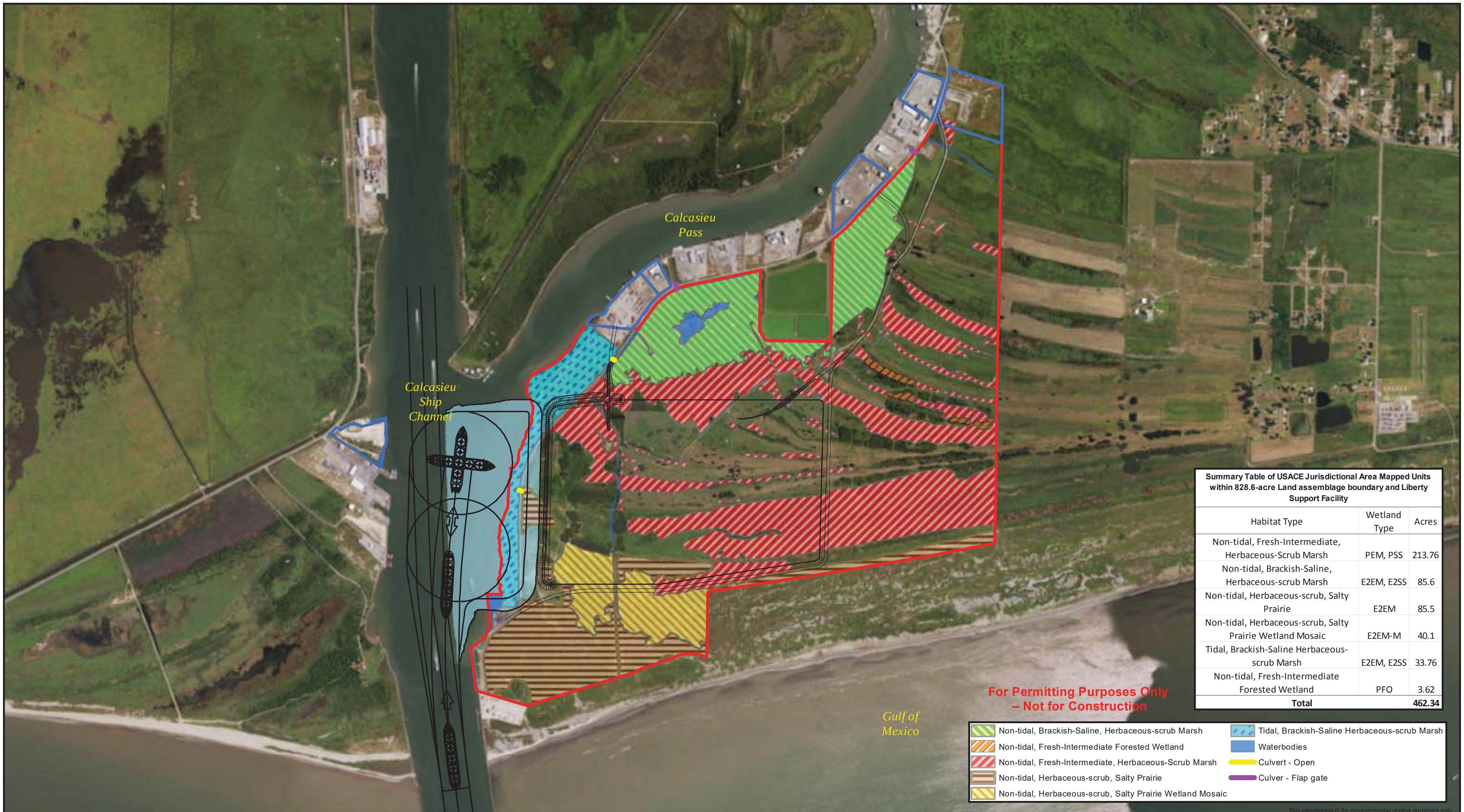

Summary Table of USACE Jurisdictional Area Mapped Units within 828.6-acre Land assemblage boundary and Liberty Support Facility

Habitat Type	Wetland Type	Acres
Non-tidal, Fresh-Intermediate, Herbaceous-Scrub Marsh	PEM, PSS	213.76
Non-tidal, Brackish-Saline, Herbaceous-scrub Marsh	E2EM, E2SS	85.6
Non-tidal, Herbaceous-scrub, Salty Prairie	E2EM	85.5
Non-tidal, Herbaceous-scrub, Salty Prairie Wetland Mosaic	E2EM-M	40.1
Tidal, Brackish-Saline Herbaceous-scrub Marsh	E2EM, E2SS	33.76
Non-tidal, Fresh-Intermediate Forested Wetland	PFO	3.62
Total		**462.34**

Figure 2
Terminal Layout and Wetland Community Types
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana

CALCASIEU PASS

TransCameron PIPELINE

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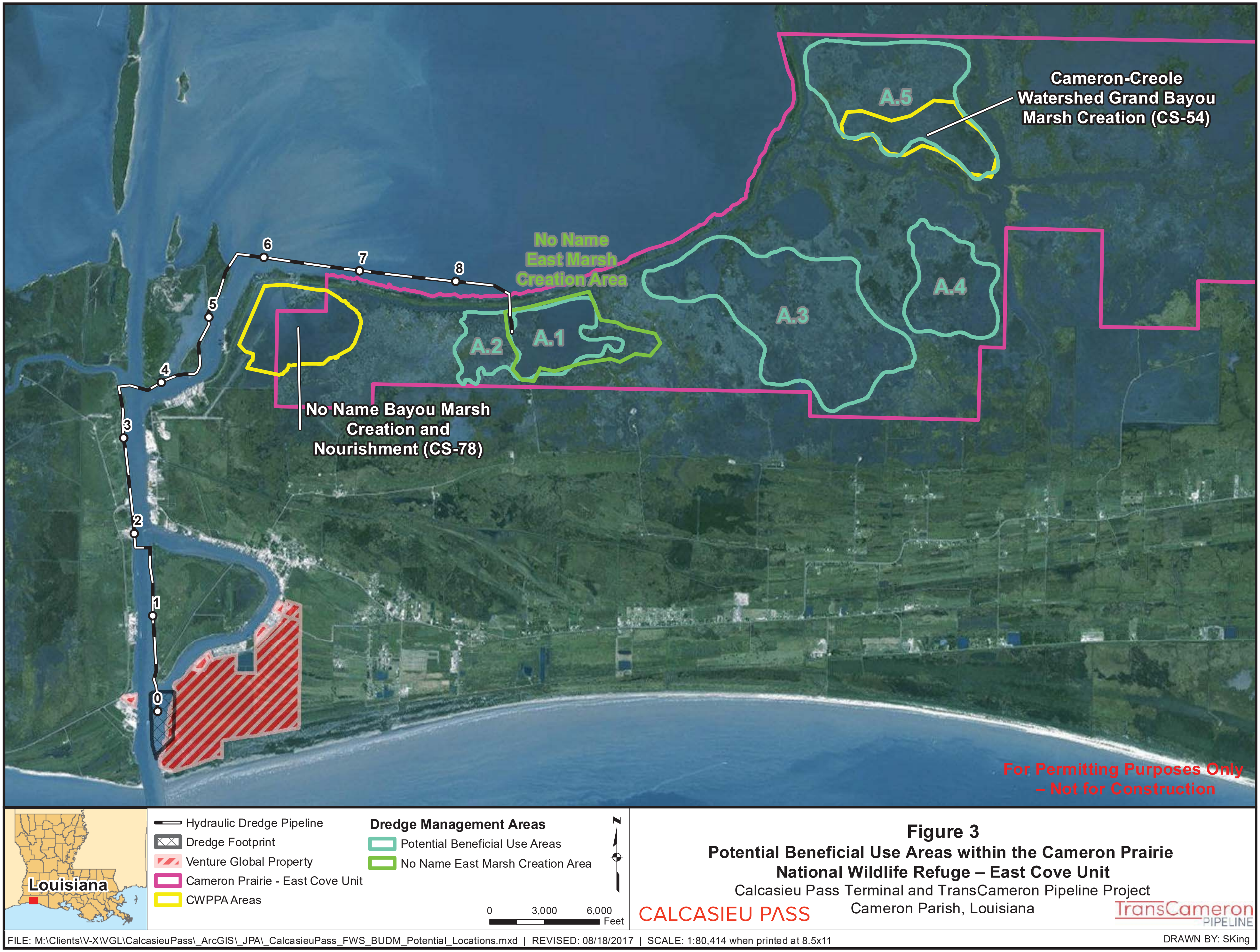

Cameron-Creole Watershed Grand Bayou Marsh Creation (CS-54)
A.5
No Name East Marsh Creation Area
A.4
A.3
A.2
A.1
No Name Bayou Marsh Creation and Nourishment (CS-78)
0
1
2
3
4
5
6
7
8
For Permitting Purposes Only – Not for Construction
Louisiana
Hydraulic Dredge Pipeline
Dredge Footprint
Venture Global Property
Cameron Prairie - East Cove Unit
CWPPA Areas
Dredge Management Areas
Potential Beneficial Use Areas
No Name East Marsh Creation Area
N
0
3,000
6,000
Feet
Figure 3
Potential Beneficial Use Areas within the Cameron Prairie National Wildlife Refuge – East Cove Unit
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana
CALCASIEU PASS
TransCameron PIPELINE
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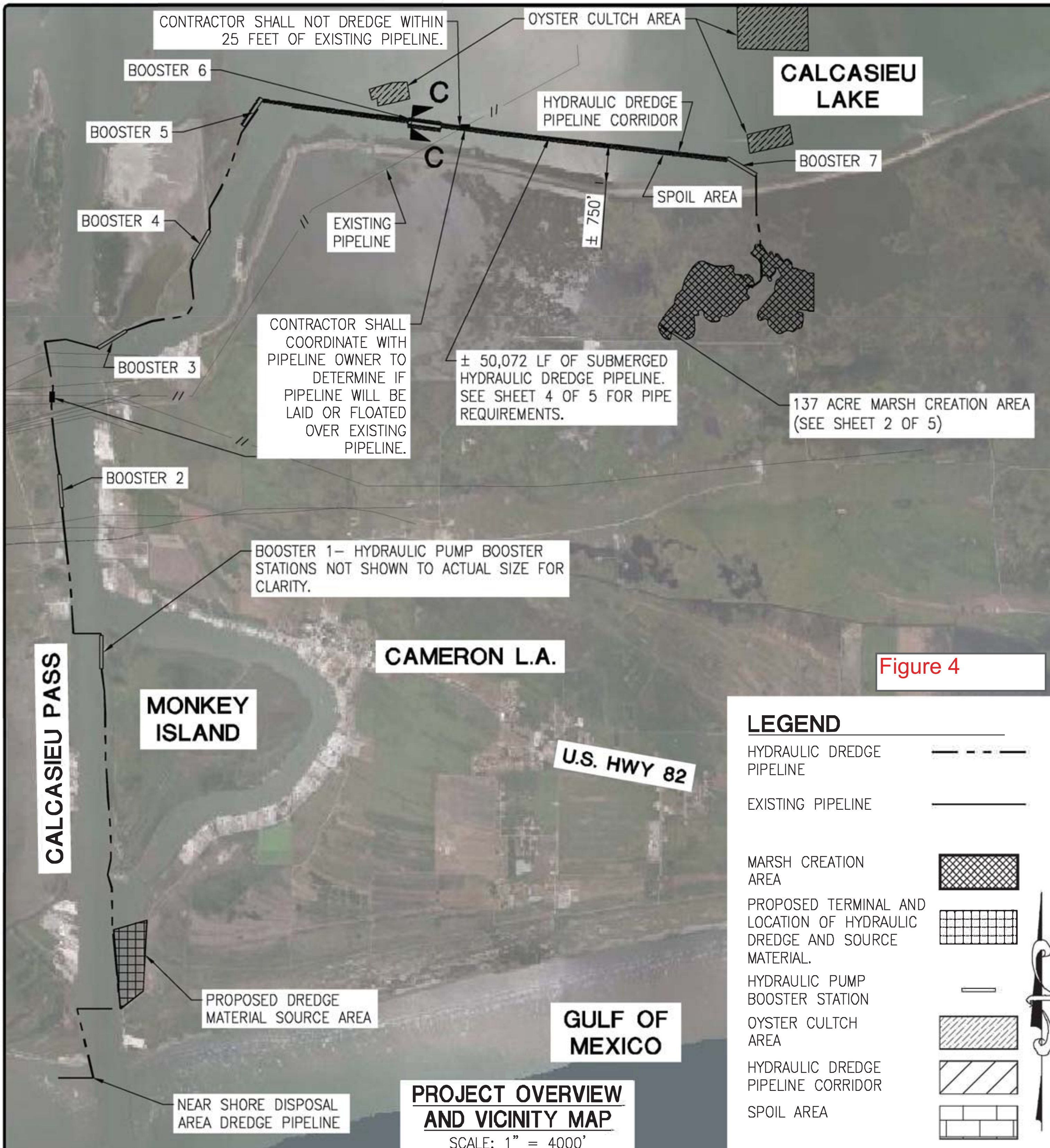

Figure 4

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DREDGED MATERIAL PLACEMENT OVERVIEW MAP

VENTURE GLOBAL CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

DATE: 6–30–2017

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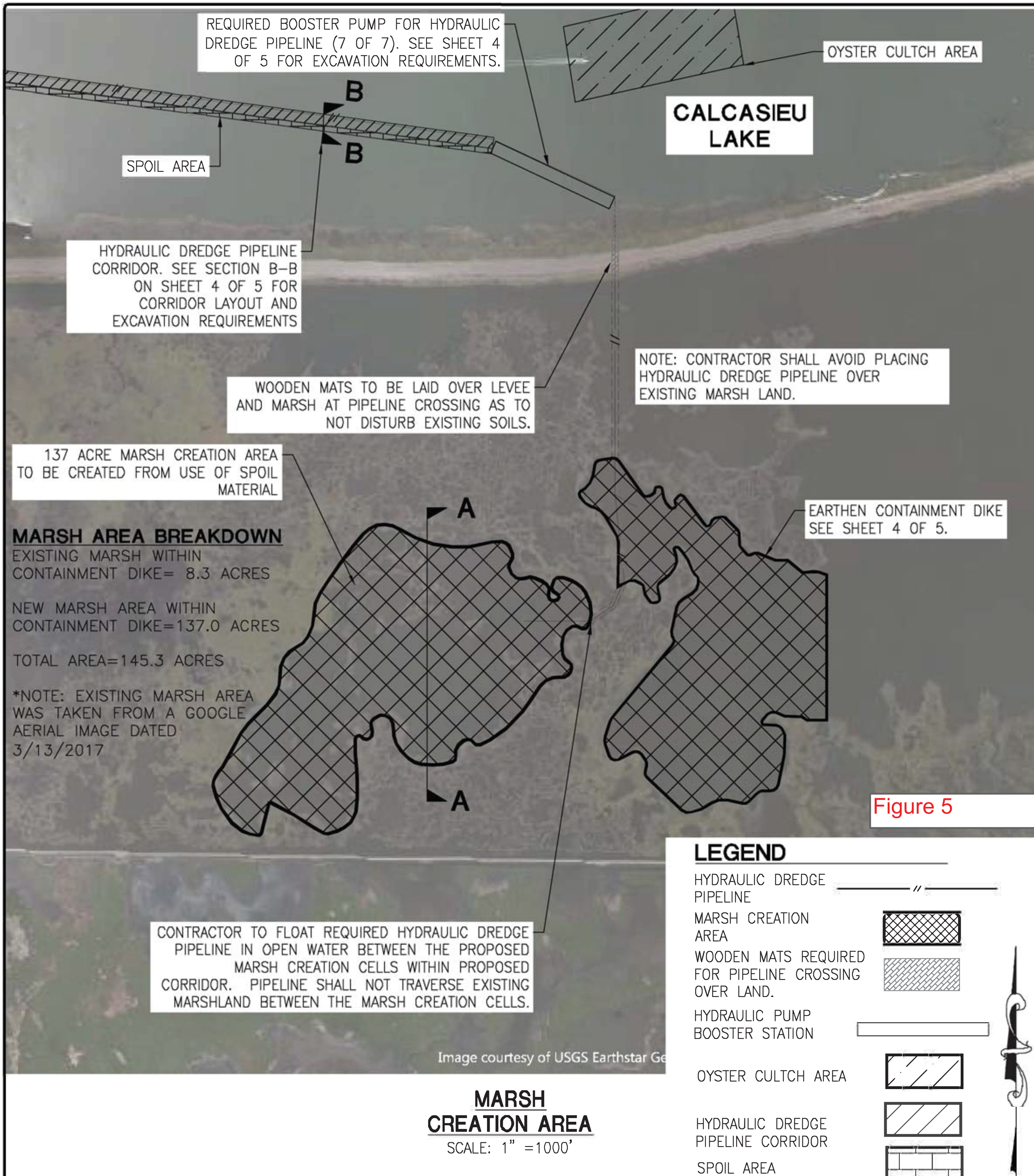

MARSH CREATION AREA

SCALE: 1" =1000'

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MARSH CREATION AREA
VENTURE GLOBAL CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

DATE: 6-28-2017

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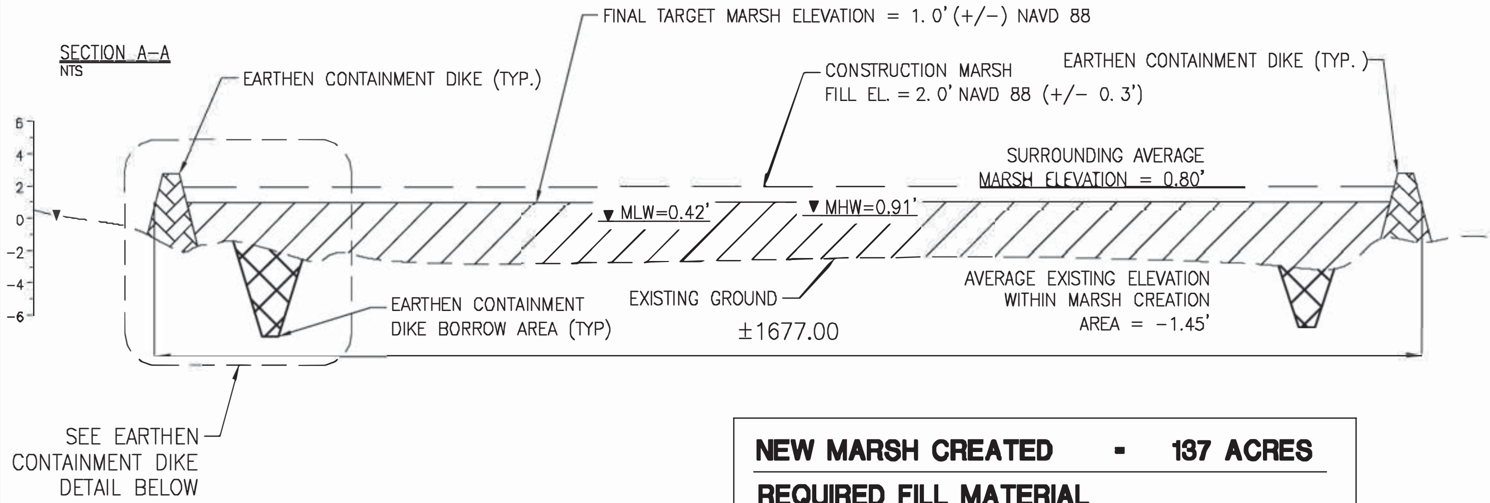
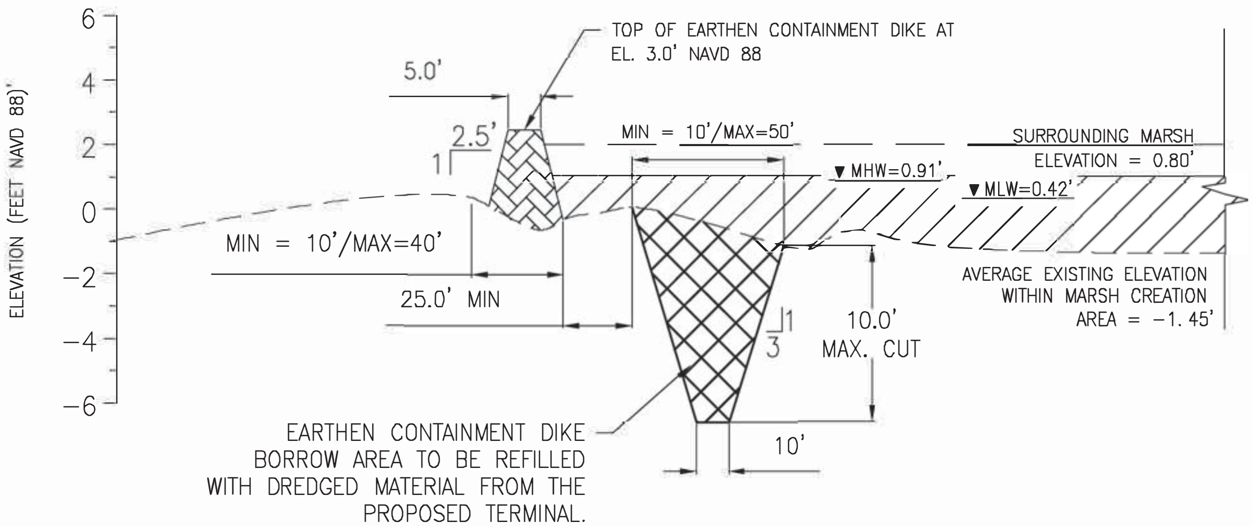
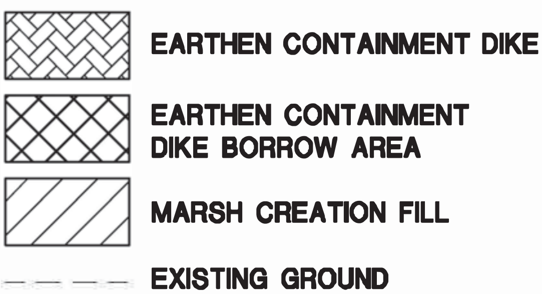


NEW MARSH CREATED	-	137 ACRES
REQUIRED FILL MATERIAL FOR MARSH CREATION.	-	720,000 CY





EARTHEN CONTAINMENT DIKE DETAIL

SCALE= N.T.S.

