Office of Energy Projects

September 2018

FERC/DEIS-0285D

DRAFT ENVIRONMENTAL IMPACT STATEMENT

FOR

Port Arthur Liquefaction Project, Texas Connector Project, and Louisiana Connector Project

Port Arthur LNG, LLC	Docket Nos.: CP17-20-000
PALNG Common Facilities Company, LLC	CP17-21-000
Port Arthur Pipeline, LLC	CP17-21-001
	CP18-7-000

Volume I

Source: Sempra LNG & Midstream, Port Arthur Liquefaction Project Website, 2018

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

Cooperating Agencies:

U.S. Army Corps of Engineers	**U.S. Coast Guard**	**U.S. Department of Energy**	**U.S. Department of Transportation PHMSA**	**U.S. Environmental Protection Agency**

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

In Reply Refer To:
OEP/DG2E/Gas 4
Port Arthur LNG, LLC; PALNG Common Facilities Company, LLC; and Port Arthur Pipeline, LLC
Docket Nos. CP17-20-000, CP17-21-000, CP17-21-001, and CP 18-7-000

TO THE INTERESTED PARTY:

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared a draft environmental impact statement (EIS) for the Port Arthur Liquefaction Project proposed by Port Arthur LNG, LLC and PALNG Common Facilities Company LLC (collectively referred to as PALNG), and the Texas Connector Project and Louisiana Connector Project proposed by Port Arthur Pipeline, LLC (PAPL) in the above-referenced dockets. PALNG requests authorization pursuant to section 3(a) of the Natural Gas Act (NGA) to construct and operate liquefied natural gas (LNG) export facilities in Jefferson County, Texas, and PAPL requests a Certificate of Public Convenience and Necessity pursuant to section 7(c) of the NGA to construct, operate, and maintain certain natural gas pipeline facilities in Jefferson and Orange Counties, Texas and Cameron, Calcasieu, Beauregard, Allen, Evangeline, and St. Landry Parishes, Louisiana. Together, these proposed facilities are referred to as “the Projects.”

The draft EIS assesses the potential environmental effects of the construction and operation of the Projects in accordance with the requirements of the National Environmental Policy Act (NEPA). The FERC staff concludes that approval of the proposed Projects, with the mitigation measures recommended in the EIS, would have some adverse environmental impact; however, these impacts would be avoided or reduced to less-than-significant levels.

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

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

- two liquefaction trains, each with a capacity of 6.73 million tons per annum of LNG for export;
- three LNG storage tanks, each with a capacity of 160,000 cubic meters;
- a refrigerant storage area and truck unloading facilities;
- a condensate storage area and truck loading facilities;
- a new marine slip with two LNG vessel berths, an LNG vessel and support vessel maneuvering area, and an LNG transfer system;
- a materials off-loading facility and Pioneer Dock;
- approximately 34.2 miles of 42-inch-diameter pipeline to bring feed gas from interconnections with Kinder Morgan Louisiana Pipeline LLC, Natural Gas Pipeline Company of America, Houston Pipeline Company LP, Texas Eastern Transmission, LP (TETCO), Florida Gas Transmission Company, LLC, and Golden Triangle Storage, Inc./Centana Intrastate Pipeline, LLC to the terminal site;
- approximately 130.8 miles of 42-inch-diameter pipeline to bring feed gas from interconnections with Centana Interstate Pipeline, LP, TETCO, Tennessee Gas Pipeline Company, Market Hub Partners – Egan, Pine Prairie Energy Center, Texas Gas Transmission, LLC, ANR Pipeline Company, and Columbia Gulf Transmission, LLC to the terminal site;
- three compressor stations;
- meter stations at the pipeline interconnects; and
- other associated utilities, systems, and facilities (yards, access roads, etc.).

The Commission mailed a copy of the *Notice of Availability* to federal, state, and local government representatives and agencies; elected officials; environmental and public interest groups; Native American tribes; potentially affected landowners and other interested individuals and groups; and newspapers and libraries in the project area. The draft EIS is only available in electronic format. It may be viewed and downloaded from the FERC's website (www.ferc.gov), on the Environmental Documents page (https://www.ferc.gov/industries/gas/enviro/eis.asp). In addition, the draft EIS may be accessed by using the eLibrary link on the FERC's website. Click on the eLibrary link (https://www.ferc.gov/docs-filing/elibrary.asp), click on General Search, and enter the docket number in the "Docket Number" field, excluding the last three digits (i.e. CP17-20, CP17-21, or CP18-7). 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.

Any person wishing to comment on the draft EIS may do so. Your comments should focus on draft EIS's disclosure and discussion of potential environmental effects, reasonable alternatives, and measures to avoid or lessen environmental impacts. To ensure consideration of your comments on the proposal in the final EIS, it is important that the Commission receive your comments on or before 5:00 pm Eastern Time on **November 19, 2018**.

For your convenience, there are four methods you can use to submit your comments to 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 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 file your comments electronically by 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." If you are filing a comment on a particular project, please select "Comment on a Filing" as the filing type; or

3) You can file a paper copy of your comments by mailing them to the following address. Be sure to reference the Projects docket numbers (CP17-20-000, CP17-21-000, and CP18-7-000) 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 one of the public comment sessions its staff will conduct in the Projects area to receive comments on the draft EIS, scheduled as follows:

Date and Time	**Location**
Tuesday, October 16, 2018 4:00 – 7:00 pm local time	Coushatta Golf Course Veranda Room 777 Koasati Dr. Kinder, LA 70648 337-738-4777
Wednesday, October 17, 2018 4:00 – 7:00 pm local time	Hampton Inn & Suites Meeting Room 7660 Memorial Blvd. Port Arthur, TX 77642 409-722-6999
Thursday, October 18, 2018 4:00 – 7:00 pm local time	Holiday Inn Lake Charles W – Sulphur Ballrooms 1, 2, and 3 330 Arena Rd. Sulphur, LA 70665 337-527-0858

The primary goal of these comment sessions 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.

Each scoping session is scheduled from 4:00 pm to 7:00 pm local time. You may arrive at any time after 4:00 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. Comments will be taken until 7:00 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 6:30 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.

Any person seeking to become a party to the proceeding must file a motion to intervene pursuant to Rule 214 of the Commission's Rules of Practice and Procedures (18 CFR Part 385.214). Motions to intervene are more fully described at http://www.ferc.gov/resources/guides/how-to/intervene.asp. Only intervenors have the right to seek rehearing or judicial review of the Commission's decision. The Commission grants affected landowners and others with environmental concerns intervenor status upon showing good cause by stating that they have a clear and direct interest in this proceeding that no other party can adequately represent. **Simply filing environmental comments will not give you intervenor status, but you do not need intervenor status to have your comments considered.**

Questions?

Additional information about the Projects is available from the Commission's Office of External Affairs, at **(866) 208-FERC**, or on the FERC website (www.ferc.gov) using the eLibrary link. The eLibrary link also provides access to the texts of all formal documents issued by the Commission, such as orders, notices, and rulemakings.

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

Port Arthur Liquefaction Project, Texas Connector Project, and

Louisiana Connector Project

Draft Environmental Impact Statement

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TECHNICAL ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
μPa	microPascal
ACHP	Advisory Council on Historic Preservation
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
ASTM	American Society for Testing and Materials
BA	Biological Assessment
BACT	Best Available Control Technology
BCC	Birds of Conservation Concern
BECi	Beauregard Electric CO-OP Inc.
BGEPA	Bald and Golden Eagle Protect Act of 1940
BLEVE	boiling liquid expanding vapor explosion
BO	Biological Opinion
BOG	boil-off gas
BPVC	Boiler and Pressure Vessel Code
bscfd	billion standard cubic feet per day
Btu/ft^2-hr	British thermal units per square foot hour
CAA	Clean Air Act
Centana	Centana Interstate Pipeline, LP
CEQ	Council on Environmental Quality
Certificate	Certificate of Public Convenience and Necessity
CFR	Code of Federal Regulations
CGT	Columbia Gulf Transmission, LLC
CH_4	methane
CIP	Sabine-Neches Waterway Canal Improvement Project
CLECO	Central Louisiana Electric Company
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
COTP	Captain of the Port
CPT	cone penetration tests
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
dB	decibels
dBA	A- weighted decibels
DCS	Distributed Control System
DHS	Department of Homeland Security
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy, Office of Fossil Energy
DOT	U.S. Department of Transportation

DWPL	Driftwood Pipeline LLC
EEM	estuarine emergent
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
Egan	Market Hub Partners – Egan
EI	Environmental Inspector
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
EPAct 2005	Energy Policy Act of 2005
ERP	Emergency Response Plan
ESA	Endangered Species Act of 1973
ESD	emergency shutdown
ESS	estuarine scrub-shrub
FE	Fossil Energy
FEED	front-end-engineering-design
FEMA	Federal Emergency Management Agency
FERC or Commission	Federal Energy Regulatory Commission
FGT	Florida Gas Transmission
FMP	fisheries management plans
FSA	Facility Security Assessment
FSP	Facility Security Plan
FTA	Free Trade Agreement
FWS	U.S. Fish and Wildlife Service
GCD	Groundwater Conservation Districts
GHG	greenhouse gases
GMD	Geomagnetic disturbances
GMFMC	Gulf of Mexico Fishery Management Council
GTS/CIPCO	Golden Triangle Storage, Inc./Centana Intrastate Pipeline, LLC
GWP	global warming potential
H_2S	hydrogen sulfide
HAP	hazardous air pollutants
HAZOP	hazard and operability review
HCA	high consequence area
HDD	horizontal directional drilling
HGB	Houston-Galveston-Brazoria
hp	horsepower
HPL	Houston Pipeline Company LP
HUC	Hydrologic unit code
IBA	Important Bird and Biodiversity Area
IBC	International Building Code
ICWW	Intracoastal Waterway
IMO	International Maritime Organization
ISA	International Society for Automation
KMLP	Kinder Morgan Louisiana Pipeline LLC
LAC	Louisiana Administrative Code
LDEQ	Louisiana Department of Environmental Quality

L_{dn}	day-night sound level
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LEDPA	Least Environmentally Damaging Practicable Alternative
L_{eq}	equivalent sound level
LNG	liquefied natural gas
LNHP	Louisiana Natural Heritage Program
LNVA	Lower Neches Valley Authority
LOD	Letter of Determination
LOR	Letter of Recommendation
LOS	level of service
Louisiana FWS	Louisiana Ecological Services Field Office of the U.S. Fish and Wildlife Service
m^3	cubic meter
MBTA	Migratory Bird Treaty Act of 1918
MCC	Municipal Code Corporation
MCL	Maximum Contaminant Level
Memorandum	*Memorandum of Understanding on Natural Gas Transportation Facilities*
MEOW	maximum envelope of water
MLLW	mean lower low water
MLV	mainline valve
MMPA	Marine Mammal Protection Act of 1972
MOF	material offloading facility
MOU	Memorandum of Understanding
MP	milepost
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MTPA	million tons per annum
MTSA	Maritime Transportation Security Act of 2002
MW	megawats
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act of 1969
NESHAPs	National Emission Standards for Hazardous Air Pollutants for Source Categories
NFPA	National Fire Protection Association
NGA	Natural Gas Act
NGPL	Natural Gas Pipeline Company of America
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NNSR	Nonattainment New Source Review
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOx	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service