• BOTTOM WIDTH OF CONTAINMENT DIKE AND TOP WIDTH OF BORROW AREA VARY WITH WATER DEPTH AND FINAL TARGET ELEVATION

Figure 6

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MARSH CREATION SECTIONS
VENTURE GLOBAL CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

DATE: 6-30-2017

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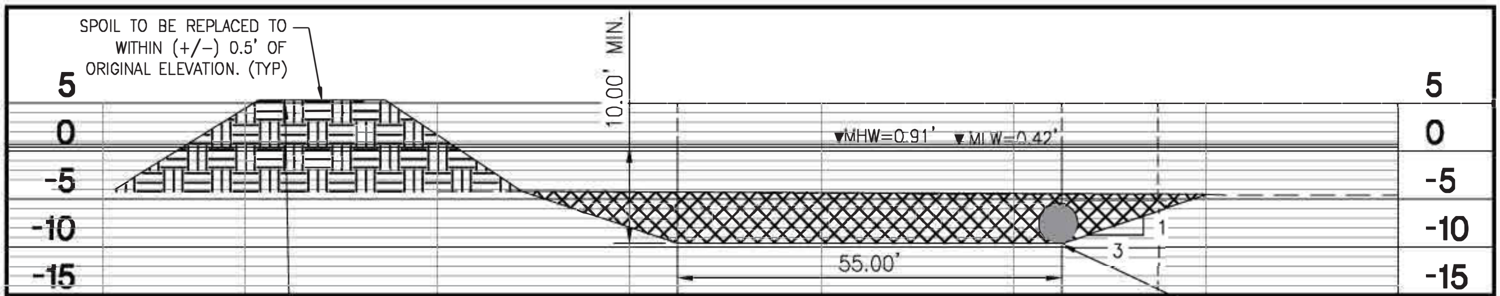


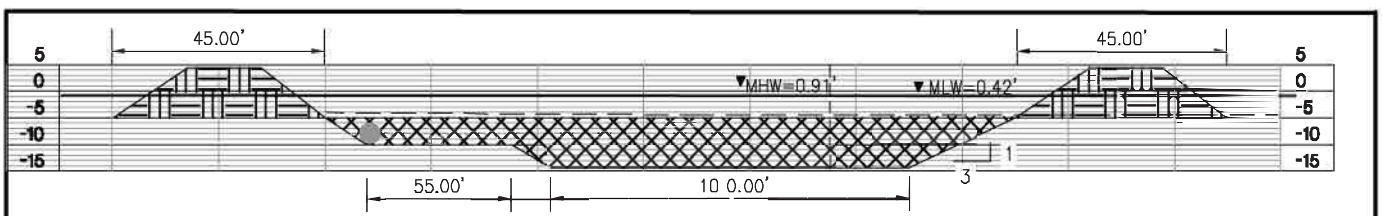
SECTION B-B
PIPELINE CORRIDOR LAYOUT
(NTS)

REQUIRED EXCAVATION FOR PIPELINE CORRIDOR

SPOIL AREA

EXISTING GROUND

PIPELINE LENGTH WITHIN CALCASIEU LAKE	-	15,000 LF
EXCAVATION REQUIRED FOR BOAT CHANNEL AND PIPELINE WITHIN CALCASIEU LAKE	-	194,444 CY



SECTION C-C
BOOSTER PUMP STATION
(NTS)

REQUIRED EXCAVATION FOR BOOSTER PUMP STATION

SPOIL AREA

EXISTING GROUND

BOOSTER PUMP STATIONS WITHIN CALCASIEU LAKE	-	3
EXCAVATION REQUIRED FOR BOOSTER PUMP STATIONS WITHIN CALCASIEU LAKE	-	28,889 CY

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HYDRAULIC DREDGE PIPELINE CORRIDOR SECTIONS

VENTURE GLOBAL CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

Figure 7

DATE: 6-30-2017

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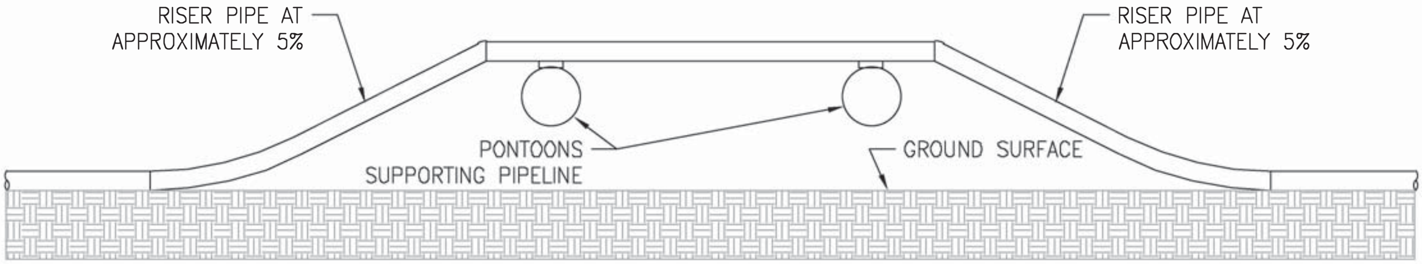
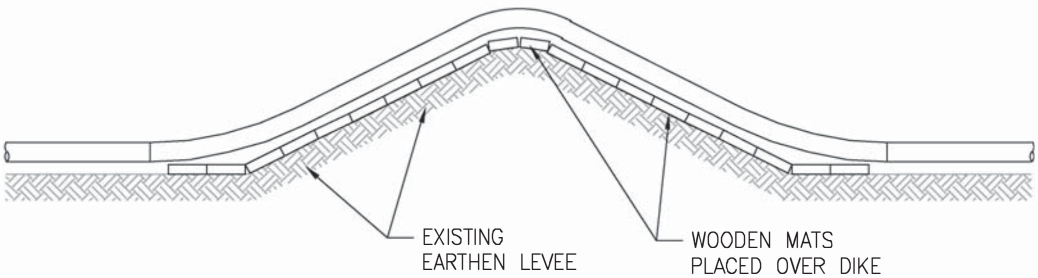
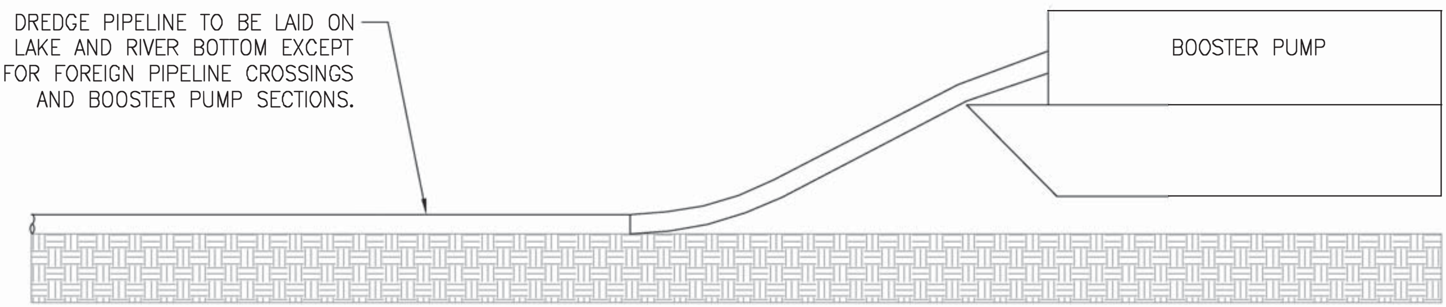


FLOATING PIPELINE SECTION



LEVEE CROSSING



TYPICAL SUBMERGED DREDGE PIPELINE AND BARGE SECTION

Figure 8

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HYDRAULIC DREDGE PIPELINE DETAILS
VENTURE GLOBAL CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT

DATE: 6-30-2017

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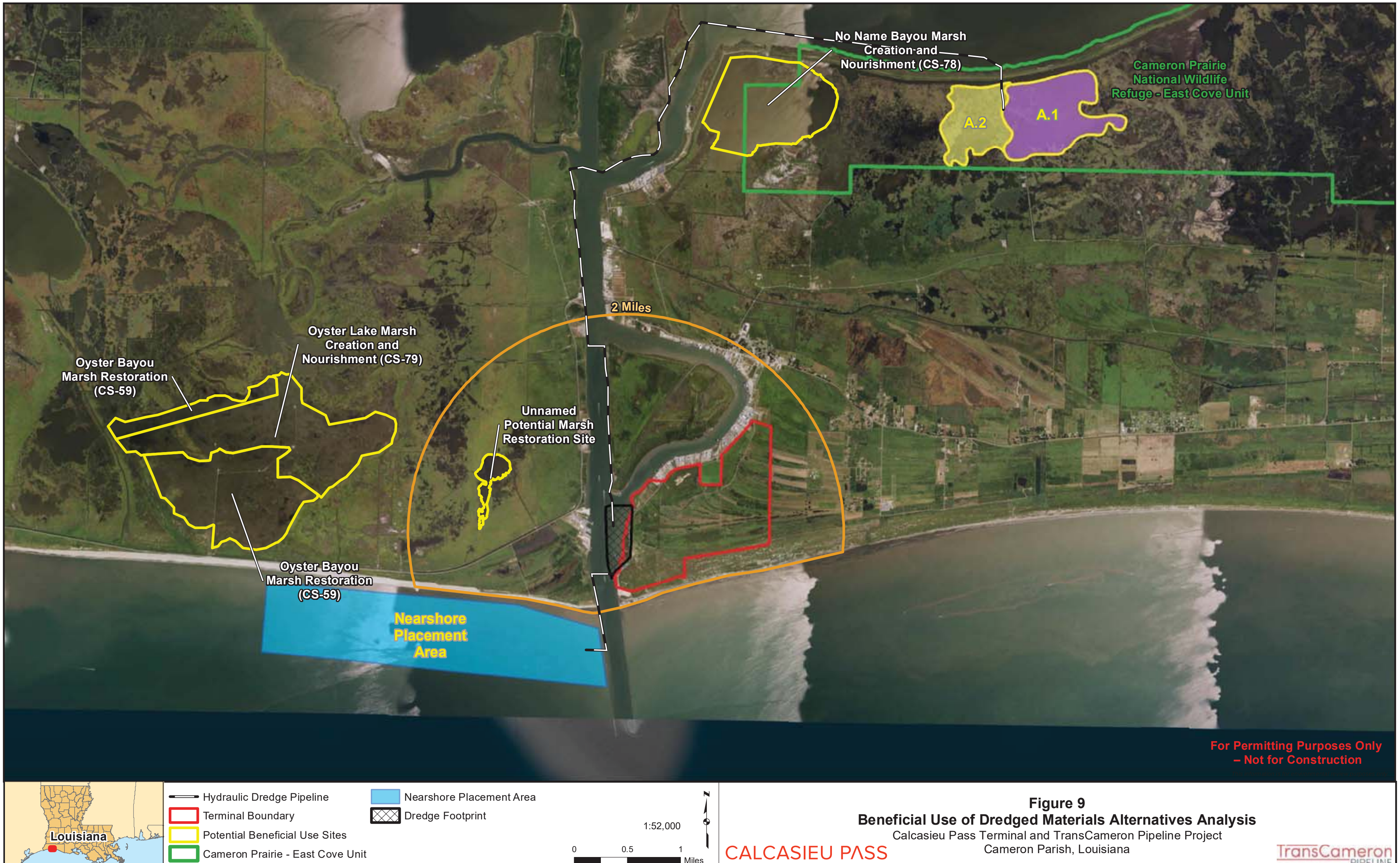

Figure 9
Beneficial Use of Dredged Materials Alternatives Analysis
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana

CALCASIEU PASS

TransCameron PIPELINE

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APPENDIX F

LIST OF WATERBODIES AT THE TERMINAL FACILITY AND CROSSED BY PIPELINE

APPENDIX F
LIST OF WATERBODIES AT THE TERMINAL FACILITY AND CROSSED BY PIPELINE

TABLE F-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WATERBODIES AT THE TERMINAL FACILITIES

Terminal Facility	Waterbody ID	Waterbody Type	Waterbody Regime	Impact Type	Area (Acres)
VENTURE GLOBAL PROPERTY					
Terminal Site	OW052	Ponded/Borrow Pit	Semi-permanently Flooded	Permanent	0.02
Terminal Site	OW053	Ponded/Borrow Pit	Semi-permanently Flooded	Permanent	0.04
Terminal Site	OW055	Ponded/Borrow Pit	Seasonally Flooded	Permanent	0.00
Terminal Site	WB001	Ditch	Perennial	Permanent	1.10
Terminal Site	WB002	Ditch	Intermittent	Permanent	0.00
Terminal Site	WB045	Ditch	Perennial	Permanent	0.08
Northeast Access Road	WBB01	Canal	Intermittent	Permanent	0.04
Berm TWS	OW053	Ponded/Borrow Pit	Semi-permanently Flooded	Temporary	0.00
Berm TWS	WB001	Ditch	Perennial	Temporary	0.04
Berm TWS	WB045	Ditch	Perennial	Temporary	0.04
Berm TWS	WB045	Ditch	Perennial	Temporary	0.05
Land Removed by Excavation	CMC001	Calcasieu River Ship Channel	Perennial	Permanent	1.06
Land Removed by Excavation	CMC003	Calcasieu River Ship Channel	Perennial	Permanent	0.00
Land Removed by Excavation	OW001	Ponded/Borrow Pit	Permanently Flooded	Permanent	0.11
Land Removed by Excavation	OW003	Ponded/Borrow Pit	Permanently Flooded	Permanent	0.03
Land Avoided (Not Disturbed)	CMC001	Calcasieu River Ship Channel	Perennial	No Impact	0.39
Land Avoided (Not Disturbed)	CMC002	Calcasieu River Ship Channel	Perennial	No Impact	0.34
Land Avoided (Not Disturbed)	CMC004	Calcasieu River Ship Channel	Perennial	No Impact	0.00
Land Avoided (Not Disturbed)	CMC005	Calcasieu River Ship Channel	Perennial	No Impact	0.49
Land Avoided (Not Disturbed)	OW001	Ponded/Borrow Pit	Permanently Flooded	No Impact	0.00
Land Avoided (Not Disturbed)	OW002	Ponded/Borrow Pit	Permanently Flooded	No Impact	0.09
Land Avoided (Not Disturbed)	OW054	Ponded/Borrow Pit	Semi-permanently Flooded	No Impact	0.05
Land Avoided (Not Disturbed)	OW055	Ponded/Borrow Pit	Seasonally Flooded	No Impact	0.01
Land Avoided (Not Disturbed)	OW056	Ponded/Borrow Pit	Perennial	No Impact	3.53
Land Avoided (Not Disturbed)	WB001	Ditch	Perennial	No Impact	0.40
Land Avoided (Not Disturbed)	WB002	Ditch	Intermittent	No Impact	0.02
Land Avoided (Not Disturbed)	WB045	Ditch	Perennial	No Impact	1.03

TABLE F-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WATERBODIES AT THE TERMINAL FACILITIES

Terminal Facility	Waterbody ID	Waterbody Type	Waterbody Regime	Impact Type	Area (Acres)
Land Avoided (Not Disturbed)	WB045	Ditch	Perennial	No Impact	0.01
Land Avoided (Not Disturbed)	WBB01	Canal	Intermittent	No Impact	0.18
Land Avoided (Not Disturbed)	WBB01	Canal	Intermittent	No Impact	0.34
Land Avoided (Not Disturbed)	CMC001	Calcasieu River Ship Channel	Perennial	No Impact	0.39
Land Avoided (Not Disturbed)	CMC002	Calcasieu River Ship Channel	Perennial	No Impact	0.34
Land Avoided (Not Disturbed)	CMC004	Calcasieu River Ship Channel	Perennial	No Impact	0.00
Land Avoided (Not Disturbed)	CMC005	Calcasieu River Ship Channel	Perennial	No Impact	0.49
Land Avoided (Not Disturbed)	OW001	Ponded/Borrow Pit	Permanently Flooded	No Impact	0.00
CONSTRUCTION SUPPORT FACILITIES					*none*

TABLE F-2

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT WATERBODIES AT THE PIPELINE

Approx. Milepost	Waterbody ID	Waterbody Type	Waterbody Regime	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
0.1	WB500dw	Canal	Perennial	Temporary Access Road	TAR 2	Temporary	0	0.00
0.2	WB032	Ditch	Perennial	Permanent Easement	HDD	No Impact – HDD	151	0.19
0.3	OW044	Borrow Area	Permanently Flooded	Permanent Easement	HDD	No Impact – HDD	155	0.17
0.8	WB031	Stream	Perennial	Permanent Easement	HDD	No Impact – HDD	90	0.11
1.9	OW043	Borrow Area	Permanently	Permanent Easement	Open-cut	Temporary	27	0.03
1.9	OW043	Borrow Area	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.04
2.9	OW042	Borrow Area	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.03
2.9	OW042	Borrow Area	Permanently Flooded	ATWS	Foreign Pipeline Crossing/ Push Site	Temporary	0	0.05
2.9	OW042	Borrow Area	Permanently Flooded	Permanent Easement	Open-cut	Temporary	24	0.03
7.0	WB030	Stream	Perennial	Permanent Easement	Open-cut	Temporary	33	0.04
7.0	WB030	Stream	Perennial	Temporary Workspace	Open-cut	Temporary	0	0.05
7.1	OW039	Borrow Area	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.04
7.1	OW039	Borrow Area	Permanently Flooded	Permanent Easement	Open-cut	Temporary	34	0.04
7.8	WB033	Canal	Perennial	Permanent Easement	Open-cut	Temporary	23	0.03
7.8	WB033	Canal	Perennial	Temporary Workspace	Open-cut	Temporary	0	0.03
7.8	WB033	Canal	Perennial	ATWS	HDD Pipe String	Temporary	0	0.03
8.1	WB029	Ditch	Intermittent	Permanent Easement	HDD	No Impact – HDD	5	0.01
8.1	WB028	Ditch	Perennial	Permanent Easement	HDD	No Impact – HDD	8	0.01
8.1	WB058dw	Ditch	Perennial	Temporary Access Road	TAR 11	Temporary	0	0.00
8.1	WB058dw	Ditch	Perennial	Permanent Access Road	PAR 11	Permanent	0	0.00
8.1	WB058dw	Ditch	Perennial	Temporary Access Road	TAR 11	Temporary	0	0.00
8.6	WB027	Ditch	Intermittent	Permanent Easement	HDD	No Impact – HDD	7	0.01
8.6	WB026	Canal	Perennial	Permanent Easement	HDD	No Impact – HDD	73	0.08

APPENDIX F
LIST OF WATERBODIES AT THE TERMINAL FACILITY AND CROSSED BY PIPELINE (cont'd)

TABLE F-2

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT WATERBODIES AT THE PIPELINE

Approx. Milepost	Waterbody ID	Waterbody Type	Waterbody Regime	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
9.2	WB025	Ditch	Perennial	Permanent Easement	HDD	No Impact – HDD	29	0.03
9.3	OW037	Stock Pond	Permanently Flooded	Permanent Easement	HDD	No Impact – HDD	131	0.15
9.3	WB024	Ditch	Intermittent	Permanent Easement	HDD	No Impact – HDD	27	0.03
9.4	WB507dw	Ditch	Intermittent	Temporary Access Road	TAR 12	Temporary	0	0.00
9.9	OW036	Stock Pond	Permanently Flooded	Permanent Easement	HDD	No Impact – HDD	245	0.28
9.9	WB023	Ditch	Perennial	Permanent Easement	HDD	No Impact – HDD	5	0.01
9.9	WB022	Ditch	Perennial	Permanent Easement	HDD	No Impact – HDD	10	0.01
9.9	WB022	Ditch	Perennial	Permanent Easement	TAR 13	Temporary	0	0.00
10.2	WB021	Canal	Perennial	Temporary Workspace	Open-cut	Temporary	0	0.04
10.2	WB021	Canal	Perennial	Permanent Easement	Open-cut	Temporary	27	0.03
12.5	WB020	Ditch	Perennial	Temporary Workspace	Open-cut	Temporary	0	0.03
12.5	WB020	Ditch	Perennial	Permanent Easement	Open-cut	Temporary	21	0.02
12.9	OW034	Estuarine Pond	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.11
12.9	OW034	Estuarine Pond	Permanently Flooded	Permanent Easement	Open-cut	Temporary	14	0.04
13.0	WB506dw	Ditch	Intermittent	Contractor Yard	Contractor Laydown Yard	Temporary	0	0.02
13.2	WB019	Ditch	Intermittent	Temporary Workspace	Open-cut	Temporary	0	0.02
13.2	WB019	Ditch	Intermittent	Permanent Easement	Open-cut	Temporary	18	0.02
13.4	WB018	Ditch	Intermittent	Temporary Workspace	Open-cut	Temporary	0	0.02
13.4	WB018	Ditch	Intermittent	Permanent Easement	Open-cut	Temporary	18	0.02
13.5	WB017	Canal	Perennial	Temporary Workspace	Open-cut	Temporary	0	0.03
13.5	WB017	Canal	Perennial	Permanent Easement	Open-cut	Temporary	19	0.02
14.7	WB016	Ditch	Perennial	Permanent Easement	Open-cut	Temporary	6	0.01
14.7	WB016	Ditch	Perennial	Temporary Workspace	Open-cut	Temporary	0	0.01
14.8	WB015	Ditch	Perennial	Permanent Easement	Open-cut	Temporary	8	0.01
14.8	WB015	Ditch	Perennial	Temporary Workspace	Open-cut	Temporary	0	0.01
14.9	OW033	Stock Pond	Permanently Flooded	Permanent Easement	Open-cut	Temporary	0	0.03