NRHP	National Register of Historic Places
NSA	noise-sensitive areas
NSPS	New Source Performance Standards
NSQS	National Sediment Quality Survey
NSR	New Source Review
NWI	National Wetlands Inventory
OBE	operating basis earthquake
OCM	Office for Coastal Management
OEP	Office of Energy Projects
OSHA	Occupational Safety and Health Administration
P&IDs	piping and instrument diagrams
PALNG	Port Arthur LNG, LLC and PALNG Common Facilities Company, LLC
PAPL	Port Arthur Pipeline, LLC
PBR	Permit By Rule
PCBs	polychlorinated biphenyls
PEM	palustrine emergent
PFDs	process flow diagrams
PFO	palustrine forested
PGA	peak ground acceleration
PHMSA	Pipeline and Hazardous Materials Safety Administration
Pine Prairie	Pine Prairie Energy Center
Plan	Commission's *Upland Erosion Control, Revegetation and Maintenance Plan*
PM	particulate matter
PM_{10}	fine particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$	fine particulate matter less than or equal to 2.5 microns in diameter
ppt	parts per thousand
Procedures	Commission's *Wetland and Waterbody Construction and Mitigation Procedures*
Projects	Port Arthur Liquefaction Project, Texas Connector Project, and Louisiana Connector Project
PSD	Prevention of Significant Deterioration
psig	pounds per square inch gauge
PSS	palustrine scrub-shrub
PUB	palustrine unconsolidated bottom
RCP	Residential Construction Plans
RHA	Rivers and Harbors Act of 1899
RMP	Risk Management Plan
SCADA	Supervisory Control and Data Acquisition
SCPTs	seismic cone penetration tests
Secretary	Secretary of the Commission
SH	State Highway
SHPO	State Historic Preservation Office
SIL	significant impact levels
SIS	safety instrument system

SNND	Sabine-Neches Navigation District
SNWW	Sabine-Neches Waterway
SO_2	sulfur dioxide
SSA	sole source aquifer
SSE	safe shutdown earthquake
SSURGO	Soil Survey Geographic database
SWDA	Safe Water Drinking Act
SWEL	Still Water Elevation
SWPPP	Stormwater Pollution Prevention Plan
Systems Rivers	Louisiana Natural and Scenic Rivers System
TCEQ	Texas Commission on Environmental Quality
TCMP	Texas Coastal Management Program
TDOT	Texas Department of Transportation
TETCO	Texas Eastern Transmission Company
Texas FWS	Texas Coastal Ecological Services Field Office of the U.S. Fish and Wildlife Service
Texas RRC	Railroad Commission of Texas
TGLO	Texas General Land Office
TGP	Tennessee Gas Pipeline Company
TGT	Texas Gas Transmission, LLC
TNW	Traditional Navigable Water
TPWD	Texas Parks and Wildlife Department
tpy	tons per year
TSS	total suspended solids
TWDB	Texas Water Development Board
TWIC	Transportation Worker Identification Credential
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
VOC	volatile organic compounds
WHPA	wellhead protection area
WMA	Wildlife Management Area
WOUS	Waters of the United States
WSA	Waterway Suitability Assessment
yd^3	cubic yards

EXECUTIVE SUMMARY

The staff of the Federal Energy Regulatory Commission (FERC or Commission) prepared this draft Environmental Impact Statement (EIS) to assess the environmental impacts associated with construction and operation of facilities proposed by Port Arthur LNG, LLC and PALNG Common Facilities Company, LLC (collectively referred to as PALNG) and Port Arthur Pipeline, LLC (PAPL). The EIS was prepared in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA) and the Commission's implementing regulations under Title 18 of the Code of Federal Regulations, Part 380 (18 CFR 380).

On November 29, 2016, PALNG filed an application with the FERC for the Port Arthur Liquefaction Project in Docket No. CP17-20-000 pursuant to section 3(a) of the Natural Gas Act (NGA) and Parts 153 and 380 of the Commission's regulations. On November 29, 2016, PAPL filed an application with the FERC for the Texas Connector Project in Docket No. CP17-21-000 for a Certificate of Public Convenience and Necessity (Certificate) pursuant to section 7(c) of the NGA and Parts 157 and 284 of the Commission's regulations. On October 16, 2017, PAPL also filed an application with the FERC for the Louisiana Connector Project in Docket No. CP18-7-000 for a Certificate pursuant to section 7(c) of the NGA and Part 157 of the Commission's regulations. The combined PALNG and PAPL actions and facilities are referred to as the Port Arthur Liquefaction Project, Texas Connector Project, and Louisiana Connector Project (Projects). PALNG and PAPL propose to construct and operate onshore natural gas liquefaction and associated facilities in Texas to allow the export of liquefied natural gas (LNG), and to construct, own, operate, and maintain interstate natural gas pipelines, new compressor stations, and ancillary facilities in Texas and Louisiana.

The purpose of the EIS is to inform the FERC decision makers, the public, and the permitting agencies about the potential adverse and beneficial environmental impacts of the proposed Projects and their alternatives, and recommend mitigation measures that would reduce adverse impacts to the extent practicable. We[1] prepared our analysis based on information provided by PALNG and PAPL and further developed from data requests; field investigations; scoping; literature research; and contacts with or comments from federal, state, and local agencies, Native American tribes, and individual members of the public.

The FERC is the federal agency responsible for authorizing interstate natural gas transmission facilities under the NGA and is the lead federal agency for the preparation of this EIS in compliance with the requirements of NEPA. The U.S. Army Corps of Engineers (USACE); U.S. Coast Guard (USCG); Department of Energy (DOE); U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA); and U.S. Environmental Protection Agency (EPA)[2] are cooperating agencies for development of this EIS consistent with 40 CFR 1501.6(b). A cooperating agency has jurisdiction by law or has special expertise with respect to environmental resource issues associated with the Projects.

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

2 Cooperating agencies for the Liquefaction Project and Texas Connector Project include the USACE, USCG, DOE, EPA, and DOT, PHMSA. Cooperating agencies for the Louisiana Connector Project include the USACE and EPA.

PROPOSED ACTION

The Liquefaction Project's purpose as stated by PALNG is to receive and liquefy domestic natural gas into LNG for export to foreign markets. The Texas Connector and Louisiana Connector Projects' purposes as stated by PAPL are to provide 2.0 billion standard cubic feet per day of feed gas to the Liquefaction Project.

Liquefaction Project

PALNG would construct the Liquefaction Project on 898 acres of a 2,900-acre property that PALNG has already purchased on the western shore of the Port Arthur Canal, about 5 miles south of Port Arthur, Texas and 6 miles north of Sabine, Texas. In the past, the site was used as a dredge material placement area for materials dredged during maintenance of the Port Arthur Canal. All ship traffic would access the Liquefaction Project via the Port Arthur Canal, while all construction and personnel vehicles would access the site from State Highway (SH) 87. Further, the Liquefaction Project would be located on a site previously reviewed and approved by the Commission in 2006 (FERC Docket No. CP05-83-000). The liquefaction site would include the following facilities:

- Two liquefaction trains,[3] each with a capacity of 6.73 million tons per annum of LNG for export;
- Three LNG storage tanks, each with a capacity of 160,000 cubic meters;
- A refrigerant storage area and truck unloading facilities;
- A condensate storage area and truck loading facilities;
- A new marine slip with two LNG vessel berths, an LNG vessel and support vessel maneuvering area, and an LNG transfer system;
- A material offloading facility (MOF);
- A Pioneer Dock;[4] and
- Other ancillary utilities, buildings, and service facilities.

Construction of the Liquefaction Project would require the relocation of 3.3 miles of SH 87 and existing pipelines and utilities that parallel the highway, which are not under FERC's jurisdiction. PALNG would relocate the highway, pipelines, and utilities to its own property.

Texas Connector Project

PAPL proposes to construct and operate about 34.2 miles total of new natural gas pipeline in Jefferson and Orange Counties, Texas and Cameron Parish, Louisiana. The pipeline facilities would be comprised of the following:

- Northern Pipeline – 26.6 miles of 42-inch-diameter pipeline entering the liquefaction facilities site from the north and interconnecting with existing facilities near Beaumont, Texas owned by the following companies: Golden Triangle Storage, Inc./Centana

3 Liquefaction and purification facility that condenses natural gas into a liquid at atmospheric pressure.
4 The Pioneer Dock would consist of concreted docks and off-loading areas to support barge and aggregate bulk carrier vessel traffic to unload bulk materials such as gravel and rock.

Intrastate Pipeline, LLC (Centana); Houston Pipeline Company LP; Texas Eastern Transmission, LP (TETCO); and Florida Gas Transmission; and

- Southern Pipeline – 7.6 miles of 42-inch-diameter pipeline entering the liquefaction facilities site from the south to interconnections with an existing Natural Gas Pipeline Company of America facility in Jefferson County, Texas and an existing Kinder Morgan Louisiana Pipeline LLC facility in Cameron Parish, Louisiana

The Texas Connector Project would also include 4.7 miles of 42-inch-diameter lateral pipelines that connect the Northern and Southern Pipelines to six meter stations proposed at existing pipelines that would supply feed gas to the Texas Connector Project and, ultimately, the Liquefaction Project; two compressor stations; six interconnecting meter stations, one receipt meter station, one mainline valve, and eight pig launchers/receivers; contractor yards; and access roads. Of these aboveground facilities, one compressor station and the receipt meter station would be constructed within the Liquefaction Project property boundaries.

Construction of the pipeline and associated facilities associated with the Texas Connector Project would affect a total of about 665 acres of land, and operation of the pipeline facilities would affect a total of about 186 acres.

Louisiana Connector Project

PAPL proposes to construct and operate about 130.8 miles total of new 42-inch-diameter natural gas pipeline in Jefferson and Orange Counties, Texas and Cameron, Calcasieu, Beauregard, Allen, Evangeline, and St. Landry Parishes, Louisiana. This pipeline would connect with the existing Centana; TETCO; Tennessee Gas Pipeline Company; Market Hub Partners – Egan; Pine Prairie Energy Center; Texas Gas Transmission, LLC; ANR Pipeline Company, and Columbia Gulf Transmission, LLC pipeline systems.

The Louisiana Connector Project would also include 0.5 mile of 42-inch-diameter lateral and tie-in pipelines to connect the Louisiana Connector Project to eight existing pipelines to supply feed gas to the Louisiana Connector Project and, ultimately, the Liquefaction Project; one compressor station; nine meter stations; nine mainline valves; four pig launchers/receivers; contractor yards; and access roads. Of these aboveground facilities, one meter station would be constructed within the Liquefaction Project property boundaries.