TABLE F-2

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT WATERBODIES AT THE PIPELINE

Approx. Milepost	Waterbody ID	Waterbody Type	Waterbody Regime	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
14.9	OW052dw	Pond – Natural	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.26
14.9	OW052dw	Pond – Natural	Permanently Flooded	Permanent Easement	Open-cut	Temporary	112	0.08
15.2	WB014	Ditch	Perennial	Temporary Workspace	Open-cut	Temporary	0	0.02
15.2	WB014	Ditch	Perennial	Permanent Easement	Open-cut	Temporary	11	0.01
15.2	WB014	Ditch	Perennial	ATWS	Open Water Crossing	Temporary	0	0.01
15.2	OW029	Estuarine Openwater	Permanently Flooded	ATWS	Open Water Crossing	Temporary	0	0.46
15.2	OW029	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	1.84
15.2	OW030	Estuarine Pond	Permanently Flooded	Permanent Easement	Open-cut	Temporary	62	0.07
15.2	OW030	Estuarine Pond	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.01
15.3	OW029	Estuarine Openwater	Permanently Flooded	Permanent Easement	Open-cut	Temporary	899	1.05
15.5	OW029	Estuarine Openwater	Permanently Flooded	ATWS	Open Water Crossing	Temporary	0	0.03
15.5	OW029	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.02
15.5	OW027	Estuarine Openwater	Permanently Flooded	ATWS	Open Water Crossing	Temporary	0	0.40
15.5	OW027	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	1.41
15.6	OW027	Estuarine Openwater	Permanently Flooded	Permanent Easement	Open-cut	Temporary	428	0.76
15.7	OW026	Estuarine Openwater	Permanently Flooded	ATWS	Open Water Crossing	Temporary	0	0.02
15.7	OW026	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.07
15.8	OW026	Estuarine Openwater	Permanently Flooded	Permanent Easement	Open-cut	Temporary	33	0.06
15.8	OW025	Estuarine Openwater	Permanently Flooded	ATWS	Open Water Crossing	Temporary	0	0.01
16.0	WB012	Estuarine Channel	Perennial	Permanent Easement	Open-cut	Temporary	34	0.04
16.0	WB012	Estuarine Channel	Perennial	Temporary Workspace	Open-cut	Temporary	0	0.05
16.3	OW024	Estuarine Openwater	Permanently Flooded	ATWS	Open Water Crossing	Temporary	0	0.04
16.3	OW024	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.12
16.3	OW024	Estuarine Openwater	Permanently Flooded	Permanent Easement	Open-cut	Temporary	69	0.09
16.4	OW023	Estuarine Openwater	Permanently Flooded	ATWS	Open Water Crossing	Temporary	0	0.01
16.4	OW023	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.00
16.4	WB011	Estuarine Channel	Perennial	ATWS	Open Water Crossing	Temporary	0	0.02
16.4	WB011	Estuarine Channel	Perennial	Temporary Workspace	Open-cut	Temporary	0	0.06
16.4	WB011	Estuarine Channel	Perennial	Permanent Easement	Open-cut	Temporary	38	0.04
16.4	OW022	Estuarine Openwater	Permanently Flooded	ATWS	Open Water Crossing	Temporary	0	0.31
16.4	OW022	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.93
16.5	OW022	Estuarine Openwater	Permanently Flooded	Permanent Easement	Open-cut	Temporary	495	0.61

APPENDIX F
LIST OF WATERBODIES AT THE TERMINAL FACILITY AND CROSSED BY PIPELINE (cont'd)

TABLE F-2

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT WATERBODIES AT THE PIPELINE

Approx. Milepost	Waterbody ID	Waterbody Type	Waterbody Regime	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
16.6	OW021	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	4.90
16.6	OW021	Estuarine Openwater	Permanently Flooded	ATWS	Open Water Crossing	Temporary	0	0.81
17.1	OW021	Estuarine Openwater	Permanently Flooded	ATWS	Foreign Pipeline Crossing	Temporary	0	1.25
17.2	OW021	Estuarine Openwater	Permanently Flooded	Permanent Easement	Open-cut	Temporary	766	3.95
17.2	OW021	Estuarine Openwater	Permanently Flooded	ATWS	Open Water Crossing	Temporary	0	0.24
17.3	OW021	Estuarine Openwater	Permanently Flooded	ATWS	Foreign Pipeline Crossing	Temporary	0	0.02
17.4	OW020	Borrow Area	Permanently Flooded	ATWS	Open Water Crossing	Temporary	0	0.01
17.4	OW020	Borrow Area	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.05
17.4	OW020	Borrow Area	Permanently Flooded	Permanent Easement	Open-cut	Temporary	52	0.06
17.4	OW019	Estuarine Openwater	Permanently Flooded	ATWS	Open Water Crossing	Temporary	0	0.16
17.4	OW019	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.59
17.4	OW019	Estuarine Openwater	Permanently Flooded	Permanent Easement	Open-cut	Temporary	374	0.43
17.5	OW018	Estuarine Openwater	Permanently Flooded	ATWS	Open Water Crossing	Temporary	0	0.19
17.5	OW018	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.93
17.5	OW018	Estuarine Openwater	Permanently Flooded	Permanent Easement	Open-cut	Temporary	614	0.75
17.7	OW017	Estuarine Openwater	Permanently Flooded	ATWS	Foreign Pipeline Crossing	Temporary	0	0.09
17.8	OW017	Estuarine Openwater	Permanently Flooded	Permanent Easement	Open-cut	Temporary	51	0.06
17.8	OW017	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.03
17.8	OW016	Estuarine Openwater	Permanently Flooded	ATWS	Foreign Pipeline Crossing	Temporary	0	0.07
17.8	OW016	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.06
17.8	OW016	Estuarine Openwater	Permanently Flooded	ATWS	Foreign Pipeline Crossing	Temporary	0	0.22
17.8	OW016	Estuarine Openwater	Permanently Flooded	Permanent Easement	Open-cut	Temporary	39	0.06
17.8	OW016	Estuarine Openwater	Permanently Flooded	Permanent Easement	Open-cut	Temporary	132	0.56
17.8	OW016	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.35
17.8	OW016	Estuarine Openwater	Permanently Flooded	ATWS	Foreign Pipeline Crossing	Temporary	0	0.27
17.9	OW015	Borrow Area	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.05
17.9	OW015	Borrow Area	Permanently Flooded	Permanent Easement	Open-cut	Temporary	199	0.16
18.0	OW014	Borrow Area	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.06

TABLE F-2

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT WATERBODIES AT THE PIPELINE

Approx. Milepost	Waterbody ID	Waterbody Type	Waterbody Regime	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
18.1	OW013	Borrow Area	Permanently Flooded	Permanent Easement	Open-cut	Temporary	95	0.15
18.1	OW013	Borrow Area	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.34
18.2	OW010	Borrow Area	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.29
18.4	OW008	Borrow Area	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.09
18.6	OW006	Estuarine Pond	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.21
18.6	OW006	Estuarine Pond	Permanently Flooded	Permanent Easement	Open-cut	Temporary	57	0.04
20.3	OW005	Estuarine Openwater	Permanently Flooded	Permanent Easement	Open-cut	Temporary	385	0.40
20.3	OW005	Estuarine Openwater	Permanently Flooded	Temporary Workspace	Open-cut	Temporary	0	0.53
20.5	WB010	Canal	Perennial	Permanent Easement	Open-cut	Temporary	76	0.09
20.5	WB010	Canal	Perennial	Temporary Workspace	Open-cut	Temporary	0	0.11
21.4	WB009	Canal	Perennial	Permanent Easement	HDD	No Impact – HDD	36	0.04
21.9	WB501d	Ditch	Perennial	Temporary Access Road	TAR 22	Temporary	0	0.01
22.1	WB008	Canal	Perennial	Permanent Easement	Open-cut	Temporary	30	0.03
22.1	WB008	Canal	Perennial	Temporary Workspace	Open-cut	Temporary	0	0.04

[a] Waterbody IDs with "dw" were previously desktop digitized then later field verified/surveyed; those ending with "d" are desktop digitized.
[b] Features at the Crossing Length at Centerline (feet) column with "0" means not crossed by centerline.
[c] Features at the Area (acres) column equal less than 0.01 acres, which rounds to 0.00 acres.
ATWS = additional temporary workspace; HDD = horizontal directional drill; PAR = permanent access road; TAR = temporary access road

APPENDIX G

LIST OF WETLANDS AT TERMINAL FACILITY AND CROSSED BY PIPELINE

APPENDIX G
LIST OF WETLANDS AT TERMINAL FACILITY AND CROSSED BY PIPELINE

TABLE G-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE TERMINAL FACILITIES

Terminal Facilities	Wetland ID	Wetland Type	Impact Type	Area (acres)
VENTURE GLOBAL PROPERTY				
Terminal Site	WA004	PEM	Permanent	0.01
Terminal Site	WA006	PEM	Permanent	0.16
Terminal Site	WA006	PSS	Permanent	0.21
Terminal Site	WA008	PEM	Permanent	0.05
Terminal Site	WA009	PEM	Permanent	0.41
Terminal Site	WA010	PEM	Permanent	0.32
Terminal Site	WA011	PEM	Permanent	0.16
Terminal Site	WA012	PEM	Permanent	0.05
Terminal Site	WA013	PEM	Permanent	0.43
Terminal Site	WA015	PEM	Permanent	0.43
Terminal Site	WA016	PSS	Permanent	0.23
Terminal Site	WA016	PEM	Permanent	0.59
Terminal Site	WA017	PEM	Permanent	1.02
Terminal Site	WA018	PEM	Permanent	0.53
Terminal Site	WA019	PEM	Permanent	0.13
Terminal Site	WA020	PEM	Permanent	0.27
Terminal Site	WA021	PEM	Permanent	0.57
Terminal Site	WL001	E2EM	Permanent	0.33
Terminal Site	WL002e4_ext	E2EM	Permanent	0.00
Terminal Site	WL002e4_ext	E2EM	Permanent	0.07
Terminal Site	WL002e4_ext	E2EM	Permanent	2.33
Terminal Site	WL002m1_ext	Mudflat	Permanent	0.30
Terminal Site	WL002s3_ext	E2SS	Permanent	0.01
Terminal Site	WL002s3_ext	E2SS	Permanent	0.05
Terminal Site	WL002s4	E2SS	Permanent	0.36
Terminal Site	WL002s6	E2SS	Permanent	0.04
Terminal Site	WL002s6	E2SS	Permanent	0.22
Terminal Site	WL004	E2EM	Permanent	2.02
Terminal Site	WL005	E2EM-Mosaic	Permanent	3.01
Terminal Site	WL005	E2EM-Mosaic	Permanent	11.01
Terminal Site	WL006	E2EM	Permanent	0.31

APPENDIX G
LIST OF WETLANDS AT TERMINAL FACILITY AND CROSSED BY PIPELINE (cont'd)

TABLE G-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE TERMINAL FACILITIES

Terminal Facilities	Wetland ID	Wetland Type	Impact Type	Area (acres)
Terminal Site	WL007e	E2EM	Permanent	6.72
Terminal Site	WL007e2	E2EM	Permanent	0.32
Terminal Site	WL007e8	PEM	Permanent	0.01
Terminal Site	WL007p	E2EM	Permanent	0.56
Terminal Site	WL007s	PSS	Permanent	9.72
Terminal Site	WL008	E2SS	Permanent	0.03
Terminal Site	WL009e	PEM	Permanent	0.02
Terminal Site	WL009e	PEM	Permanent	14.20
Terminal Site	WL009e2	PEM	Permanent	0.00
Terminal Site	WL009e2	PEM	Permanent	13.22
Terminal Site	WL009s	PSS	Permanent	0.00
Terminal Site	WL009s	PSS	Permanent	12.18
Terminal Site	WL010	E2EM	Permanent	0.88
Terminal Site	WL010s	PSS	Permanent	0.03
Terminal Site	WL011e	PEM	Permanent	0.41
Terminal Site	WL047e	PEM	Permanent	25.33
Terminal Site	WL047e2	E2EM	Permanent	0.63
Terminal Site	WL047e3	PEM	Permanent	0.04
Terminal Site	WL047e3	PEM	Permanent	0.07
Terminal Site	WL047e3	PEM	Permanent	1.19
Terminal Site	WL047e3	PEM	Permanent	1.21
Terminal Site	WL047s1	PSS	Permanent	0.48
Terminal Site	WL047s2	PSS	Permanent	0.07
Terminal Site	WL047s2	PSS	Permanent	0.80
Terminal Site	WL047s4	PSS	Permanent	5.18
Northeast Access Road	WA014	PEM	Permanent	0.24
Northeast Access Road	WA015	PEM	Permanent	1.16
Northeast Access Road	WL001e	PEM	Permanent	0.28
Northeast Access Road	WL003e	E2EM	Permanent	0.44
Northeast Access Road	WL003e2	PEM	Permanent	0.06
Northeast Access Road	WL003e3	PEM	Permanent	0.09
Northeast Access Road	WL003e4	PEM	Permanent	0.41

TABLE G-1

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE TERMINAL FACILITIES**

Terminal Facilities	Wetland ID	Wetland Type	Impact Type	Area (acres)
Northeast Access Road	WL005s	PSS	Permanent	0.03
Northeast Access Road	WL007e	PEM	Permanent	0.71
Martin Access Road	WL003e	E2EM	Permanent	0.54
Martin Access Road	WL003e2	PEM	Permanent	0.04
DeHyCo Access Road	WL002e4_ext	E2EM	Temporary	0.07
DeHyCo Access Road	WL002s6	E2SS	Temporary	0.02
Berm TWS	WA015	PEM	Temporary	0.37
Berm TWS	WA018	PEM	Temporary	0.27
Berm TWS	WL001	E2EM	Temporary	0.22
Berm TWS	WL002e4_ext	E2EM	Temporary	1.51
Berm TWS	WL002m1_ext	Mudflat	Temporary	0.02
Berm TWS	WL002m3	Mudflat	Temporary	0.03
Berm TWS	WL002s6	E2SS	Temporary	0.07
Berm TWS	WL005	E2EM-Mosaic	Temporary	1.46
Berm TWS	WL005	E2EM-Mosaic	Temporary	2.21
Berm TWS	WL006	E2EM	Temporary	0.07
Berm TWS	WL007e	PEM	Temporary	0.02
Berm TWS	WL007e2	E2EM	Temporary	3.15
Berm TWS	WL007e8	PEM	Temporary	0.53
Berm TWS	WL007s	PSS	Temporary	1.68
Berm TWS	WL009e	PEM	Temporary	0.08
Berm TWS	WL010s	PSS	Temporary	0.14
Berm TWS	WL011e	PEM	Temporary	1.98
Berm TWS	WL012e	E2EM	Temporary	0.12
Berm TWS	WL047e	PEM	Temporary	0.36
Berm TWS	WL047e	PEM	Temporary	2.20
Berm TWS	WL047e2	E2EM	Temporary	0.22
Berm TWS	WL047e2	E2EM	Temporary	0.56
Eastern TWS	WL003e4	PEM	Temporary	10.25
Eastern TWS	WL005e	PEM	Temporary	1.44
Eastern TWS	WL005s	PSS	Temporary	2.02
Eastern TWS	WL007e	PEM	Temporary	0.00

TABLE G-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE TERMINAL FACILITIES

Terminal Facilities	Wetland ID	Wetland Type	Impact Type	Area (acres)
Eastern TWS	WL007e	PEM	Temporary	1.15
Eastern TWS	WL007e2	PEM	Temporary	0.15
Eastern TWS	WL007e3	PEM	Temporary	0.01
Eastern TWS	WL007e4	PEM	Temporary	0.00
Eastern TWS	WL007e4	PEM	Temporary	0.03
Eastern TWS	WL007e6	PEM	Temporary	0.00
Eastern TWS	WL007e6	PEM	Temporary	0.05
Eastern TWS	WL007e8	PEM	Temporary	0.82
Eastern TWS	WL007e8	PEM	Temporary	4.89
Eastern TWS	WL007f	PFO	Temporary	1.78
Eastern TWS	WL007f2	PFO	Temporary	0.73
Eastern TWS	WL007s	PSS	Temporary	0.17
Eastern TWS	WL007s2	PSS	Temporary	0.06
Eastern TWS	WL007s3	PSS	Temporary	0.03
Eastern TWS	WL007s4	PSS	Temporary	0.00
Eastern TWS	WL007s4	PSS	Temporary	0.01
Eastern TWS	WL007s5	PSS	Temporary	0.00
Eastern TWS	WL007s5	PSS	Temporary	0.48
Eastern TWS	WL007s6	PSS	Temporary	0.00
Eastern TWS	WL007s6	PSS	Temporary	0.07
Eastern TWS	WL008s	PSS	Temporary	0.06
Northeastern TWS	WL001e	PEM	Temporary	0.26
Northwest TWS	WL002e4_ext	E2EM	Temporary	0.00
Northwest TWS	WL002e5	E2EM	Temporary	0.00
Pipeline within Property Boundary	WL003e4	PEM	Temporary	0.23
Pipeline within Property Boundary	WL005e	PEM	Temporary	0.40
Pipeline within Property Boundary	WL007e	PEM	Temporary	0.03
Pipeline within Property Boundary	WL007e5	PEM	Temporary	0.02
Pipeline within Property Boundary	WL007e6	PEM	Temporary	0.00
Pipeline within Property Boundary	WL007e6	PEM	Temporary	0.02
Pipeline within Property Boundary	WL007e7	PEM	Temporary	0.06
Pipeline within Property Boundary	WL007e8	PEM	Temporary	1.40

APPENDIX G
LIST OF WETLANDS AT TERMINAL FACILITY AND CROSSED BY PIPELINE (cont'd)

TABLE G-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE TERMINAL FACILITIES

Terminal Facilities	Wetland ID	Wetland Type	Impact Type	Area (acres)
Pipeline within Property Boundary	WL007f2	PFO	Temporary	0.02
Pipeline within Property Boundary	WL007s4	PSS	Temporary	0.09
Pipeline within Property Boundary	WL007s5	PSS	Temporary	0.00
Pipeline within Property Boundary	WL007s6	PSS	Temporary	0.00
Pipeline within Property Boundary	WL007s6	PSS	Temporary	0.25
Pipeline within Property Boundary	WL007s7	PSS	Temporary	0.44
Pipeline within Property Boundary	WL007s8	PSS	Temporary	0.40
Marine Facilities	WL001	E2EM	Permanent	0.10
Marine Facilities	WL002e1	E2EM	Permanent	1.64
Marine Facilities	WL002e2	E2EM	Permanent	0.81
Marine Facilities	WL002e3	E2EM	Permanent	1.15
Marine Facilities	WL002e4	E2EM	Permanent	0.00
Marine Facilities	WL002e4	E2EM	Permanent	0.00
Marine Facilities	WL002e4	E2EM	Permanent	0.02
Marine Facilities	WL002e4	E2EM	Permanent	0.43
Marine Facilities	WL002e4	E2EM	Permanent	0.58
Marine Facilities	WL002e4_ext	E2EM	Permanent	0.00
Marine Facilities	WL002e4_ext	E2EM	Permanent	0.00
Marine Facilities	WL002e4_ext	E2EM	Permanent	0.02
Marine Facilities	WL002e4_ext	E2EM	Permanent	1.49
Marine Facilities	WL002m1	Mudflat	Permanent	0.00
Marine Facilities	WL002m1	Mudflat	Permanent	0.32
Marine Facilities	WL002m1_ext	Mudflat	Permanent	0.00
Marine Facilities	WL002m1_ext	Mudflat	Permanent	0.14
Marine Facilities	WL002m2	Mudflat	Permanent	0.18
Marine Facilities	WL002p1	E2EM	Permanent	0.26
Marine Facilities	WL002p2	E2EM	Permanent	0.19
Marine Facilities	WL002s1	E2SS	Permanent	0.13
Marine Facilities	WL002s1	E2SS	Permanent	1.60
Marine Facilities	WL002s1	E2SS	Permanent	2.02
Marine Facilities	WL002s1	E2SS	Permanent	2.16
Marine Facilities	WL002s2	E2SS	Permanent	0.20