Construction of the pipeline and associated facilities associated with the Louisiana Connector Project would affect a total of about 2,807 acres of land, and operation of the pipeline facilities would affect a total of about 771 acres.

PUBLIC INVOLVEMENT

Liquefaction Project and Texas Connector Project

On March 20, 2015, PALNG and PAPL filed requests with FERC to use our pre-filing review process for the Liquefaction Project and Texas Connector Project (formerly referred to as the Port Arthur Pipeline Project). The requests to use our pre-filing review process were approved on March 31, 2015. Pre-filing Docket Nos. PF15-18-000 and PF15-19-000 were established for the Liquefaction Project and Texas Connector Project, respectively, to place information filed by PALNG and PAPL and related documents issued by the FERC, as well as comments from the public, agencies, tribes, organizations, and other stakeholders into the public record. PALNG and PAPL held Public Open Houses in Port Arthur, Texas on May 28, 2015. FERC staff participated in those meetings to describe the FERC process and provide those attending with information on how to file comments with FERC. In addition, on May 28, 2015, FERC staff visited the proposed Liquefaction Project site.

On June 24, 2015, the FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Port Arthur Liquefaction Project and Port Arthur Pipeline Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Meeting* (NOI). This notice was sent to 441 interested parties including federal, state, and local officials; agency representatives; conservation organizations; Native American tribes; local libraries and newspapers in the Projects area; and property owners in the vicinity of the projects. Publication of the NOI established a 30-day public comment period for the submission of comments, concerns, and issues related to the environmental aspects of the proposed projects. On July 13, 2015, we conducted two public scoping meetings in Port Arthur, Texas, to provide an opportunity for the public to learn more about the projects and provide comments on environmental issues to be addressed in the EIS. One person provided comments during the sessions expressing support for the project. On July 14, 2015, FERC staff visited the proposed pipeline routes and compressor station sites.

On May 27, 2015, we attended an interagency meeting hosted by PALNG and PAPL to discuss the projects and FERC process with representatives from the Texas Department of Transportation, Texas General Land Office, and Texas Parks and Wildlife Department (TPWD). On July 15, 2015, we held a joint interagency meeting for the Projects and met with representatives of the USACE, USCG, and National Marine Fisheries Service (NMFS), and PALNG and PAPL representatives. On September 29, 2106, we conducted another agency meeting and met with representatives of the USACE, USCG, NMFS, U.S. Fish and Wildlife Service, EPA, DOT PHMSA, TPWD, J.D. Murphree Wildlife Management Area (WMA), Jefferson County, and the City of Port Arthur, as well as representatives of PALNG and PAPL.

Louisiana Connector Project

On February 27, 2017, PAPL a filed request with FERC to use our pre-filing review process for the Louisiana Connector Project, which would also provide feed gas to the liquefaction facilities. The request to use our pre-filing review process was approved on March 13, 2017. Pre-filing Docket No. PF17-5-000 was established for the Louisiana Connector Project to place information filed by PAPL and related documents issued by FERC into the public record, as well as comments from the public, agencies, tribes, organizations, and other stakeholders into the public record. PAPL held Public Open Houses in Kinder and Sulphur, Texas on May 2 and 3, 2017. The FERC staff participated in those meetings to describe the FERC process and provide those attending with information on how to file comments with FERC.

On May 25, 2017, the FERC issued a NOI for the Louisiana Connector Project. This notice was sent to 1,299 interested parties including federal, state, and local officials; agency representatives; conservation organizations; Native American tribes; local libraries and newspapers in the project area; and property owners in the vicinity of project facilities.

On June 12, 13, and 14, 2017, we conducted three public scoping sessions in Sulphur, Kinder, and Eunice, Louisiana, respectively, 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. Four persons provided comments during the sessions, one of which expressed support for the project, one of which noted they are not affected, and two of which expressed environmental concerns. On June 12, 2017, FERC staff visited the proposed pipeline route. In addition, on June 13, 2017, we attended a meeting hosted by the Coushatta Tribe of Louisiana to discuss the project and the FERC process. Representatives from PAPL also attended this meeting.

During the scoping comment period for PALNG's and PAPL's Projects, we received comments on a variety of environmental issues. Substantive environmental issues identified through this public review process are addressed in this EIS. The transcripts of the public scoping meetings and all written comments are part of the FERC's public record for the Projects, and are available for viewing under the Projects pre-filing docket numbers and the application docket numbers.

PROJECT IMPACTS

We evaluated the potential impacts of construction and operation of the Projects on geology; soils; water use and quality; wetlands; vegetation; wildlife, aquatic resources, and essential fish habitat; threatened, endangered, and special-status species; land use, recreation, and visual resources; socioeconomics; cultural resources; air quality and noise; reliability and safety; and cumulative impacts. Where necessary, we are recommending additional mitigation to minimize or avoid these impacts. Section 5 of the EIS contains a compilation of our recommendations.

Overall, construction of Projects would disturb about 10,612 acres of land and open water, and operation of the Projects would require about 7,953 acres. For the land not used permanently to operate the Projects, PALNG and PAPL would allow the remaining land disturbed during construction to return to pre-construction conditions and uses.

Construction of the Liquefaction Project would result in impacts on about 948 acres of open land, road/transportation land, wetlands, and open water; of which about 898 acres would be permanently impacted. Associated with the Liquefaction Project would be the dredging of material in the Port Arthur Canal. This material would be placed at four locations: existing Dredge Disposal Areas 8, 9, and 9A, and at the J.D. Murphree WMA. The proposed dredging and disposal would affect an additional 6,071 acres of land, and includes the beneficial reuse of dredge material to create about 1,269 acres of coastal marsh wetland. Construction of the Texas Connector Project would affect about 665 acres of agricultural land, open land, forest land, residential land, industrial/commercial land, road/transportation land, wetlands, and open water, of which about 186 acres would be permanently impacted. Construction of the Louisiana Connector Project would affect about 2,807 acres of agricultural land, open land, forest land, silviculture land, rangeland, residential land, industrial/commercial land, and open water, of which about 771 acres would be permanently impacted. About 14.7 miles, or 43 percent, of the Texas Connector Project's pipeline rights-of-way would be collocated with existing rights-of-way; about 95.4 miles, or 73 percent, of the Louisiana Connector Project's pipeline right-of-way would be collocated with existing rights-of-way.

Based on our analysis, scoping, and agency consultations, the major issues associated with the Projects are impacts on wetlands, visual resources, air quality, noise, and cumulative impacts.

Wetlands

Construction of the Projects would impact 2,810.9 acres of wetlands, of which 1,030.7 acres would be permanently affected by either fill, loss of function, or conversion to emergent wetland. As a result of the USACE's identification of differing wetland data, we are recommending that PALNG and PAPL file updated wetland impact data for the Projects to ensure accuracy and consistency with the wetland data provided to the USACE as part of PALNG's and PAPL's permit applications prior to construction.

Construction of the Liquefaction Project would affect a total of 1,661.9 acres of wetlands, of which 725.7 acres would be permanently filled. Due to previous dredge disposal disturbance at the project site, however, these wetlands are considered low quality. PALNG would offset impacts on USACE jurisdictional wetlands through mitigation measures included in its project Compensatory Mitigation Plan. The mitigation measures include the beneficial reuse of over 7.8 million cubic yards of dredge material excavated from the ship berthing area and Pioneer Dock. The beneficial reuse of this material would create about 1,268.8 acres of coastal marsh wetland. PALNG's wetland mitigation would include adhering to the measures in the Commission's *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) to control erosion, to minimize construction disturbance, and to ensure wetland restoration; acquisition of credits at a USACE-approved wetland mitigation banks; and compensatory mitigation, the amount of which will be determined based preliminary jurisdictional determinations by the USACE. PALNG has filed a draft Compensatory Mitigation Plan with the USACE, Galveston District, as part of its Clean Water Act, section 404 permit application filing.

Relocation of SH 87 and associated utilities would temporarily impact 140.8 acres of wetland and permanently impact 45.1 acres of wetland. All areas outside the new roadway and maintained right-of-way would be allowed to revert to preconstruction conditions while forested wetlands would revegetate to palustrine and EEM or scrub-shrub wetlands.

Construction and operation of the Texas Connector Project and Louisiana Connector Project would affect about 302.4 acres and 705.4 acres of wetlands, respectively, of which 17.2 acres and 242.8 acres, respectively, would be permanently disturbed. Emergent (palustrine and estuarine), scrub-shrub (palustrine), and unconsolidated bottom wetlands would be temporarily affected during construction and operation of the pipeline projects because the vegetation would return to a community that would function similarly to the pre-construction community. The 11.1 acres and 68.6 acres of forested wetlands that would be cleared for construction along the Texas Connector Project's and Louisiana Connector Project's pipeline construction rights-of-way, respectively, would result in long-term impacts to the value and functions of the wetlands because of the long regeneration period of these vegetation types. PAPL would implement the mitigation measures outlined in its project-specific *Environmental Plan*, which includes the FERC's Procedures, to control erosion and restore the grade and hydrology after construction in wetlands. In addition to the measures outlined in our Procedures, PAPL would be required to comply with any mitigation measures identified in the USACE permit conditions for the pipeline projects.

Visual Resources

The liquefaction site would include many aboveground structures that could result in a visual resource impact. These include three LNG storage tanks that would be about 256 feet high each, liquefaction trains, and new buildings and infrastructure. In addition, most of these structures would require lighting. PALNG would site the liquefaction facilities along the Port Arthur Canal, which would create a strong vertical visual contrast across a relatively flat existing landscape. The ship berths, offloading facilities, and utility buildings would also alter the existing viewshed. The storage tanks and liquefaction facilities would not be screened and would result in permanent visual impacts on views from the eastern edge of the nearby J.D. Murphree WMA. Impacts on views for those traveling on SH 87 and SH 82, visiting Pleasure Island or the Port Arthur Canal, boaters in the waterway, and viewers from a variety of recreational locations would be relatively minor due to existing industrial facilities surrounding and northeast of the project area. In addition, viewers may be able to see the ground flare at night when in use; however, PALNG would restrict any permanent lighting needed for the Liquefaction Project terminal facilities to the property boundaries and ensure that the permanent lighting is pointed downward towards these sites. We conclude that, because of the existing commercial, industrial, and developed nature of the area, including the existing Golden Pass liquefaction terminal within 3 miles of the proposed project, impacts from facility siting and its lighting would be consistent with the area.

Air Quality and Noise

The Projects are generally located in air quality attainment areas; however, the delivery of equipment and facilities by marine vessels would pass through the Houston-Galveston-Brazoria area which is classified a marginal nonattainment area for the 2008 8-hour ozone standard. Based on our General

Conformity applicability determination, the marine operation emissions would not exceed the general conformity determination thresholds for nitrogen oxides or volatile organic compounds (both precursors for ozone). As such, General Conformity would not apply to the Projects.