TABLE G-1

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE TERMINAL FACILITIES**

Terminal Facilities	Wetland ID	Wetland Type	Impact Type	Area (acres)
Marine Facilities	WL002s3	E2SS	Permanent	0.10
Marine Facilities	WL002s3_ext	E2SS	Permanent	0.06
Marine Facilities	WL002s3_ext	E2SS	Permanent	0.49
Marine Facilities	WL004	E2EM	Permanent	2.97
Land Avoided (Not Disturbed)	WA014	PEM	No Impact	0.15
Land Avoided (Not Disturbed)	WA015	PEM	No Impact	0.75
Land Avoided (Not Disturbed)	WA015	PEM	No Impact	0.92
Land Avoided (Not Disturbed)	WA018	PEM	No Impact	0.95
Land Avoided (Not Disturbed)	WL001	E2EM	No Impact	11.06
Land Avoided (Not Disturbed)	WL001	E2EM	No Impact	48.40
Land Avoided (Not Disturbed)	WL001e	PEM	No Impact	0.28
Land Avoided (Not Disturbed)	WL002e	PEM	No Impact	0.10
Land Avoided (Not Disturbed)	WL002e3	E2EM	No Impact	0.01
Land Avoided (Not Disturbed)	WL002e4_ext	E2EM	No Impact	0.07
Land Avoided (Not Disturbed)	WL002e4_ext	E2EM	No Impact	10.75
Land Avoided (Not Disturbed)	WL002e5	E2EM	No Impact	3.19
Land Avoided (Not Disturbed)	WL002m3	Mudflat	No Impact	0.04
Land Avoided (Not Disturbed)	WL002s5	E2SS	No Impact	0.16
Land Avoided (Not Disturbed)	WL002s6	E2SS	No Impact	0.06
Land Avoided (Not Disturbed)	WL002s6	E2SS	No Impact	0.19
Land Avoided (Not Disturbed)	WL003	E2EM	No Impact	0.19
Land Avoided (Not Disturbed)	WL003e	E2EM	No Impact	0.00
Land Avoided (Not Disturbed)	WL003e	E2EM	No Impact	0.00
Land Avoided (Not Disturbed)	WL003e	E2EM	No Impact	3.96
Land Avoided (Not Disturbed)	WL003e	E2EM	No Impact	27.66
Land Avoided (Not Disturbed)	WL003e2	PEM	No Impact	0.11
Land Avoided (Not Disturbed)	WL003e2	PEM	No Impact	0.13
Land Avoided (Not Disturbed)	WL003e2	PEM	No Impact	0.53
Land Avoided (Not Disturbed)	WL003e3	PEM	No Impact	0.00
Land Avoided (Not Disturbed)	WL003e3	PEM	No Impact	0.02
Land Avoided (Not Disturbed)	WL003e3	PEM	No Impact	0.26
Land Avoided (Not Disturbed)	WL003e4	PEM	No Impact	0.00

TABLE G-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE TERMINAL FACILITIES

Terminal Facilities	Wetland ID	Wetland Type	Impact Type	Area (acres)
Land Avoided (Not Disturbed)	WL003e4	PEM	No Impact	0.35
Land Avoided (Not Disturbed)	WL003e4	PEM	No Impact	0.82
Land Avoided (Not Disturbed)	WL003e4	PEM	No Impact	1.02
Land Avoided (Not Disturbed)	WL004s	PSS	No Impact	1.11
Land Avoided (Not Disturbed)	WL005	E2EM-Mosaic	No Impact	0.00
Land Avoided (Not Disturbed)	WL005	E2EM-Mosaic	No Impact	4.68
Land Avoided (Not Disturbed)	WL005	E2EM-Mosaic	No Impact	17.73
Land Avoided (Not Disturbed)	WL005e	PEM	No Impact	0.01
Land Avoided (Not Disturbed)	WL005e	PEM	No Impact	1.68
Land Avoided (Not Disturbed)	WL005s	PSS	No Impact	0.30
Land Avoided (Not Disturbed)	WL006	E2EM	No Impact	0.11
Land Avoided (Not Disturbed)	WL006e	E2EM	No Impact	0.17
Land Avoided (Not Disturbed)	WL007e	PEM	No Impact	0.00
Land Avoided (Not Disturbed)	WL007e2	PEM	No Impact	0.02
Land Avoided (Not Disturbed)	WL007e2	E2EM	No Impact	0.25
Land Avoided (Not Disturbed)	WL007e3	PEM	No Impact	0.03
Land Avoided (Not Disturbed)	WL007e4	PEM	No Impact	0.05
Land Avoided (Not Disturbed)	WL007e5	PEM	No Impact	0.00
Land Avoided (Not Disturbed)	WL007e5	PEM	No Impact	0.64
Land Avoided (Not Disturbed)	WL007e8	PEM	No Impact	0.00
Land Avoided (Not Disturbed)	WL007e8	PEM	No Impact	0.00
Land Avoided (Not Disturbed)	WL007e8	PEM	No Impact	0.00
Land Avoided (Not Disturbed)	WL007e8	PEM	No Impact	0.09
Land Avoided (Not Disturbed)	WL007e8	PEM	No Impact	10.05
Land Avoided (Not Disturbed)	WL007f3	PFO	No Impact	0.00
Land Avoided (Not Disturbed)	WL007f3	PFO	No Impact	0.52
Land Avoided (Not Disturbed)	WL007f4	PFO	No Impact	0.57
Land Avoided (Not Disturbed)	WL007s2	PSS	No Impact	0.03
Land Avoided (Not Disturbed)	WL007s3	PSS	No Impact	0.08
Land Avoided (Not Disturbed)	WL007s4	PSS	No Impact	0.00
Land Avoided (Not Disturbed)	WL007s4	PSS	No Impact	0.02
Land Avoided (Not Disturbed)	WL007s4	PSS	No Impact	0.15

TABLE G-1

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE TERMINAL FACILITIES**

Terminal Facilities	Wetland ID	Wetland Type	Impact Type	Area (acres)
Land Avoided (Not Disturbed)	WL007s6	PSS	No Impact	0.00
Land Avoided (Not Disturbed)	WL007s7	PSS	No Impact	0.01
Land Avoided (Not Disturbed)	WL007s7	PSS	No Impact	0.10
Land Avoided (Not Disturbed)	WL007s8	PSS	No Impact	0.00
Land Avoided (Not Disturbed)	WL007s8	PSS	No Impact	0.80
Land Avoided (Not Disturbed)	WL007s9	PSS	No Impact	0.00
Land Avoided (Not Disturbed)	WL007s9	PSS	No Impact	0.56
Land Avoided (Not Disturbed)	WL009e	PEM	No Impact	0.01
Land Avoided (Not Disturbed)	WL010s	PSS	No Impact	0.34
Land Avoided (Not Disturbed)	WL011e	PEM	No Impact	45.56
Land Avoided (Not Disturbed)	WL012e	E2EM	No Impact	7.91
Land Avoided (Not Disturbed)	WL047e	PEM	No Impact	0.22
Land Avoided (Not Disturbed)	WL047e	PEM	No Impact	15.97
Land Avoided (Not Disturbed)	WL047e2	E2EM	No Impact	0.18
Land Avoided (Not Disturbed)	WL047e2	E2EM	No Impact	41.89
Land Avoided (Not Disturbed)	WL047s3	E2SS	No Impact	12.20
CONSTRUCTION SUPPORT FACILITIES				
Liberty Support Facility	WETB17	PEM	Temporary	0.55
Liberty Support Facility	WL001e	PEM	Temporary	0.45
Liberty Support Facility	WL002e	PEM	Temporary	0.00

Note: Multiple features at the Area (acres) column equal less than 0.01 acre, which rounds to 0.00 acres.
E2EM = estuarine intertidal emergent; E2EM-Mosaic = estuarine intertidal emergent-mosaic; E2SS = estuarine intertidal scrub shrub; PEM = palustrine emergent; PFO = palustrine forested; PSS = palustrine scrub shrub; TWS = temporary workspace

TABLE G-2

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
0.0	WL131de	E2EM	Permanent Access Road	PAR 1	Permanent	0	0.01
0.0	WL131ds	E2SS	ATWS	Meter Station	Temporary	0	0.71
0.0	WL131ds	E2SS	Aboveground Facilities	Meter Station	Permanent	40	1.24
0.0	WL131ds	E2SS	Temporary Workspace	Open-cut	Temporary	0	0.30
0.0	WL131ds	E2SS	Permanent Easement	Open-cut	Temporary	282	0.32
0.1	WL131de	E2EM	ATWS	Meter Station	Temporary	0	0.13
0.1	WL131de	E2EM	Permanent Easement	Open-cut	Temporary	101.9	0.12
0.1	WL131de	E2EM	Temporary Workspace	Open-cut	Temporary	0	0.13
0.1	WL042e	E2EM	ATWS	Meter Station	Temporary	0	0.09
0.1	WL042e	E2EM	Permanent Easement	Open-cut	Temporary	74.5	0.09
0.1	WL042e	E2EM	Temporary Workspace	Open-cut	Temporary	0	0.30
0.1	WL042e	E2EM	ATWS	HDD Exit	Temporary	0	0.15
0.1	WL063de	E2EM	ATWS	HDD Exit	Temporary	0	0.78
0.1	WL063de	E2EM	ATWS	HDD Pipe String	Temporary	0	0.08
0.1	WL063ds	E2SS	ATWS	HDD Pipe String	Temporary	0	1.25
0.1	WL063de	E2EM	ATWS	HDD Pipe String	Temporary	0	3.79
0.1	WL042e	E2EM	Permanent Easement	HDD	No Impact – HDD	338.5	0.38
0.1	WL500de	E2EM	Temporary Access Road	TAR 2	Temporary	0	0.30
0.3	WL041s	E2SS	Permanent Easement	HDD	No Impact – HDD	43.6	0.05
0.3	WL041e	E2EM	Permanent Easement	HDD	No Impact – HDD	914.5	1.03
0.5	WL041e	E2EM	Temporary Workspace	HDD Section with Potential Impacts	Temporary	0	0.70
0.5	WL041e	E2EM	ATWS	HDD Entry	Temporary	0	1.21
0.5	WL041e	E2EM	Permanent Easement	HDD Section with Potential Impacts	Temporary	492.5	0.56
0.5	WL106ds	E2SS	Temporary Access Road	TAR 3	Temporary	0	0.00
0.5	WL106de	E2EM	Temporary Access Road	TAR 3	Temporary	0	0.12
0.5	WL106ds	E2SS	Temporary Access Road	TAR 3	Temporary	0	0.00
0.6	WL041e	E2EM	Permanent Easement	HDD	No Impact – HDD	1061	1.21
0.8	WL040s	E2SS	Permanent Easement	HDD	No Impact – HDD	30.7	0.04
0.8	WL040e	E2EM	Permanent Easement	HDD	No Impact – HDD	820.3	0.94
1.0	WL040e	E2EM	Permanent Easement	HDD Section with Potential Impacts	Temporary	157.1	0.18

TABLE G-2

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
1.0	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	6.52
1.0	WL040e	E2EM	ATWS	Push Site	Temporary	0	1.38
1.0	WL040e	E2EM	ATWS	HDD Exit	Temporary	0	0.19
1.0	WL104de	E2EM	ATWS	HDD Exit	Temporary	0	1.86
1.0	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	4659.7	5.35
1.0	WL501d	E2EM	Temporary Access Road	TAR 4	Temporary	0	0.38
1.0	WL501d	E2SS	Temporary Access Road	TAR 4	Temporary	0	0.02
1.1	WL104de	E2EM	ATWS	HDD Pipe String	Temporary	0	4.11
1.4	WL104ds	E2SS	ATWS	HDD Pipe String	Temporary	0	0.45
1.4	WL104de	E2EM	ATWS	HDD Pipe String	Temporary	0	1.54
1.7	WL040e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	1.61
1.7	WL040e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.37
1.9	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	5.90
2.3	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.62
2.3	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	48.5	0.07
2.4	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.69
2.5	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	3.9	0.07
2.5	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	2113.1	5.92
2.8	WL040e	E2EM	ATWS	Foreign Pipeline Crossing/ Push Site	Temporary	0	0.95
2.8	WL040e	E2EM	ATWS	Foreign Pipeline Crossing/ Push Site	Temporary	0	0.01
2.8	WL040e	E2EM	ATWS	Foreign Pipeline Crossing/ Push Site	Temporary	0	0.07
2.8	WL040e	E2EM	Temporary Access Road	TAR 5	Temporary	0	0.11
2.8	WL040e	E2EM	ATWS	Foreign Pipeline Crossing/ Push Site	Temporary	0	0.02
2.8	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.02
2.8	WL040e	E2EM	ATWS	Foreign Pipeline Crossing/ Push Site	Temporary	0	0.05
2.9	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	3.88
2.9	WL040e	E2EM	ATWS	Foreign Pipeline Crossing/ Push Site	Temporary	0	0.38
3.2	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	31	0.02
3.2	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.02
3.2	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.00

TABLE G-2

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
3.2	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	15.4	0.02
3.2	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.03
3.3	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.62
3.4	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	16.9	0.03
3.4	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	336.5	3.71
3.5	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.08
3.5	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	63.5	0.07
3.5	WL502de	E2EM	Temporary Access Road	TAR 6	Temporary	0	0.00
3.5	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	2.45
3.5	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	1763.7	2.02
3.5	WL502de	E2EM	Temporary Access Road	TAR 6	Temporary	0	0.02
3.5	WL503de	E2EM	Temporary Access Road	TAR 6	Temporary	0	0.00
3.6	WL040e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.50
3.6	WL040e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.18
3.9	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	618.8	0.72
3.9	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.85
4.0	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	1.79
4.0	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.01
4.0	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	28.1	0.02
4.0	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	1013.3	1.45
4.1	WL040e	E2EM	Permanent Easement	Push-Pull	Temporary	0	0.02
4.2	WL040e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.12
4.2	WL040e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.05
4.2	WL040e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.07
4.2	WL509ds	E2SS	ATWS	Foreign Pipeline Crossing	Temporary	0	0.07
4.2	WL040e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.01
4.2	WL510de	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.06
4.2	WL039e	E2EM	Permanent Easement	Push-Pull	Temporary	1296.1	1.49
4.2	WL039e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	1.78
4.2	WL039e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	2.64

TABLE G-2

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
4.3	WL510de	E2EM	Temporary Access Road	TAR 7	Temporary	0	0.00
4.4	WL130de	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.38
4.5	WL039e	E2EM	Permanent Easement	Push-Pull	Temporary	2032.8	2.34
4.5	WL039e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	2.71
4.6	WL039e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.06
4.8	WL039e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.27
4.9	WL039e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.07
4.9	WL039e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	1.90
4.9	WL039e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	4.35
4.9	WL039e	E2EM	Permanent Easement	Push-Pull	Temporary	3135.5	3.59
5.0	WL129de	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.53
5.5	WL039e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.07
5.5	WL039e	E2EM	Permanent Easement	Push-Pull	Temporary	57	0.07
5.5	WL039e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	3.08
5.7	WL038s	E2SS	Permanent Easement	Push-Pull	Temporary	205	0.24
5.7	WL038s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.01
5.8	WL039s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.82
5.9	WL039e	E2EM	Permanent Easement	Push-Pull	Temporary	205.2	1.74
5.9	WL039s	E2SS	Permanent Easement	Push-Pull	Temporary	721	1.48
6.0	WL057ds	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.43
6.1	WL057ds	E2SS	Permanent Easement	Push-Pull	Temporary	152.6	0.14
6.1	WL057de	E2EM	Permanent Easement	Push-Pull	Temporary	1069.8	1.24
6.1	WL057de	E2EM	Temporary Workspace	Push-Pull	Temporary	0	1.38
6.4	WL038e	E2EM	Permanent Easement	Push-Pull	Temporary	168.6	0.22
6.4	WL038e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.11
6.4	WL056ds	E2SS	Temporary Workspace	Push-Pull	Temporary	0	1.49
6.4	WL056ds	E2SS	Permanent Easement	Push-Pull	Temporary	1046.9	1.19
6.6	WL055de	E2EM	Temporary Workspace	Push-Pull	Temporary	0	1.36
6.6	WL055de	E2EM	Permanent Easement	Push-Pull	Temporary	984.9	1.09
6.7	WL055de	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	1.58

TABLE G-2

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
6.8	WL038e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.32
6.8	WL038e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.00
6.8	WL038e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.20
6.8	WL038e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.05
6.8	WL038e	E2EM	Permanent Easement	Push-Pull	Temporary	130.5	0.15
6.8	WL038e	E2EM	Temporary Access Road	TAR 9	Temporary	0	0.03
6.8	WL038e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.04
6.8	WL562d	E2EM	Temporary Access Road	TAR 9	Temporary	0	0.30
6.8	WL038e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	1.59
6.9	WL563d	E2EM	Temporary Access Road	TAR 9	Temporary	0	0.02
6.9	WL038e	E2EM	Permanent Easement	Push-Pull	Temporary	101.7	0.12
6.9	WL038e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.05
6.9	WL038e	E2EM	Permanent Easement	Push-Pull	Temporary	537.5	1.29
7.0	WL038e	E2EM	ATWS	Waterbody Crossing	Temporary	0	0.06
7.0	WL038e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.46
7.0	WL038e	E2EM	Permanent Easement	Push-Pull	Temporary	341.4	0.39
7.1	WL038e	E2EM	ATWS	Waterbody Crossing	Temporary	0	0.06
7.1	WL038s	E2SS	Permanent Easement	Push-Pull	Temporary	48.8	0.05
7.1	WL038s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.07
7.1	WL038e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	3.58
7.3	WL038e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.04
7.3	WL038e	E2EM	Permanent Easement	Push-Pull	Temporary	12.7	0.01
7.3	WL038e	E2EM	Permanent Easement	Push-Pull	Temporary	1751.6	3.00
7.4	WL038e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.35
7.4	WL038e	E2EM	ATWS	HDD Pipe String	Temporary	0	2.31
7.6	WL038e	E2EM	Permanent Easement	Push-Pull	Temporary	869.4	1.00
7.6	WL038e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	1.21
7.6	WL038e	E2EM	ATWS	HDD Pipe String	Temporary	0	1.41
7.6	WL038e	E2EM	ATWS	HDD Pipe String	Temporary	0	0.35
7.7	WL038e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.00

TABLE G-2

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
7.8	WL038e	E2EM	Permanent Easement	Push-Pull	Temporary	451.9	0.52
7.8	WL038e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.62
7.8	WL038e	E2EM	ATWS	HDD Pipe String	Temporary	0	0.18
7.8	WL038e	E2EM	ATWS	HDD Exit	Temporary	0	0.61
7.8	WL038e	E2EM	ATWS	HDD Exit	Temporary	0	0.40
7.9	WL530de	E2EM	Temporary Access Road	TAR 10	Temporary	0	0.03
7.9	WL038e	E2EM	Permanent Easement	Push-Pull	Temporary	115.4	0.13
7.9	WL038e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.17
7.9	WL038e	E2EM	Permanent Easement	HDD Section with Potential Impacts	Temporary	9.4	0.01
7.9	WL038s	E2SS	ATWS	HDD Exit	Temporary	0	0.34
7.9	WL038s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.24
7.9	WL038s	E2SS	Permanent Easement	HDD Section with Potential Impacts	Temporary	172.5	0.20
8.0	WL038s	E2SS	Permanent Easement	HDD	No Impact – HDD	148.9	0.17
8.0	WL038f	E2FO	Permanent Easement	HDD	No Impact – HDD	336.9	0.39
8.0	WL529de	PEM	Temporary Access Road	TAR 10	Temporary	0	0.01
8.1	WL037e	PEM	Permanent Easement	HDD	No Impact – HDD	106	0.12
8.2	WL037e	PEM	Permanent Easement	HDD	No Impact – HDD	156.4	0.19
8.2	WL037e	PEM	Permanent Easement	HDD	No Impact – HDD	441.9	0.50
8.2	WL102de	PEM	Temporary Access Road	TAR 11	Temporary	0	0.02
8.2	WL102de	PEM	Permanent Access Road	PAR 11	Permanent	0	0.07
8.2	WL102de	PEM	Temporary Access Road	TAR 11	Temporary	0	0.01
8.3	WL037e	PEM	Permanent Easement	HDD Section with Potential Impacts	Temporary	51.2	0.06
8.3	WL037e	PEM	ATWS	HDD Entry	Temporary	0	0.58
8.3	WL037e	PEM	Temporary Workspace	Open-cut	Temporary	0	0.97
8.3	WL037e	PEM	Permanent Easement	Open-cut	Temporary	18.7	0.02
8.3	WL037e	PEM	Aboveground Facilities	Main Line Block Valve Site	Permanent	50	0.06
8.3	WL037e	PEM	Permanent Easement	Open-cut	Temporary	498.1	0.55
8.3	WL101de	PEM	ATWS	HDD Pipe String	Temporary	0	1.26
8.3	WL101ds	PSS	ATWS	HDD Pipe String	Temporary	0	0.06
8.3	WL101de	PEM	ATWS	HDD Pipe String	Temporary	0	2.71