Long-term impacts on air quality would result from operation of the Liquefaction Project facilities and the pipeline compressor stations. PALNG and PAPL would minimize potential impacts on air quality caused by operation of the liquefaction facilities and compressor stations by adhering to applicable federal and state regulations and installing best available control technology to minimize emissions.

During construction of the Texas Connector and Louisiana Connector Projects, use of the horizontal directional drilling (HDD) method would result in minor impacts on noise-sensitive areas (NSA) in the vicinity. We are recommending that PAPL develop an HDD noise mitigation plan to reduce the projected noise level attributable to the proposed drilling operations at nearby NSAs.

Operation of the liquefaction facilities and associated South Compressor Station would generate sound levels throughout the life of the project, but the increase in noise levels would be below the "barely detectable" noise level increase of 3 A-weighted decibels (dBA), would be below the FERC limit standard of a day-night sound level (L_{dn}) of 55 dBA, resulting in only minor impacts on the nearest NSA. We are recommending that PALNG file a full-load noise survey no later than 60 days after each liquefaction train is put in service for the first and second liquefaction trains. If noise levels attributable to operation of the Liquefaction Project exceed the FERC limit of 55 dBA L_{dn}, PALNG would reduce the facilities' noise contribution to result in a noise level that is no higher than the FERC standard. We are also recommending that PALNG file a full-load noise survey no later than 60 days after placing all the Liquefaction Project facilities in service. Therefore, we conclude that operational noise from the Liquefaction Project would result in minor impacts on the nearest NSAs.

Sound levels would increase during operation of the Texas Connector Project's North Compressor Station, the Louisiana Connector Project's compressor station, and the meter stations associated with the pipeline projects, which would occur for the life of the Projects. To reduce noise impacts, PAPL would implement mitigation measures such as the use of acoustically treated compressor enclosures, silencers on the exhaust outlet and air intake, and acoustically treated wall and roof fan openings. Based on our noise analysis, the predicted noise levels attributable to operation of the North Compressor Station associated the Texas Connector Project, the Louisiana Connector Project's compressor station, and the meter stations would be less than 55 dBA L_{dn} at all nearby NSAs. To ensure that noise levels would be below 55 dBA L_{dn}, we are recommending that PAPL file noise surveys during full-load operations and, if the noise levels exceed the FERC standard, that PAPL install additional noise controls to meet the FERC standard within 1 year of the in-service date. As a result, we conclude that any increase in noise levels during operation of the pipeline projects would be minor.

Cumulative Impacts

We considered the cumulative contributions of the proposed Projects in specific impact areas for resources affected by the Projects. As a part of that assessment, we identified existing projects, projects under construction, and reasonably foreseeable projects. These included existing LNG terminals and future LNG liquefaction projects, currently operating and future oil and gas projects, land transportation projects, commercial and residential developments, and dredging projects. This also included areas where the Louisiana Connect Project could be collocated with another proposed pipeline project (the Driftwood Pipeline Project). Our assessment considered the impacts of the proposed Projects combined with the impacts of the other projects on resources within all or part of the same area and time. We conclude that the Projects' contribution to impacts on resources affected by the Projects would not result in significant cumulative impacts.

More detailed discussions of the Projects impacts, PALNG's and PAPL's proposed mitigation, and our recommendations to avoid or further reduce impacts are presented in sections 4.0 and 5.0 of this EIS.

ALTERNATIVES CONSIDERED

We assessed the No-Action Alternative, system alternatives, and other siting and design alternatives that could achieve the Projects' objectives. Alternatives were evaluated and compared to the Projects to determine whether the alternatives were technically and economically feasible and practical; and offer a significant environmental advantage over the proposed Projects. While the No-Action Alternative would avoid the environmental impacts identified in this EIS, adoption of this alternative would preclude meeting the Projects' objectives. If the Project is not approved and built, the need could potentially be met by other LNG export projects developed elsewhere in the Gulf Coast region or in other areas of the United States. Implementation of other LNG export projects likely would result in impacts similar to or greater than those of the proposed Projects.

We evaluated 20 new LNG or LNG terminal expansion system alternatives. To meet all or part of PALNG's contractual agreements, each of these projects would require substantial construction beyond what is currently planned and would not offer significant environmental advantages over the proposed Liquefaction Project. In addition, the permitting and authorization processes for constructing additional facilities and the time required for construction would substantially delay meeting the proposed timeline for the Liquefaction Project. As a result, we eliminated all potential system alternatives from further consideration.

Three alternative sites for the Liquefaction Project were evaluated along the SNWW. The alternative sites were screened against a set of seven criteria: access to a deepwater channel, access to safety and security infrastructure, access to major roads and barge traffic, sufficient size, available utilities, practicable site, and impacts on aquatic habitat characteristics relative to the proposed site. Alternative Site 2 lacked available land, and all three of the alternative sites considered had higher quality aquatic habitat present. Therefore, impacts on this resource would be greater at the alternatives than at the proposed site. For these reasons, we concluded that these sites would be impractical and create greater impacts on aquatic habitat, and they were eliminated from further consideration.

Additionally, facility configurations at the proposed site location were evaluated. We determined that the current facility footprint of the Liquefaction Project has been designed to minimize impacts on aquatic habitat while meeting required regulatory siting and safety requirements. We did not identify alternative configurations that would meet regulations, codes, and guidelines while avoiding or reducing impacts when compared to the proposed site configuration.

Based on the Texas Connector Project's and Louisiana Connector Project's collocation with existing rights-of-way where possible, many types of environmental impacts have been lessened compared to establishing new rights-of-way. We did not identify any site-specific environmental concerns that would drive the need to evaluate alternative pipeline routes, nor were any alternatives suggested during the public scoping period.