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CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
8.3	WL101ds	PSS	ATWS	HDD Pipe String	Temporary	0	0.09
8.3	WL101de	PEM	ATWS	HDD Pipe String	Temporary	0	3.97
8.3	WL053de	PEM	ATWS	HDD Pipe String	Temporary	0	0.15
8.3	WL037e	PEM	ATWS	HDD Pipe String	Temporary	0	0.36
8.4	WL037s	PSS	Temporary Workspace	Open-cut	Temporary	0	0.10
8.4	WL037s	PSS	Permanent Easement	Open-cut	Temporary	70	0.08
8.4	WL037e	PEM	Temporary Workspace	Open-cut	Temporary	0	1.06
8.4	WL037e	PEM	Permanent Easement	Open-cut	Temporary	769.7	0.88
8.5	WL037e	PEM	ATWS	HDD Exit	Temporary	0	0.57
8.5	WL037e	PEM	Permanent Easement	HDD	No Impact – HDD	420.9	0.48
8.6	WL037e	PEM	Permanent Easement	HDD	No Impact – HDD	22.1	0.03
8.7	WL036e	PEM	Permanent Easement	HDD	No Impact – HDD	1144.9	1.31
8.9	WL036e	PEM	Permanent Easement	HDD	No Impact – HDD	41.4	0.05
8.9	WL036s	PSS	Permanent Easement	HDD	No Impact – HDD	49.6	0.06
8.9	WL036e	PEM	Permanent Easement	HDD	No Impact – HDD	1710.5	1.96
9.3	WL036e	PEM	Permanent Easement	HDD	No Impact – HDD	235	0.45
9.3	WL036e	PEM	Permanent Easement	HDD	No Impact – HDD	358.3	0.41
9.4	WL036e	PEM	Permanent Easement	HDD	No Impact – HDD	25.4	0.03
9.4	WL128de	PEM	Temporary Access Road	TAR 12	Temporary	0	0.27
9.4	WL036e	PEM	Permanent Easement	HDD	No Impact – HDD	26.3	0.03
9.4	WL036e	PEM	ATWS	HDD Entry	Temporary	0	0.58
9.4	WL036e	PEM	Temporary Workspace	HDD Section with Potential Impacts	Temporary	0	0.39
9.4	WL036e	PEM	Permanent Easement	HDD Section with Potential Impacts	Temporary	280	0.32
9.4	WL036e	PEM	ATWS	HDD Entry	Temporary	0	0.06
9.5	WL036e	PEM	Temporary Access Road	TAR 12	Temporary	0	0.01
9.5	WL036e	PEM	Permanent Easement	HDD	No Impact – HDD	225.7	0.26
9.5	WL036e	PEM	Permanent Easement	HDD	No Impact – HDD	11.5	0.01
9.5	WL036s	PSS	Permanent Easement	HDD	No Impact – HDD	27.7	0.03
9.5	WL036e	PEM	Permanent Easement	HDD	No Impact – HDD	1845.9	2.12
9.9	WL036e	PEM	Permanent Easement	HDD	No Impact – HDD	73.2	0.08

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**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
9.9	WL035e	PEM	Permanent Easement	HDD	No Impact – HDD	7.9	0.01
9.9	WL035e	PEM	Permanent Easement	TAR 13	Temporary	0	0.00
9.9	WL035e	PEM	Permanent Easement	HDD	No Impact – HDD	325.2	0.29
10.0	WL035e	PEM	Permanent Easement	TAR 13	Temporary	31.8	0.23
10.0	WL035e	PEM	Temporary Access Road	TAR 13	Temporary	0	0.08
10.0	WL035e	PEM	Permanent Easement	HDD	No Impact – HDD	198.2	0.12
10.0	WL035e	PEM	Permanent Easement	HDD Section with Potential Impacts	Temporary	86.9	0.10
10.0	WL035e	PEM	ATWS	HDD Exit	Temporary	0	1.19
10.0	WL035e	PEM	Temporary Workspace	Push-Pull	Temporary	0	0.88
10.1	WL035e	PEM	Permanent Easement	Push-Pull	Temporary	143.6	0.70
10.1	WL035e	PEM	ATWS	HDD Exit	Temporary	0	0.19
10.1	WL035e	PEM	Temporary Workspace	Push-Pull	Temporary	0	0.10
10.1	WL035e	PEM	Permanent Easement	Push-Pull	Temporary	33.2	0.02
10.2	WL035e	PEM	Temporary Workspace	Push-Pull	Temporary	0	1.12
10.2	WL035e	PEM	Permanent Easement	Push-Pull	Temporary	806.7	0.92
10.3	WL035e	PEM	Temporary Workspace	Push-Pull	Temporary	0	0.06
10.3	WL035e	PEM	Permanent Easement	Push-Pull	Temporary	77.8	0.09
10.3	WL035e	PEM	Temporary Workspace	Push-Pull	Temporary	0	1.40
10.4	WL035e	PEM	Permanent Easement	Push-Pull	Temporary	861	1.00
10.5	WL035s	PSS	Permanent Easement	Push-Pull	Temporary	858.8	0.99
10.5	WL035s	PSS	Temporary Workspace	Push-Pull	Temporary	0	0.99
10.6	WL035e	PEM	Temporary Workspace	Push-Pull	Temporary	0	0.97
10.7	WL035e	PEM	Permanent Easement	Push-Pull	Temporary	697.4	0.81
10.8	WL035s	PSS	Temporary Workspace	Push-Pull	Temporary	0	0.91
10.8	WL035s	PSS	Permanent Easement	Push-Pull	Temporary	650.8	0.74
10.9	WL034s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	1.26
10.9	WL034s	E2SS	Permanent Easement	Push-Pull	Temporary	897.7	1.03
11.1	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	22.5	0.03
11.1	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.03
11.1	WL034s	E2SS	Permanent Easement	Push-Pull	Temporary	54.9	0.07

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**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
11.1	WL034s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.06
11.1	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	45.4	0.05
11.1	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.10
11.1	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	0	0.00
11.1	WL034s	E2SS	Permanent Easement	Push-Pull	Temporary	0	0.00
11.1	WL034s	E2SS	Permanent Easement	Push-Pull	Temporary	947.3	1.10
11.1	WL034s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	1.25
11.3	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.04
11.3	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	27.2	0.03
11.3	WL034s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.50
11.3	WL034s	E2SS	Permanent Easement	Push-Pull	Temporary	323.4	0.34
11.4	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	1770.4	2.38
11.4	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	2.46
11.7	WL034s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	1.78
11.7	WL034s	E2SS	Permanent Easement	Push-Pull	Temporary	14.2	1.02
11.9	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	763.4	0.92
11.9	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.85
12.1	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.03
12.1	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.91
12.1	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	20	0.02
12.1	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	660.4	0.76
12.2	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	1.84
12.2	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	1339.3	1.54
12.5	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	2.80
12.5	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	2060	2.37
12.8	WL561d	E2EM	Contractor Yard	Contractor Laydown Yard	Temporary	0	6.10
12.9	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.42
12.9	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	271	0.27
12.9	WL527de	E2EM	Temporary Access Road	TAR 14	Temporary	0	0.01
12.9	WL527ds	E2SS	Temporary Access Road	TAR 14	Temporary	0	0.04

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**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
12.9	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	113	0.12
12.9	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.16
12.9	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	1576.5	1.83
12.9	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	2.07
13.0	WL034e	E2EM	ATWS	Waterbody Crossing	Temporary	0	0.02
13.0	WL034e	E2EM	ATWS	Waterbody Crossing	Temporary	0	0.09
13.0	WL527de	E2EM	Contractor Yard	Contractor Laydown Yard	Temporary	0	0.03
13.2	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	1.16
13.2	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	845.2	0.97
13.4	WL034e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.62
13.4	WL034e	E2EM	Permanent Easement	Push-Pull	Temporary	447.2	0.51
13.5	WL034e	E2EM	ATWS	Waterbody Crossing	Temporary	0	0.06
13.5	WL033e	PEM	Temporary Workspace	Push-Pull	Temporary	0	5.07
13.5	WL033e	PEM	Permanent Easement	Push-Pull	Temporary	2022.4	4.12
13.5	WL033e	PEM	ATWS	Waterbody Crossing	Temporary	0	0.06
13.9	WL033s	PSS	Temporary Workspace	Push-Pull	Temporary	0	0.10
13.9	WL033s	PSS	Permanent Easement	Push-Pull	Temporary	131.9	0.14
14.0	WL033s	PSS	Temporary Workspace	Push-Pull	Temporary	0	0.14
14.0	WL033s	PSS	Permanent Easement	Push-Pull	Temporary	144.6	0.16
14.0	WL033s	PSS	Permanent Easement	Push-Pull	Temporary	32.6	0.02
14.0	WL033s	PSS	Temporary Workspace	Push-Pull	Temporary	0	0.02
14.1	WL033e	PEM	ATWS	Foreign Pipeline Crossing	Temporary	0	1.36
14.1	WL033s	PSS	ATWS	Foreign Pipeline Crossing	Temporary	0	0.31
14.2	WL033de	PEM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.38
14.2	WL033s	PSS	Temporary Workspace	Push-Pull	Temporary	0	0.74
14.3	WL033s	PSS	Permanent Easement	Push-Pull	Temporary	433.2	0.50
14.3	WL033e	PEM	Temporary Workspace	Push-Pull	Temporary	0	0.26
14.3	WL033e	PEM	Permanent Easement	Push-Pull	Temporary	150.1	0.15
14.4	WL033s	PSS	Permanent Easement	Push-Pull	Temporary	33.6	0.05
14.4	WL033s	PSS	Temporary Workspace	Push-Pull	Temporary	0	0.02

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**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
14.4	WL033e	PEM	Permanent Easement	Push-Pull	Temporary	1862.1	2.13
14.4	WL033e	PEM	Temporary Workspace	Push-Pull	Temporary	0	2.44
14.4	WL033s	PSS	Temporary Workspace	Push-Pull	Temporary	0	0.04
14.8	WL032s	E2SS	Permanent Easement	Push-Pull	Temporary	212	0.24
14.8	WL032s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.17
14.8	WL145ds	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.12
14.8	WL144de	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.13
14.8	WL032e	E2EM	Permanent Easement	Push-Pull	Temporary	159.9	0.31
14.8	WL032e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.00
14.8	WL143de	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.44
14.8	WL143de	E2EM	Permanent Easement	Push-Pull	Temporary	280.1	0.24
14.9	WL127de	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.61
14.9	WL127de	E2EM	Permanent Easement	Push-Pull	Temporary	378.5	0.54
15.0	WL126ds	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.27
15.0	WL126ds	E2SS	Permanent Easement	Push-Pull	Temporary	5.9	0.01
15.0	WL032s	E2SS	Permanent Easement	Push-Pull	Temporary	557.6	0.64
15.0	WL032s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.68
15.1	WL032e	E2EM	Permanent Easement	Push-Pull	Temporary	407	0.47
15.1	WL032e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.47
15.2	WL032e	E2EM	ATWS	Waterbody Crossing	Temporary	0	0.58
15.2	WL032s	E2SS	ATWS	Waterbody Crossing	Temporary	0	0.00
15.2	WL032e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.01
15.2	WL526de	E2EM	Temporary Access Road	TAR 15	Temporary	0	0.01
15.2	WL526ds	E2EM	Temporary Access Road	TAR 15	Temporary	0	0.02
15.2	WL527de	E2EM	Temporary Access Road	TAR 15	Temporary	0	0.02
15.2	WL032e	E2EM	Permanent Easement	Push-Pull	Temporary	13.8	0.02
15.2	WL032e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.02
15.2	WL032e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.01
15.2	WL032e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.26
15.2	WL032e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.03

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**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
15.2	WL525de	E2EM	Temporary Access Road	TAR 15	Temporary	0	0.02
15.3	WL032e	E2EM	Permanent Easement	Push-Pull	Temporary	105.9	0.71
15.5	WL032s	E2SS	ATWS	Open Water Crossing	Temporary	0	0.02
15.5	WL032s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.04
15.5	WL525ds	E2SS	Temporary Access Road	TAR 15	Temporary	0	0.01
15.5	WL525ds	E2SS	Temporary Access Road	TAR 15	Temporary	0	0.00
15.5	WL031s	E2SS	ATWS	Open Water Crossing	Temporary	0	0.01
15.5	WL031s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.03
15.5	WL032s	E2SS	Permanent Easement	Push-Pull	Temporary	8.8	0.01
15.5	WL031s	E2SS	Permanent Easement	Push-Pull	Temporary	18.8	0.02
15.5	WL524de	E2EM	Temporary Access Road	TAR 16	Temporary	0	0.09
15.6	WL031e	E2EM	Permanent Easement	Push-Pull	Temporary	423.2	0.50
15.6	WL031e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.18
15.7	WL523de	E2EM	Temporary Access Road	TAR 16	Temporary	0	0.02
15.7	WL031s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.05
15.7	WL031s	E2SS	ATWS	Open Water Crossing	Temporary	0	0.01
15.7	WL031e	E2EM	Permanent Easement	Push-Pull	Temporary	22.8	0.03
15.7	WL031e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.00
15.7	WL031s	E2SS	Permanent Easement	Push-Pull	Temporary	18.3	0.05
15.7	WL031e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.05
15.7	WL031e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.20
15.7	WL031e	E2EM	Permanent Easement	Push-Pull	Temporary	139.6	0.16
15.8	WL523ds	E2SS	Temporary Access Road	TAR 16	Temporary	0	0.00
15.8	WL524ds	E2SS	Temporary Access Road	TAR 16	Temporary	0	0.01
15.8	WL523de	E2EM	Temporary Access Road	TAR 16	Temporary	0	0.00
15.8	WL524de	E2EM	Temporary Access Road	TAR 16	Temporary	0	0.00
15.8	WL031e	E2EM	Permanent Easement	Push-Pull	Temporary	16.1	0.02
15.8	WL031e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.02
15.8	WL031e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.00
15.8	WL030e	E2EM	Permanent Easement	Push-Pull	Temporary	1220.4	1.40

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**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
15.8	WL030e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	1.68
15.8	WL030e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.27
16.0	WL030e	E2EM	Permanent Easement	Push-Pull	Temporary	376.3	0.44
16.0	WL030e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.50
16.1	WL030e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	1.29
16.1	WL030e	E2EM	Permanent Easement	Push-Pull	Temporary	936.2	1.06
16.2	WL030e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.05
16.3	WL030e	E2EM	Permanent Easement	Push-Pull	Temporary	560.7	0.64
16.3	WL030e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.76
16.3	WL030e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.17
16.4	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	15.8	0.02
16.4	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.02
16.4	WL029e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.00
16.4	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	250.8	0.29
16.4	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.29
16.4	WL029e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.03
16.4	WL029e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.00
16.5	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	204.2	0.23
16.5	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.21
16.5	WL029e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.03
16.6	WL029s	E2SS	Permanent Easement	Push-Pull	Temporary	14.8	0.02
16.6	WL029s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.02
16.6	WL029s	E2SS	ATWS	Open Water Crossing	Temporary	0	0.00
16.8	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	0	0.04
16.8	WL520de	E2EM	Permanent Easement	Push-Pull	Temporary	0	0.00
16.8	WL520de	E2EM	Temporary Access Road	TAR 17	Temporary	0	0.05
16.8	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.00
16.8	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	65	0.15
16.9	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	0	0.01
17.0	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	151.9	0.18

TABLE G-2

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
17.0	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.05
17.1	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.56
17.1	WL029e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.35
17.2	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	245.3	0.29
17.2	WL029e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.09
17.2	WL570d	E2EM	Temporary Access Road	TAR 18	Temporary	0	0.00
17.4	WL029s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.13
17.4	WL029s	E2SS	Permanent Easement	Push-Pull	Temporary	112.1	0.13
17.4	WL029s	E2SS	ATWS	Open Water Crossing	Temporary	0	0.02
17.4	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.01
17.4	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	13.4	0.02
17.4	WL029e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.06
17.4	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.25
17.4	WL029e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.02
17.4	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.05
17.4	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	220.3	0.25
17.4	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.04
17.4	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	56.2	0.07
17.5	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	146.4	0.16
17.5	WL029e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.04
17.5	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.18
17.6	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.11
17.6	WL029e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.05
17.7	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	108.9	0.51
17.7	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.54
17.7	WL029e	E2EM	ATWS	Open Water Crossing	Temporary	0	0.07
17.7	WL029e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.60
17.8	WL029e	E2EM	Permanent Easement	Push-Pull	Temporary	15.7	0.03
17.8	WL029e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.02
17.8	WL029e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.04

TABLE G-2

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
17.8	WL029e	E2EM	Temporary Access Road	TAR 18	Temporary	0	0.00
17.8	WL517de	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.18
17.8	WL028e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.02
17.8	WL028e	E2EM	Permanent Easement	Push-Pull	Temporary	20.2	0.02
17.8	WL028e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.02
17.8	WL028e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.03
17.8	WL028e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.01
17.8	WL028e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.35
17.8	WL028e	E2EM	Permanent Easement	Push-Pull	Temporary	76.8	0.14
17.8	WL028e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.33
17.8	WL028e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.00
17.8	WL028e	E2EM	Permanent Easement	Push-Pull	Temporary	0	0.00
17.9	WL028e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.36
17.9	WL028e	E2EM	Permanent Easement	Push-Pull	Temporary	197.1	0.17
17.9	WL028e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.51
17.9	WL028e	E2EM	Permanent Easement	Push-Pull	Temporary	42.1	0.19
18.0	WL028e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.31
18.0	WL027e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.08
18.0	WL027e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.28
18.0	WL026s	E2SS	Permanent Easement	Push-Pull	Temporary	223.3	2.77
18.0	WL026s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	2.44
18.1	WL026e	E2EM	Permanent Easement	Push-Pull	Temporary	76.6	0.19
18.5	WL026e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.08
18.5	WL026e	E2EM	Permanent Easement	Push-Pull	Temporary	59.6	0.07
18.5	WL026s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.88
18.5	WL026s	E2SS	Permanent Easement	Push-Pull	Temporary	602.9	0.90
18.7	WL026e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.97
18.7	WL026e	E2EM	Permanent Easement	Push-Pull	Temporary	690.2	0.79
18.8	WL026e	E2EM	ATWS	HDD Exit	Temporary	0	0.14
18.8	WL026s	E2SS	ATWS	HDD Exit	Temporary	0	1.23

TABLE G-2

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
18.8	WL026s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.71
18.8	WL026s	E2SS	Permanent Easement	Push-Pull	Temporary	448.4	0.51
18.9	WL026s	E2SS	Permanent Easement	HDD Section with Potential Impacts	Temporary	58.6	0.07
18.9	WL026s	E2SS	Permanent Easement	HDD	No Impact – HDD	0	0.17
18.9	WL026s	E2SS	Permanent Easement	HDD	No Impact – HDD	201.9	0.11
18.9	WL026s	E2SS	Temporary Access Road	TAR 19	Temporary	0	0.08
18.9	WL026s	E2SS	Permanent Easement	TAR 19	Temporary	32.8	0.34
19.0	WL026s	E2SS	Permanent Easement	HDD	No Impact – HDD	610	0.34
19.1	WL026s	E2SS	Temporary Access Road	TAR 19	Temporary	0	0.03
19.1	WL026s	E2SS	Permanent Easement	HDD	No Impact – HDD	0	0.01
19.1	WL025e	E2EM	Temporary Access Road	TAR 20	Temporary	0	0.02
19.1	WL025e	E2EM	Permanent Easement	HDD	No Impact – HDD	0	0.01
19.1	WL025e	E2EM	Permanent Easement	HDD	No Impact – HDD	599.4	0.32
19.1	WL025e	E2EM	Permanent Easement	HDD	No Impact – HDD	0	0.20
19.1	WL099d	E2EM	Temporary Access Road	TAR 19	Temporary	0	0.03
19.1	WL098d	E2EM	Temporary Access Road	TAR 19	Temporary	0	0.01
19.2	WL025e	E2EM	Permanent Easement	TAR 20	Temporary	34	0.33
19.2	WL025e	E2EM	Temporary Access Road	TAR 20	Temporary	0	0.08
19.2	WL025e	E2EM	Permanent Easement	HDD	No Impact – HDD	198.8	0.10
19.2	WL025e	E2EM	Permanent Easement	HDD Section with Potential Impacts	Temporary	110.4	0.13
19.2	WL025e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	2.46
19.2	WL025e	E2EM	ATWS	HDD Entry	Temporary	0	0.57
19.3	WL025e	E2EM	Permanent Easement	Push-Pull	Temporary	836.2	2.35
19.3	WL025e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.00
19.3	WL121d	E2EM	Temporary Workspace	Push-Pull	Temporary	0	4.57
19.3	WL121d	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.00
19.4	WL025e	E2EM	Permanent Easement	Push-Pull	Temporary	0	0.00
19.4	WL121d	E2EM	Permanent Easement	Push-Pull	Temporary	0	0.00
19.4	WL121d	E2EM	Permanent Easement	Push-Pull	Temporary	2927.6	3.26
19.5	WL098d	E2EM	Temporary Access Road	TAR 19	Temporary	0	0.01

TABLE G-2

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
19.8	WL121d	E2EM	ATWS	ATWS, Foreign Pipeline Crossing	Temporary	0	7.17
20.0	WL025e	E2EM	ATWS	ATWS, Foreign Pipeline Crossing	Temporary	0	1.43
20.0	WL025e	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	1.73
20.0	WL059d	E2EM	ATWS	Foreign Pipeline Crossing	Temporary	0	0.34
20.1	WL097d	E2EM	Temporary Access Road	TAR 19	Temporary	0	0.00
20.2	WL024e	E2EM	Temporary Access Road	TAR 19	Temporary	0	0.01
20.2	WL024e	E2EM	Permanent Easement	Push-Pull	Temporary	554.2	0.64
20.2	WL024e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.73
20.2	WL024e	E2EM	Temporary Access Road	TAR 19	Temporary	0	0.00
20.3	WL024e	E2EM	ATWS	Waterbody Crossing	Temporary	0	0.17
20.4	WL108d	E2EM	Temporary Access Road	TAR 19	Temporary	0	0.00
20.4	WL024e	E2EM	Permanent Easement	Push-Pull	Temporary	537	0.65
20.4	WL024e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.76
20.4	WL024e	E2EM	ATWS	Waterbody Crossing	Temporary	0	0.17
20.4	WL024e	E2EM	ATWS	Waterbody Crossing	Temporary	0	0.17
20.5	WL024s	E2SS	Permanent Easement	Push-Pull	Temporary	70.9	0.08
20.5	WL024s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.07
20.5	WL024s	E2SS	Permanent Easement	Push-Pull	Temporary	67.8	0.08
20.5	WL024s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.09
20.5	WL024e	E2EM	Permanent Easement	Push-Pull	Temporary	137	0.18
20.5	WL024e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.31
20.5	WL024e	E2EM	ATWS	Waterbody Crossing	Temporary	0	0.17
20.5	WL024s	E2SS	ATWS	Waterbody Crossing	Temporary	0	0.00
20.5	WL024e	E2EM	Permanent Easement	Push-Pull	Temporary	37.6	0.06
20.6	WL024s	E2SS	Permanent Easement	Push-Pull	Temporary	113	0.14
20.6	WL024s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.13
20.6	WL024e	E2EM	Permanent Easement	Push-Pull	Temporary	314.6	0.36
20.6	WL024e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.41
20.6	WL024s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.15
20.6	WL024s	E2SS	Permanent Easement	Push-Pull	Temporary	108.8	0.12

TABLE G-2

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
20.6	WL024e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	2.00
20.7	WL024e	E2EM	Permanent Easement	Push-Pull	Temporary	1186	1.54
20.9	WL024e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.15
20.9	WL024e	E2EM	Permanent Easement	Push-Pull	Temporary	91.6	0.09
20.9	WL024e	E2EM	Permanent Easement	Push-Pull	Temporary	100.9	1.34
20.9	WL024e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	1.62
21.0	WL024e	E2EM	Permanent Easement	Push-Pull	Temporary	95.6	0.13
21.0	WL024e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.02
21.1	WL024e	E2EM	Permanent Easement	Push-Pull	Temporary	0	0.03
21.2	WL024e	E2EM	ATWS	HDD Exit	Temporary	0	0.04
21.2	WL024s	E2SS	ATWS	HDD Exit	Temporary	0	0.71
21.2	WL024s	E2SS	Temporary Workspace	Push-Pull	Temporary	0	0.33
21.2	WL024s	E2SS	Permanent Easement	Push-Pull	Temporary	220.9	0.26
21.2	WL024e	E2EM	Permanent Easement	Push-Pull	Temporary	58.5	0.07
21.2	WL024e	E2EM	Temporary Workspace	Push-Pull	Temporary	0	0.07
21.2	WL024e	E2EM	ATWS	HDD Exit	Temporary	0	0.09
21.2	WL514de	E2EM	ATWS	HDD Exit	Temporary	0	0.14
21.2	WL513de	E2EM	Temporary Access Road	TAR 21	Temporary	0	0.11
21.4	WL023s	PSS	Permanent Easement	HDD	No Impact – HDD	31.3	0.04
21.4	WL023s	PSS	Permanent Easement	HDD	No Impact – HDD	489.8	0.57
21.5	WL023e	PEM	Permanent Easement	HDD	No Impact – HDD	135.4	0.15
21.5	WL023s	PSS	Permanent Easement	HDD	No Impact – HDD	402.4	0.46
21.6	WL023s	PSS	Temporary Workspace	Open-cut	Temporary	0	0.91
21.6	WL023s	PSS	Permanent Easement	HDD Section with Potential Impacts	Temporary	343.1	0.39
21.6	WL023s	PSS	ATWS	HDD Entry	Temporary	0	0.27
21.6	WL023ds	PSS	ATWS	HDD Entry	Temporary	0	0.30
21.6	WL023s	PSS	Permanent Easement	Open-cut	Temporary	307.4	0.35
21.7	WL023ds	PSS	Temporary Access Road	TAR 22	Temporary	0	0.11
21.7	WL023de	PEM	Temporary Access Road	TAR 22	Temporary	0	0.04
21.7	WL023e	PEM	Permanent Easement	Open-cut	Temporary	459.1	0.53

TABLE G-2

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
21.7	WL023e	PEM	Temporary Workspace	Open-cut	Temporary	0	0.55
21.7	WL521de	E2EM	Temporary Access Road	TAR 22	Temporary	0	0.61
21.8	WL023s	PSS	Temporary Workspace	Open-cut	Temporary	0	1.73
21.8	WL023s	PSS	Permanent Easement	Open-cut	Temporary	1293.2	1.47
21.9	WL521de	E2EM	Temporary Access Road	TAR 22	Temporary	0	0.00
21.9	WL521de	E2EM	Temporary Access Road	TAR 22	Impact Addressed in Terminal Document	0	0.09
22.0	WL023e	PEM	Temporary Workspace	Open-cut	Temporary	0	0.38
22.0	WL023e	PEM	Permanent Easement	Open-cut	Temporary	165.5	0.20
22.0	WL023e	PEM	ATWS	Waterbody Crossing	Temporary	0	0.06
22.1	WL023e	PEM	Permanent Easement	Open-cut	Temporary	168	0.20
22.1	WL023e	PEM	Temporary Workspace	Open-cut	Temporary	0	0.19
22.1	WL023e	PEM	ATWS	Waterbody Crossing	Temporary	0	0.03
22.1	WL023s	PSS	Temporary Workspace	Open-cut	Temporary	0	0.21
22.1	WL023s	PSS	ATWS	Waterbody Crossing	Temporary	0	0.03
22.1	WL023s	PSS	Permanent Easement	Open-cut	Temporary	143.5	0.16
22.1	WL023e	PEM	Permanent Easement	Open-cut	Temporary	448.9	0.51
22.1	WL023e	PEM	Temporary Workspace	Open-cut	Temporary	0	0.64
22.2	WL023e	PEM	Permanent Easement	Open-cut	Temporary	344.4	0.39
22.2	WL023e	PEM	Temporary Workspace	Open-cut	Temporary	0	0.46
22.3	WL023s	PSS	Permanent Easement	Open-cut	Temporary	101	0.12
22.3	WL023s	PSS	Temporary Workspace	Open-cut	Temporary	0	0.15
22.3	WL022s	PSS	Permanent Easement	Open-cut	Temporary	327.2	0.37
22.3	WL022s	PSS	Temporary Workspace	Open-cut	Temporary	0	0.64
22.4	WL022e	PEM	Permanent Easement	Open-cut	Temporary	312.5	0.37
22.4	WL022e	PEM	Temporary Workspace	Open-cut	Temporary	0	0.24
22.4	WL022e	PEM	Permanent Easement	Open-cut	Temporary	126.6	0.17
22.4	WL022e	PEM	Temporary Workspace	Open-cut	Temporary	0	0.06
22.4	WL022e	PEM	Temporary Workspace	Open-cut	Impact Addressed in Terminal Document	0	0.00

TABLE G-2

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
WETLANDS AT THE PIPELINE**

Approx. Milepost In	Wetland ID	Wetland Type	Facility Type	Workspace Type	Impact Type	Crossing Length at Centerline (feet)	Area (acres)
22.4	WL022e	PEM	Temporary Workspace	Open-cut	Impact Addressed in Terminal Document	0	0.03
22.5	WL022e	PEM	Permanent Easement	Open-cut	Impact Addressed in Terminal Document	27.1	0.03
22.5	WL022e	PEM	Permanent Easement	Open-cut	Impact Addressed in Terminal Document	696.2	0.80
22.5	WL022e	PEM	Temporary Workspace	Open-cut	Impact Addressed in Terminal Document	0	0.95
22.5	WL022e	PEM	Temporary Workspace	Open-cut	Impact Addressed in Terminal Document	0	0.00
22.6	WL021s	PSS	Permanent Easement	Open-cut	Impact Addressed in Terminal Document	324.3	0.39
22.6	WL021s	PSS	Temporary Workspace	Open-cut	Impact Addressed in Terminal Document	0	0.35
22.7	WL021s	PSS	ATWS	HDD Pipe String	Impact Addressed in Terminal Document	0	0.14
22.7	WL021s	PSS	ATWS	Tie-in Location	Impact Addressed in Terminal Document	0	0.14
22.7	WL021e	PEM	Temporary Workspace	Open-cut	Impact Addressed in Terminal Document	0	0.06
22.7	WL021e	PEM	Permanent Easement	Open-cut	Impact Addressed in Terminal Document	40.9	0.05
22.7	WL021s	PSS	Permanent Easement	Open-cut	Impact Addressed in Terminal Document	21.3	0.03
22.7	WL021s	PSS	Temporary Workspace	Open-cut	Impact Addressed in Terminal Document	0	0.00

ATWS = additional temporary workspace; E2EM = estuarine intertidal emergent; E2FO = estuarine intertidal forested; E2SS = estuarine intertidal scrub shrub; HDD = horizontal directional drill; PAR = permanent access road; PEM = palustrine emergent; PSS = palustrine scrub shrub; TAR = temporary access road; TWS = temporary workspace

APPENDIX H

ESSENTIAL FISH HABITAT POTENTIALLY AFFECTED BY CONSTRUCTION AND OPERATIONS

APPENDIX H
ESSENTIAL FISH HABITAT POTENTIALLY AFFECTED BY CONSTRUCTION AND OPERATIONS

TABLE H-1

ESSENTIAL FISH HABITAT POTENTIALLY AFFECTED BY CONSTRUCTION AND OPERATION OF THE PROJECT

Wetland/ Waterbody ID	Approx. MP In	Approx. Crossing Length [a]	Wetland/Waterbody Type	Temporary Impacts (acres)	Permanent Impacts (acres)	Impact Type
TERMINAL FACILITY						
Calcasieu River Ship Channel	N/A	N/A	Perennial Tidal River	Approx. 268	69.72	Dredge and construction of in-water structures, hydroacoustic
Gulf of Mexico	N/A	N/A	Nearshore and Coastal Marine	Approx. 865	0	Hydroacoustic
OW001	N/A	N/A	Borrow pit	0.0	0.11	Converted to water by dredging/excavating
OW002	N/A	N/A	Borrow pit	0.0	0.02	Converted to water by dredging/excavating
OW003	N/A	N/A	Borrow pit	0.0	0.03	Converted to water by dredging/excavating
WL002e	N/A	N/A	Estuarine emergent marsh	0.0	8.15	Converted to water by dredging/excavating
WL002m	N/A	N/A	Mudflat	0.0	0.94	Converted to water by dredging/excavating
WL002p	N/A	N/A	Estuarine *Phragmites australis* marsh	0.0	0.45	Converted to water by dredging/excavating
WL002s	N/A	N/A	Estuarine scrub shrub	0.0	7.18	Converted to water by dredging/excavating
WL003	N/A	N/A	Estuarine emergent marsh	0.0	0.13	Converted to water by dredging/excavating
PIPELINE						
WL131d	0.0	424	Estuarine emergent marsh	2.95	1.24	Meter station, pipeline construction, and ATWS
WL042e	0.1	104	Estuarine emergent marsh	0.61	0.0	Pipeline construction and ATWS
WL063d	0.1	N/A	Estuarine emergent marsh	3.59	0.0	ATWS and access road
WL041e	0.5	478	Estuarine emergent marsh	2.40	0.0	Pipeline construction and ATWS
WL106d	0.5	N/A	Estuarine emergent marsh	0.12	0.0	Access road
WL126d	15.0	11	Estuarine emergent marsh	0.28	0.0	Pipeline construction
OW030	15.2	60	Estuarine pond	0.08	0.0	Pipeline construction
OW029	15.2	921	Estuarine openwater	3.40	0.0	Pipeline construction and ATWS
WL124d	15.2	N/A	Estuarine emergent marsh	0.06	0.0	Access road
WL125d	15.2	N/A	Estuarine emergent marsh	0.48	0.0	Access road
WL031s	15.5	56	Estuarine scrub shrub	0.17	0.0	Pipeline construction and ATWS
OW027	15.5	692	Estuarine openwater	2.57	0.0	Pipeline construction
WL031e	15.5	607	Estuarine emergent marsh	1.16	0.0	Pipeline construction and ATWS

TABLE H-1

ESSENTIAL FISH HABITAT POTENTIALLY AFFECTED BY CONSTRUCTION AND OPERATION OF THE PROJECT

Wetland/ Waterbody ID	Approx. MP In	Approx. Crossing Length [a]	Wetland/Waterbody Type	Temporary Impacts (acres)	Permanent Impacts (acres)	Impact Type
OW026	15.7	50	Estuarine openwater	0.15	0.0	Pipeline construction and ATWS
WL030e	15.8	3,093	Estuarine emergent marsh	8.26	0.0	Pipeline construction and ATWS
OW025	15.8	N/A	Estuarine openwater	0.01	0.0	ATWS
WB012	16.0	34	Perennial estuarine channel	0.09	0.0	Pipeline construction
OW024	16.3	69	Estuarine openwater	0.25	0.0	Pipeline construction and ATWS
OW023	16.4	N/A	Estuarine openwater	0.01	0.0	ATWS
WL029e	16.4	1,794	Estuarine emergent marsh	5.94	0.0	Pipeline construction and ATWS
WB011	16.4	37	Perennial estuarine channel	0.12	0.0	Pipeline construction and ATWS
OW022	16.4	539	Estuarine openwater	1.85	0.0	Pipeline construction and ATWS
OW021	16.6	3,574	Estuarine openwater	11.17	0.0	Pipeline construction and ATWS
WL029s	16.6	127	Estuarine scrub shrub	0.32	0.0	Pipeline construction and ATWS
WL123d	16.8	N/A	Estuarine emergent marsh	0.04	0.0	Access road
OW019	17.4	376	Estuarine openwater	1.18	0.0	Pipeline construction and ATWS
OW018	17.5	694	Estuarine openwater	1.87	0.0	Pipeline construction and ATWS
OW017	17.7	51	Estuarine openwater	0.18	0.0	Pipeline construction and ATWS
WL028e	17.8	634	Estuarine emergent marsh	2.47	0.0	Pipeline construction and ATWS
OW016	17.8	362	Estuarine openwater	1.59	0.0	Pipeline construction and ATWS
WL122d	17.8	N/A	Estuarine emergent marsh	0.14	0.0	ATWS
WL026e	18.0	827	Estuarine emergent marsh	2.24	0.0	Pipeline construction and ATWS
WL026s	18.0	3,717	Estuarine scrub shrub	9.71	0.0	Pipeline construction and ATWS
WL027e	18.0	N/A	Estuarine emergent marsh	0.37	0.0	ATWS
OW006	18.6	57	Estuarine pond	0.25	0.0	Pipeline construction
WL025e	19.1	2,092	Estuarine emergent marsh	8.87	0.0	Pipeline construction and ATWS

[a] Crossing length does not include areas crossed by horizontal directional drill.
ATWS = additional temporary workspace; MP = milepost; N/A = wetland does not cross centerline

APPENDIX I

RESULTS OF BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS

APPENDIX I
RESULTS OF BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS

TABLE I-1

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
PROPOSED BEST AVAILABLE CONTROL TECHNOLOGY LIMITS FOR THE TERMINAL SITE**

Emissions Source	Pollutant	Proposed Emissions Control	Proposed Emission Limits for Each Individual Source (non-aggregated)		
Gas-fired Combined Cycle Turbines and Associated Duct Burners	NO_x	• Selective Catalytic Reduction (SCR) would be installed on the turbine system	2.50	ppmv at 15% O_2	Limit based on 24-hour block average during normal operations
		• Low NO_x burners would be installed on the turbine duct burners	16.8	lb/hr	Limit based on 1-hour average during duct burner and CC turbine operation
		• Dry Low-NO_x combustor design will be used on each turbine	118.9	lb/hr	Limit based on 2-hour average during cold start
		• Good combustion practices	103.1	lb/hr	Limit based on 1-hour average during warm start
			103.1	lb/hr	Limit based on 1-hour average during shutdown
	CO	• Catalytic Oxidation • Proper equipment design	5	ppmv at 15% O_2	Limit based on 24-hour block average during normal operations
		• Proper operation • Good combustion practices	17.6	lb/hr	Limit based on 1-hour average during duct burner and CC turbine operation
			28.4	lb/hr	Limit based on 2-hour average during cold start
			24.8	lb/hr	Limit based on 1-hour average during warm start
			24.8	lb/hr	Limit based on 1-hour average during shutdown
	$PM/PM_{10}/PM_{2.5}$	• Exclusive combustion of gaseous fuel	8.0000	lb/hr	Limit based on 1-hour average during normal operations
		• Good combustion practices including proper burner design	9.9	lb/hr	Limit based on 1-hour average duct burner and CC turbine operation
			8.0	lb/hr	Limit based on 2-hour average during cold start
			8.0	lb/hr	Limit based on 1-hour average during warm start
			8.0	lb/hr	Limit based on 1-hour average during shutdown
	SO_2	• Exclusive combustion of low sulfur fuels	4	ppmv H_2S	Based on annual average of H_2S content in fuel
		• Proper equipment design and operation	0.9	lb/hr	Limit based on 1-hour average duct burner and cc turbine operation
			0.4	lb/hr	Limit based in 2-hour average during cold start
			0.4	lb/hr	Limit based on 1-hour average during warm start
			0.4	lb/hr	Limit based on 1-hour average during shutdown
	VOC	• Catalytic Oxidation • Combustion of gaseous fuels	1.30	ppmv at 15% O_2	Limit based on 3-hour average during normal operations

TABLE I-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
PROPOSED BEST AVAILABLE CONTROL TECHNOLOGY LIMITS FOR THE TERMINAL SITE

Emissions Source	Pollutant	Proposed Emissions Control	Proposed Emission Limits for Each Individual Source (non-aggregated)		
		• Combustor process design with proper operation • Good combustion practices	2.41	ppmv at 15% O_2	Limit based on 1-hour average duct burner and cc turbine operation
			3.93	lb/hr	Limit based on 1-hour average duct burner and cc turbine operation
			2.36	lb/hr	Limit based on 2-hour average during cold start
			2.24	lb/hr	Limit based on 1-hour average during warm start
			2.24	lb/hr	Limit based on 1-hour average during shutdown
	CO_2e	• Exclusively combust low carbon fuel gas • Good combustion practices • Proper O&M practices • Insulation would be properly implemented for surfaces above 120 °F	793,414	tpy	Based on annual total per turbine
Gas-fired Simple Cycle Turbines	NO_x	• Dry low-NO_x combustor design would be used on each turbine	15	ppmv at 15% O_2	Limit based on 30-day rolling average during normal operations
		• Good combustion practices	134.69	lb/hr	Limit based on 2-hour average during cold start
		• Combustion of natural gas	134.69	lb/hr	Limit based on 1-hour average during warm start
			134.69	lb/hr	Limit based on 1-hour average during shutdown
	CO	• Combustor process design • Proper operation	25	ppmv at 15% O_2	Limit based on 30-day rolling average during normal operations
		• Good combustion practices	32.1	lb/hr	Limit based on 2-hour average during cold start
			32.1	lb/hr	Limit based on 1-hour average during warm start
			32.1	lb/hr	Limit based on 1-hour average during shutdown
	$PM/PM_{10}/PM_{2.5}$	• Exclusive combustion of natural gas	8.0	lb/hr	Limit based on 3-hour average during normal operations
		• Good combustion practices including proper burner design	8.0	lb/hr	Limit based on 2-hour average during cold start
			8.0	lb/hr	Limit based on 1-hour average during warm start
			8.0	lb/hr	Limit based on 1-hour average during shutdown
	SO_2	• Exclusive combustion of low sulfur interstate pipeline quality natural gas	4	ppmv H_2S	Based on annual average of H_2S content in fuel
		• Proper equipment design and operation	0.4	lb/hr	Limit based on 2-hour average during cold start
			0.4	lb/hr	Limit based on 1-hour average during warm start

APPENDIX I
RESULTS OF BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS (cont'd)

TABLE I-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
PROPOSED BEST AVAILABLE CONTROL TECHNOLOGY LIMITS FOR THE TERMINAL SITE

Emissions Source	Pollutant	Proposed Emissions Control	Proposed Emission Limits for Each Individual Source (non-aggregated)		
			0.4	lb/hr	Limit based on 1-hour average during shutdown
	VOC	• Combustor process design • Proper operation	1.63	ppmv at 15% O_2	Limit based on 3-hour average during normal operations
		• Good combustion practices	2.5	lb/hr	Limit based on 2-hour average during cold start
		• Combustion of natural gas	2.5	lb/hr	Limit based on 1-hour average during warm start
			2.5	lb/hr	Limit based on 1-hour average during shutdown
	CO_2e	• Exclusively combust low carbon fuel gas • Good combustion practices • Proper O&M practices • Insulation would be properly implemented for surfaces above 120 °F	602,021	tpy	Based on annual total per turbine
Hot Oil Heaters	NO_x	• Ultra low NO_x burners • Good combustion practices	0.04	lb/MMBtu	Based on 3-hour average
	CO	• Exclusive combustion of fuel gas • Good combustion practices	0.08	lb/MMBtu	Based on 3-hour average
	$PM/PM_{10}/PM_{2.5}$	• Exclusive combustion of fuel gas • Good combustion practices including proper burner design	0.0075	lb/MMBtu	Based on 3-hour average
	SO_2	• Exclusive combustion of fuel gas with a sulfur content not greater than in pipeline quality natural gas • Proper engineering practices	0.0006	lb/MMBtu	Based on 3-hour average
	VOC	• Proper equipment design • Proper operation • Good combustion practices • Exclusive combustion of fuel gas	0.0054	lb/MMBtu	Based on 3-hour average
	CO_2e	• Exclusive combustion of low-carbon fuel gas • Good combustion practices • Good O&M practices • Proper implementation of insulation for surfaces above 120 °F	59,076	tpy	Based on annual total
Acid Gas Thermal Oxidizer	NO_x	• Low NO_x burners • Good combustion practices	0.144	lb/MMBtu	Based on 3-hour average
	CO	• Proper equipment design • Proper operation • Good combustion practices	0.086	lb/MMBtu	Based on 3-hour average
	$PM/PM_{10}/PM_{2.5}$	• Exclusive combustion of fuel gas • Good combustion practices	0.0078	lb/MMBtu	Based on 3-hour average
	SO_2	• Proper equipment design	0.10	lb/MMBtu	Based on 3-hour average
		• Proper operation • Good combustion practices • Monitoring the sulfur content at the facility inlet	76	tpy	Based on 12-month rolling total

TABLE I-1

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
PROPOSED BEST AVAILABLE CONTROL TECHNOLOGY LIMITS FOR THE TERMINAL SITE**

Emissions Source	Pollutant	Proposed Emissions Control	Proposed Emission Limits for Each Individual Source (non-aggregated)		
	VOC	• Proper equipment design • Proper operation • Good combustion practices • Exclusive combustion of fuel gas	0.006	lb/MMBtu	Based on 3-hour average
	CO_2e	• Exclusive combustion of low-carbon fuel gas • Good combustion practices • Good O&M practices • Insulation would be implemented for surfaces above 120 °F	768,337	tpy	Based on annual total
Large (>560 kW) Emergency Engines	NO_x	• Good combustion and operating practices • Compliance with 40 CFR Part 60 Subpart IIII • Limiting normal operations to 100 hours per year • An ignition timing retard would be installed on each engine	5.61	g/kW-hr	
	CO	• Good combustion and operating practices • Compliance with 40 CFR Part 60 Subpart IIII • Limiting normal operations to 100 hours per year	3.5	g/kW-hr	
	$PM/PM_{10}/PM_{2.5}$	• Good combustion and operating practices • Compliance with 40 CFR Part 60 Subpart IIII • Limiting normal operations to 100 hours per year	0.20	g/kW-hr	
	SO_2	• Ultra-low sulfur diesel fuel with sulfur content of 15 ppmv not to be exceeded (40 CFR Part 60 Subpart IIII) • Compliance with 40 CFR Part 60 Subpart IIII • Limiting normal operations to 100 hours per year	1.2E-05	lb/hp-hr	
	VOC	• Good combustion and operating practices • Compliance with 40 CFR Part 60 Subpart IIII • Limiting normal operations to 100 hours per year	0.79	g/kW-hr	
	CO_2e	• Good combustion practices • Good O&M practices • Insulation would be implemented for surfaces above 120 °F • Limiting normal operations to 100 hours per year	1,481	tpy	Based on annual total

APPENDIX I
RESULTS OF BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS (cont'd)

TABLE I-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
PROPOSED BEST AVAILABLE CONTROL TECHNOLOGY LIMITS FOR THE TERMINAL SITE

Emissions Source	Pollutant	Proposed Emissions Control	Proposed Emission Limits for Each Individual Source (non-aggregated)		
Firewater Pumps	NO_x	• Good combustion and operating practices • Compliance with 40 CFR Part 60 Subpart IIII • Limiting normal operations to 50 hours per year • An ignition timing retard would be installed on each pump	3.06	g/hp-hr	
	CO	• Good combustion and operating practices • Compliance with 40 CFR Part 60 Subpart IIII • Limiting normal operations to 50 hours per year	3.70	g/hp-hr	
	$PM/PM_{10}/PM_{2.5}$	• Good combustion and operating practices • Compliance with 40 CFR Part 60 Subpart IIII • Limiting normal operations to 50 hours per year	0.30	g/hp-hr	
	SO_2	• Compliance with 40 CFR Part 60 Subpart IIII • Limiting normal operations to 50 hours per year	0.04	lb/gal	
	VOC	• Good combustion and operating practices • Compliance with 40 CFR Part 60 Subpart IIII • Limiting normal operations to 50 hours per year	0.44	g/hp-hr	
	CO_2e	• Good combustion practices • Good O&M practices • Insulation would be implemented for surfaces above 120 °F • Limiting normal operations to 50 hours per year	44.82	tpy	Based on annual total
Equipment Leaks	VOC	• Proper piping design • The provisions of LAC 33:III.2111 would be followed	5.0	tpy	Based on annual total
	CO_2e	• Proper piping design	3,129	tpy	Based on annual total
Cold Flare Pilot	NO_x	• Proper equipment design • Proper operation • Good combustion practices	0.068	lb/MMBtu	When flare is operating
	CO	• Proper equipment design • Proper operation • Good combustion practices	0.370	lb/MMBtu	When flare is operating
	$PM/PM_{10}/PM_{2.5}$	• Proper equipment design • Proper operation • Good combustion practices	0.0074	lb/MMBtu	When flare is operating

TABLE I-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
PROPOSED BEST AVAILABLE CONTROL TECHNOLOGY LIMITS FOR THE TERMINAL SITE

Emissions Source	Pollutant	Proposed Emissions Control	Proposed Emission Limits for Each Individual Source (non-aggregated)		
	SO_2	• Proper equipment design and operation • Combustion of low sulfur gas in pilot • Good combustion practices	4	ppmv	When flare is operating
	VOC	• Good combustion practices	0.006	lb/hr	When flare is operating
	CO_2e	• Good management practices and proper flare design	187	tpy	Based on annual total
Warm Flare Pilot	NO_x	• Proper equipment design • Proper operation • Good combustion practices	0.068	lb/MMBtu	When flare is operating
	CO	• Proper equipment design • Proper operation • Good combustion practices	0.370	lb/MMBtu	When flare is operating
	$PM/PM_{10}/PM_{2.5}$	• Proper equipment design • Proper operation • Good combustion practices	0.0074	lb/MMBtu	When flare is operating
	SO_2	• Proper equipment design and operation • Combustion of low sulfur gas in pilot • Good combustion practices	4	ppmv	When flare is operating
	VOC	• Good combustion practices	0.006	lb/hr	When flare is operating
	CO_2e	• Good management practices and proper flare design	187	tpy	Based on annual total
LP Vent Pilot	NO_x	• Proper equipment design • Proper operation • Good combustion practices	0.068	lb/MMBtu	When flare is operating
	CO	• Proper equipment design • Proper operation • Good combustion practices	0.370	lb/MMBtu	When flare is operating
	$PM/PM_{10}/PM_{2.5}$	• Proper equipment design • Proper operation • Good combustion practices	0.0074	lb/MMBtu	When flare is operating
	SO_2	• Proper equipment design and operation • Combustion of low sulfur gas in pilot • Good combustion practices	4	ppmv	When flare is operating
	VOC	• Good combustion practices	0.006	lb/hr	When flare is operating
	CO_2e	• Good management practices and proper flare design	187	tpy	Based on annual total
Marine Flare Pilot	NO_x	• Proper equipment design • Proper operation • Good combustion practices	0.068	lb/MMBtu	When flare is operating
	CO	• Proper equipment design • Proper operation • Good combustion practices	0.370	lb/MMBtu	When flare is operating
	$PM/PM_{10}/PM_{2.5}$	• Proper equipment design • Proper operation • Good combustion practices	0.0074	lb/MMBtu	When flare is operating

APPENDIX I
RESULTS OF BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS (cont'd)

TABLE I-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
PROPOSED BEST AVAILABLE CONTROL TECHNOLOGY LIMITS FOR THE TERMINAL SITE

Emissions Source	Pollutant	Proposed Emissions Control	Proposed Emission Limits for Each Individual Source (non-aggregated)		
	SO_2	• Proper equipment design and operation • Combustion of low sulfur gas in pilot • Good combustion practices	4	ppmv	When flare is operating
	VOC	• Good combustion practices	0.006	lb/hr	When flare is operating
	CO_2e	• Good management practices and proper flare design	187	tpy	Based on annual total
Cold Flare MSS (includes purge)	NO_x	• Proper equipment design • Proper operation • Good combustion practices	240.6	lb/hr	Maintenance/start up/shutdown operations
	CO	• Proper equipment design • Proper operation • Good combustion practices	1,308.9	lb/hr	Maintenance/start up/shutdown operations
	$PM/PM_{10}/PM_{2.5}$	• Proper equipment design • Proper operation • Good combustion practices	26.3	lb/hr	Maintenance/start up/shutdown operations
	SO_2	• Proper equipment design and operation • Combustion of low sulfur gas in pilot • Good combustion practices	2.3	lb/hr	Maintenance/start up/shutdown operations
	VOC	• Good combustion practices	72.2	lb/hr	Maintenance/start up/shutdown operations
	CO_2e	• Good management practices and proper flare design	14,010	tpy	Based on annual total
Warm Flare MSS (includes purge)	NO_x	• Proper equipment design • Proper operation • Good combustion practices	363.0	lb/hr	Maintenance/start up/shutdown operations
	CO	• Proper equipment design • Proper operation • Good combustion practices	1,975.0	lb/hr	Maintenance/start up/shutdown operations
	$PM/PM_{10}/PM_{2.5}$	• Proper equipment design • Proper operation • Good combustion practices	39.7	lb/hr	Maintenance/start up/shutdown operations
	SO_2	• Proper equipment design • Proper operation • Good combustion practices	3.5	lb/hr	Maintenance/start up/shutdown operations
	VOC	• Good combustion practices	72.2	lb/hr	Maintenance/start up/shutdown operations
	CO_2e	• Good management practices and proper flare design	14,497	tpy	Based on annual total
LP Flare MMS (includes purge)	NO_x	• Proper equipment design • Proper operation • Good combustion practices	13.8	lb/hr	Maintenance/start up/shutdown operations
	CO	• Proper equipment design • Proper operation • Good combustion practices	75.1	lb/hr	Maintenance/start up/shutdown operations
	$PM/PM_{10}/PM_{2.5}$	• Proper equipment design • Proper operation • Good combustion practices	1.5	lb/hr	Maintenance/start up/shutdown operations

TABLE I-1

CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
PROPOSED BEST AVAILABLE CONTROL TECHNOLOGY LIMITS FOR THE TERMINAL SITE

Emissions Source	Pollutant	Proposed Emissions Control	Proposed Emission Limits for Each Individual Source (non-aggregated)		
	SO_2	• Proper equipment design • Proper operation • Good combustion practices	0.1	lb/hr	Maintenance/start up/shutdown operations
	VOC	• Good combustion practices	72.2	lb/hr	Maintenance/start up/shutdown operations
	CO_2e	• Good management practices and proper flare design	13,063	tpy	Based on annual total
Marine Loading Flare (gassing up operations)	NO_x	• Proper equipment design • Proper operation • Good combustion practices • Marine gas recovery for loading return gas with methane content 80% or greater	19.3	lb/hr	Gassing up operations
	CO	• Proper equipment design • Proper operation • Good combustion practices • Marine gas recovery for loading return gas with methane content 80% or greater	104.9	lb/hr	Gassing up operations
	$PM/PM_{10}/PM_{2.5}$	• Proper equipment design • Proper operation • Good combustion practices • Marine gas recovery for loading return gas with methane content 80% or greater	2.1	lb/hr	Gassing up operations
	SO_2	• Proper equipment design • Proper operation • Good combustion practices • Marine gas recovery for loading return gas with methane content 80% or greater	0.2	lb/hr	Gassing up operations
	VOC	• Good combustion practices • Marine gas recovery for loading return gas with methane content 80% or greater	0.1	lb/hr	Gassing up operations
	CO_2e	• Good management practices and proper flare design • Marine gas recovery for loading return gas with methane content 80% or greater	1,107	tpy	Based on annual total
Pipeline Pigging	VOC	• Limit number of pipeline pigging activities to one per year • Flare	0.00024	tpy	Based on annual total
	CO_2e	• Limit number of pipeline pigging activities to one per year	0.07	tpy	Based on annual total
Batch Concrete Operations	PM/PM_{10}	• Any present storage silos and/or weigh hoppers would use cartridge filters	0.01	gr/dscf	Applicable to point source (storage silos and weigh hoppers with cartridge filters)
		• Aggregate supplier to provide onsite delivery of aggregate that is pre-washed	109.41	tpy PM	Based on annual total

TABLE I-1

**CALCASIEU PASS TERMINAL AND TRANSCAMERON PIPELINE PROJECT
PROPOSED BEST AVAILABLE CONTROL TECHNOLOGY LIMITS FOR THE TERMINAL SITE**

Emissions Source	Pollutant	Proposed Emissions Control	Proposed Emission Limits for Each Individual Source (non-aggregated)		
		• Water sprays on all aggregate and sand storage and handling operations	45.417257	tpy PM_{10}	Based on annual total
Batch Concrete Non-Emergency Engines	NO_x	• Good combustion and operating practices • Selective catalytic reduction in compliance with Tier 4 standards	0.40	g/kW-hr	
	CO	• Proper engine design and operation with good combustion practices • Exclusively combust diesel for improved combustion efficiency • Oxidation catalyst in compliance with Tier 4 standards	3.5	g/kW-hr	
	$PM/PM_{10}/PM_{2.5}$	• Exclusively combust diesel for improved combustion efficiency • Proper engine design and operation • Each generator would be equipped with a diesel particulate filter	0.20	g/kW-hr	
	SO_2	• Ultra-low sulfur diesel fuel with sulfur content of 15 ppmv not to be exceeded • Proper engine design and operation with good combustion practices	3.1E-06	lb/hp-hr	
	VOC	• Oxidation catalyst in compliance with Tier 4 standards • Proper engine design and operation with good combustion practices	0.19	g/kW-hr	
	CO_2e	• Good combustion practices • Good O&M practices • Insulation would be implemented for surfaces above 120 °F	1,226	typ	Based on annual total

CC = combined cycle; CFR = Code of Federal Regulations; CO = carbon monoxide; CO_2e = carbon dioxide equivalent; g/KW-hr = grams per kilowatt-hour; gr/dscf = grains per cubic foot; H_2S = hydrogen sulfide; kW = kilowatt; lb/gal = pounds per gallon; lb/hp-hr = pounds per horsepower-hour; lb/hr = pounds per hour; lb/MMBtu = pounds per million British thermal units; NO_x = nitrogen oxides; O&M = operations and maintenance; O_2 = oxygen; PM = particulate matter; PM_{10} = particulate matter of 10 microns in diameter or less; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; ppmv = parts per million volume; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compounds

APPENDIX J

NOISE-SENSITIVE AREAS NEAR PIPELINE HORIZONTAL DIRECTIONAL DRILL ACTIVITIES

HORIZONTAL DIRECTIONAL DRILL LOCATIONS - EAST LATERAL PIPELINE IN RELATION TO NOISE RECEPTORS

HDD: Horizontal Directional Drill
MP: Milepost

HDD Entry
HDD Exit
Noise Receptor
.5 Mile Buffer
HDD
Proposed Lateral Pipeline
ATWS
Permanent Easement
Temporary Workspace
Meter Station
Permanent Access Road
Temporary Access Road

Louisiana

1:8,400
0 360 720
Feet

Figure J-1

Mermentau River Road HDD, MP 0.5

Calcasieu Pass Terminal and TransCameron Pipeline

Project Cameron Parish, Louisiana

CALCASIEU PASS

TransCameron PIPELINE

FILE: M:\Clients\V-X\VGL\CalcasieuPass_ArcGIS\2016\09\22_EIR_13_HDD_NSA_CalcasieuPass_EIR13_East_NSA.mxd | REVISED: 10/07/2016 | SCALE: 1:8,400 when printed at 11x17 DRAWN BY: JMS

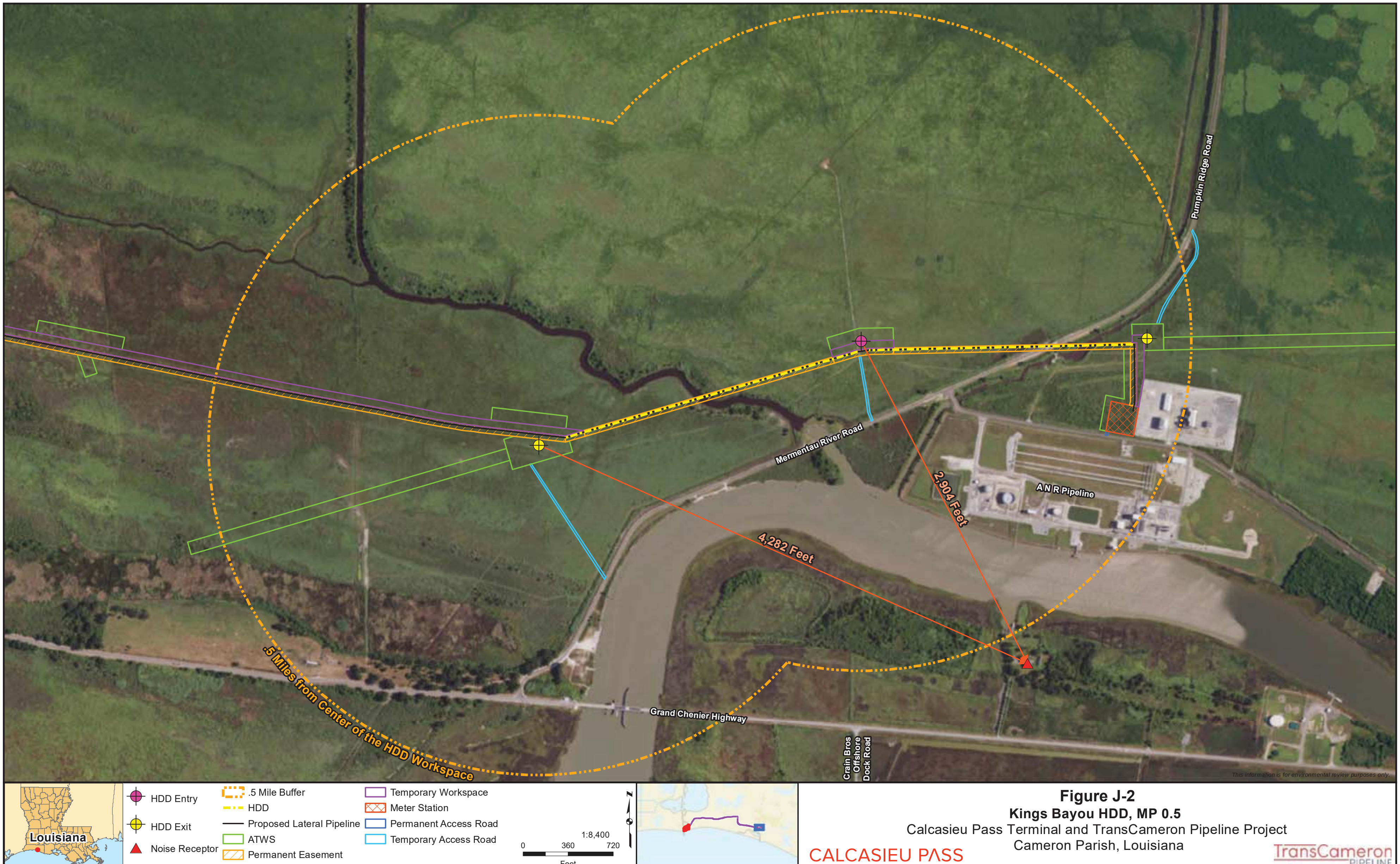

Figure J-2

Kings Bayou HDD, MP 0.5

Calcasieu Pass Terminal and TransCameron Pipeline Project

Cameron Parish, Louisiana

CALCASIEU PASS

TransCameron PIPELINE

FILE: M:\Clients\V-X\VGL\CalcasieuPass_ArcGIS\2016\09\22_EIR_13_HDD_NSA_CalcasieuPass_EIR13_East_NSA.mxd | REVISED: 10/07/2016 | SCALE: 1:8,400 when printed at 11x17

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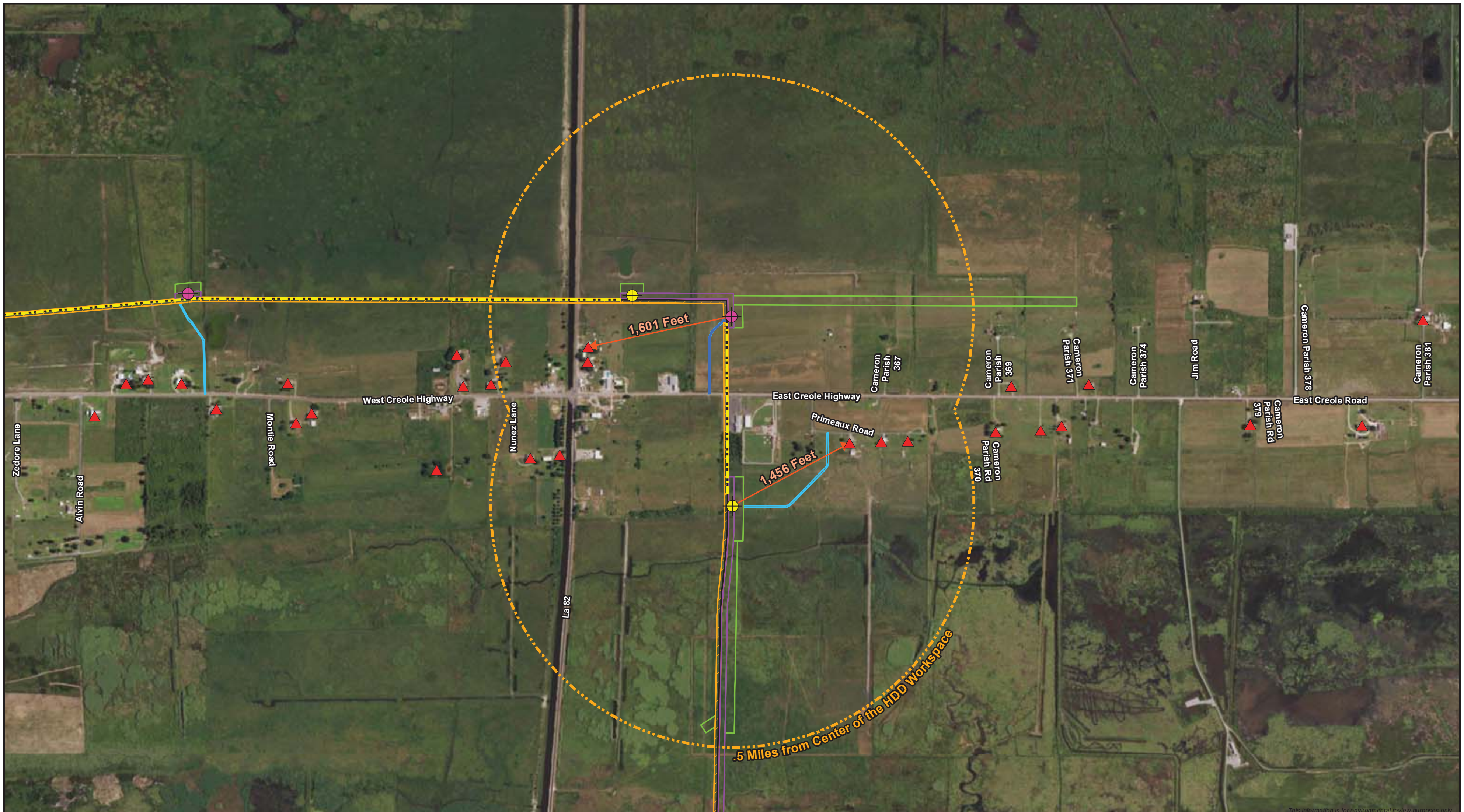


- HDD Entry
- HDD Exit
- Noise Receptor
- .5 Mile Buffer
- HDD
- Proposed Lateral Pipeline
- ATWS
- Permanent Easement
- Temporary Workspace
- Main Line Block Valve Site
- Permanent Access Road
- Temporary Access Road

1:12,000
0 500 1,000
Feet

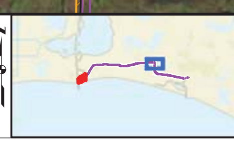
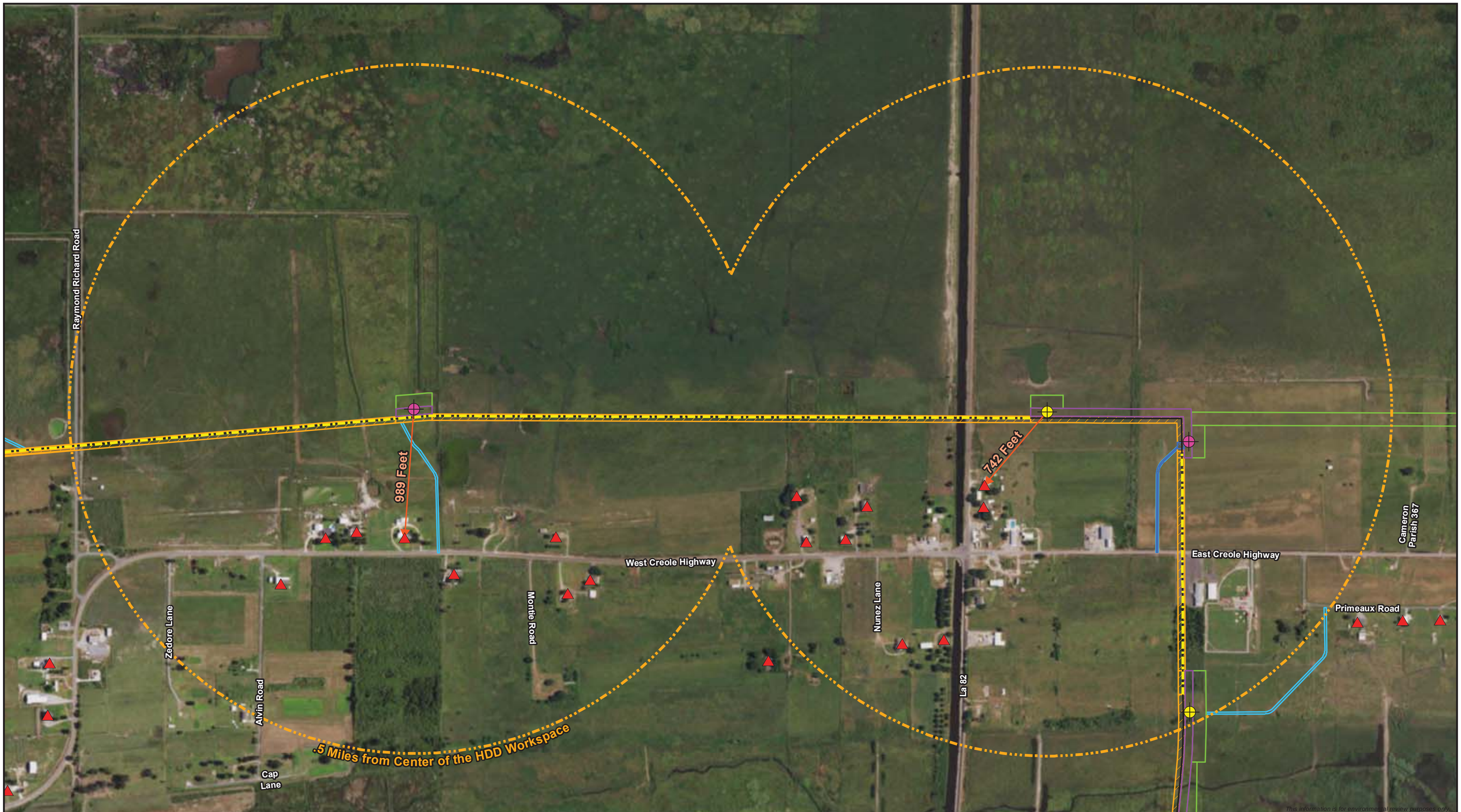


Figure J-3
East Creole Highway HDD, MP 8.3
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana

CALCASIEU PASS

TransCameron PIPELINE

FILE: M:\Clients\V-X\VGL\CalcasieuPass_ArcGIS\2016\09\22_EIR_13_HDD_NSA_CalcasieuPass_EIR13_East_NSA.mxd | REVISED: 10/07/2016 | SCALE: 1:12,000 when printed at 11x17 | DRAWN BY: JMS



HDD Entry
HDD Exit
Noise Receptor
.5 Mile Buffer
HDD
Proposed Lateral Pipeline
ATWS
Permanent Easement
Temporary Workspace
Main Line Block Valve Site
Permanent Access Road
Temporary Access Road

N

1:8,400
0 360 720
Feet

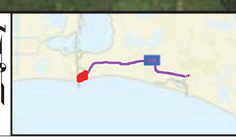


Figure J-4
West Creole Highway HDD, MP 9.4
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana

CALCASIEU PASS
TransCameron PIPELINE

FILE: M:\Clients\V-X\VGL\CalcasieuPass_ArcGIS\2016\09\22_EIR_13_HDD_NSA_CalcasieuPass_EIR13_East_NSA.mxd | REVISED: 10/07/2016 | SCALE: 1:8,400 when printed at 11x17 DRAWN BY: JMS

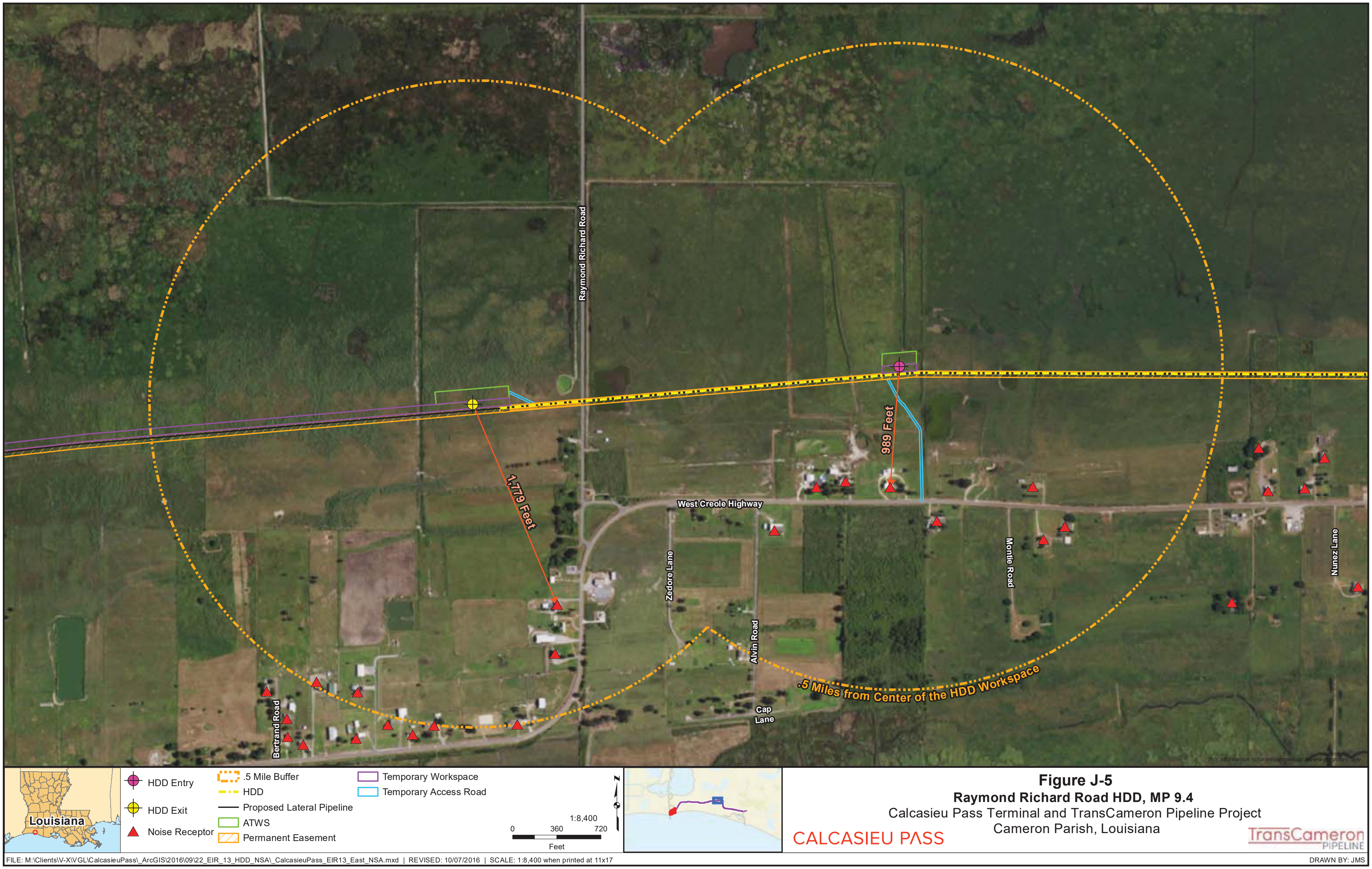


Figure J-5
Raymond Richard Road HDD, MP 9.4
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana

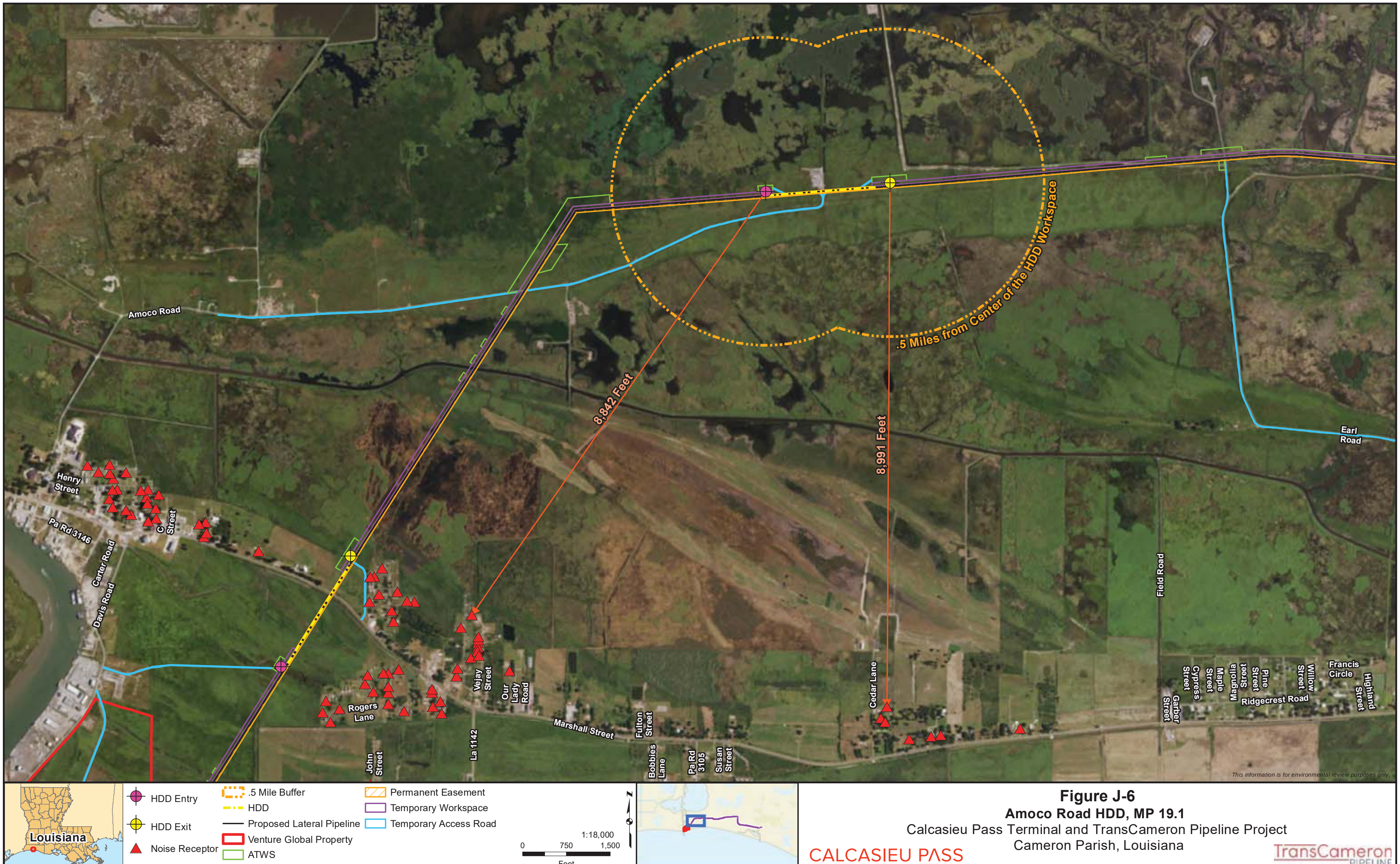


Figure J-6
Amoco Road HDD, MP 19.1
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana

FILE: M:\Clients\V-X\VGL\CalcasieuPass_ArcGIS\2016\09\22_EIR_13_HDD_NSA_CalcasieuPass_EIR13_East_NSA.mxd | REVISED: 10/07/2016 | SCALE: 1:18,000 when printed at 11x17 DRAWN BY: JMS

Louisiana

HDD Entry
HDD Exit
Noise Receptor
.5 Mile Buffer
HDD
Proposed Lateral Pipeline
Venture Global Property
ATWS
Permanent Easement
Temporary Workspace
Temporary Access Road

1:10,000
0 430 860
Feet

N

Figure J-7
Marshall Street – State Highway 27 HDD, MP 21.3
Calcasieu Pass Terminal and TransCameron Pipeline Project
Cameron Parish, Louisiana

CALCASIEU PASS
TransCameron PIPELINE

FILE: M:\Clients\V-X\VGL\CalcasieuPass_ArcGIS\2016\09\22_EIR_13_HDD_NSA_CalcasieuPass_EIR13_East_NSA.mxd | REVISED: 10/07/2016 | SCALE: 1:10,000 when printed at 11x17 DRAWN BY: JMS

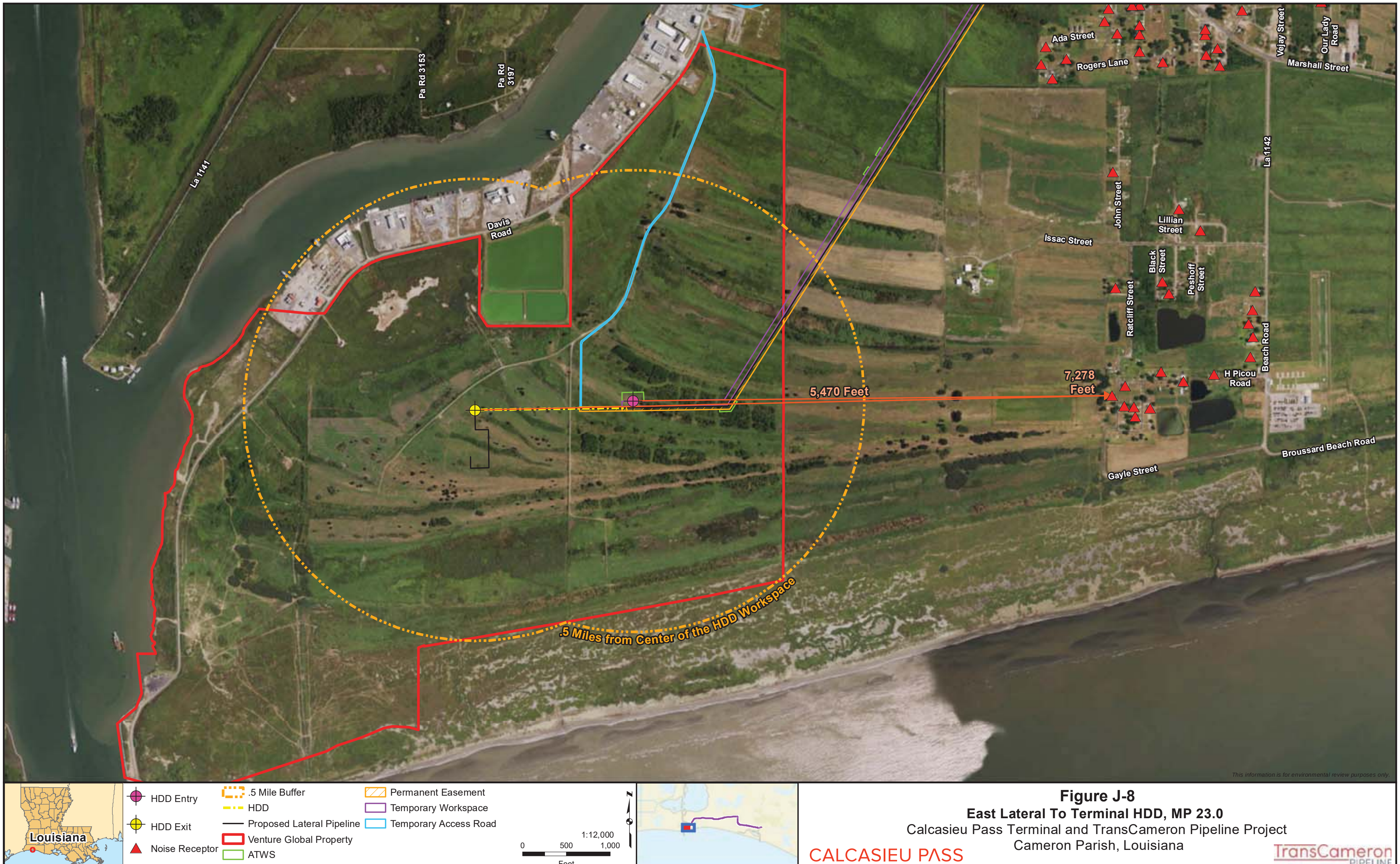


Figure J-8

East Lateral To Terminal HDD, MP 23.0

Calcasieu Pass Terminal and TransCameron Pipeline Project

Cameron Parish, Louisiana

CALCASIEU PASS

TransCameron PIPELINE

FILE: M:\Clients\V-X\VGL\CalcasieuPass_ArcGIS\2016\09\22_EIR_13_HDD_NSA_CalcasieuPass_EIR13_East_NSA.mxd | REVISED: 10/07/2016 | SCALE: 1:12,000 when printed at 11x17 DRAWN BY: JMS

APPENDIX K

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APPENDIX K
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APPENDIX L

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