CONCLUSIONS

We conclude that, if constructed and operated in accordance with applicable laws and regulations, PALNG's and PAPL's proposed mitigation, and our recommendations presented in section 5.2 of the EIS, the Projects would result in some adverse environmental impact; however, those impacts would not be significant. The principal reasons for our conclusion include the following:

- The Liquefaction Project would be located on a site previously reviewed and approved by the Commission in 2006 (FERC Docket No. CP05-83-000).

- PALNG's and PAPL's compensatory mitigation plans would adequately address impacts on wetlands and Waters of the United States.

- Adequate safety features would be incorporated into the design and operation of the Liquefaction Project facilities.

- The proposed pipeline routes would be within or adjacent to existing rights-of-way for 43 percent (Texas Connector Project) and 73 percent (Louisiana Connector Project) of their respective lengths.

- PALNG and PAPL would implement their project-specific *Environmental Plan*, which includes the Commission's *Upland Erosion Control, Revegetation, and Maintenance Plan* and Commission's Procedures to minimize construction impacts on soils, wetlands, and waterbodies.

- Use of the HDD method for pipeline installation at 25 locations along the Texas Connector Project and 26 locations along the Louisiana Connector Project would avoid disturbances to wetlands, waterbodies, essential fish habitat, protected species, and vegetation and land use resources at those locations.

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

- FERC staff would complete the process of complying with section 106 of the National Historic Preservation Act prior to any construction of the Projects.

- The FERC's environmental and engineering inspection and mitigation monitoring program for the Projects would ensure compliance with all mitigation measures and conditions of any FERC authorization.

In addition, we developed site-specific mitigation measures that PALNG and PAPL would implement to further reduce the environmental impacts that would otherwise result from construction and operation of the Projects. We are recommending that these mitigation measures, presented in section 5.2 of the EIS, be attached as conditions to any authorization issued by the Commission for the Projects.

1.0 INTRODUCTION

On November 29, 2016, Port Arthur LNG, LLC and PALNG Common Facilities Company, LLC (collectively referred to as PALNG) filed an application with the Federal Energy Regulatory Commission (Commission or FERC) pursuant to section 3(a) of the Natural Gas Act (NGA) and Parts 153 and 380 of the Commission's regulations. In Docket No. Certificate Proceeding (CP)17-20-000, PALNG requests authorization to site, construct, and operate new liquefaction facilities adjacent to the Port Arthur Canal in Jefferson County, Texas. The Port Arthur Liquefaction Project (Liquefaction Project) would allow PALNG to liquefy domestic natural gas supplies for the export of about 2.0 billion standard cubic feet per day (bscfd) of liquefied natural gas (LNG).

Also on November 29, 2016, Port Arthur Pipeline, LLC (PAPL) filed an application with FERC for a Certificate of Public Convenience and Necessity (Certificate) pursuant to section 7(c) of the NGA and Parts 157 and 284 of the Commission's regulations. In Docket No. CP17-21-000, PAPL requests authorization to construct, install, and operate two new natural gas pipelines, lateral and tie-in pipelines at several locations, two compressor stations, six meter stations,[5] and appurtenant facilities within Jefferson and Orange Counties, Texas and Cameron Parish, Louisiana. PAPL also requests a Blanket Certificate for limited future activities and services. This project, referred to as the Texas Connector Project, would allow for the transportation of natural gas from various interstate pipeline interconnections to PALNG's proposed liquefaction site for export. The proposed pipelines would contribute to the about 2.0 bscfd of feed natural gas needed for the liquefaction facilities. On November 7, 2017, PAPL filed an amendment to its application for the Texas Connector Project under Docket No. CP17-21-001 in which it identified changes to its proposed rate schedules and other non-environmental items.

On October 16, 2017, PAPL filed an application for a Certificate pursuant to section 7(c) of the NGA and Part 157 of the Commission's regulations. In Docket No. CP18-7-000, PAPL requests authorization to construct, install, and operate a new natural gas pipeline, lateral and tie-in pipelines at nine locations, one compressor station, nine meter stations, and appurtenant facilities within Jefferson and Orange Counties, Texas and Cameron, Calcasieu, Beauregard, Allen, Evangeline, and St. Landry Parishes, Louisiana. This project, referred to as the Louisiana Connector Project, would allow for the transport of natural gas from various interstate pipeline interconnections to PALNG's proposed liquefaction site for export. The proposed pipeline would contribute to the about 2.0 bscfd of feed natural gas needed at the liquefaction facilities.

Collectively, PALNG's and PAPL's actions and facilities are referred to in this draft environmental impact statement (EIS) as the Port Arthur Liquefaction and Pipeline Projects (Projects). As part of the Commission's consideration of these applications, we[6] prepared this draft EIS to assess the potential environmental impacts resulting from construction and operation of the proposed Projects in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA).

5 A meter station is an aboveground facility on a pipeline that has equipment for measuring the volume of gas flowing in the pipeline.

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

PALNG anticipates it would commence construction of the Liquefaction Project following the receipt of FERC authorization and all other applicable permits, authorizations, and approvals. The Liquefaction Project would consist of the following key facilities as described in more detail in section 2.0:

- Two liquefaction trains, each with a maximum nameplate capacity of 6.73 million tons per annum (MTPA) (or 13.5 MTPA aggregate) of LNG for export.
- Three 160,000-cubic meter (m^3) full containment LNG storage tanks.
- Boil-off gas vapor handling system.
- Flare systems.
- Refrigerant and condensate storage areas.
- Truck loading for condensate and truck unloading for refrigerant makeup.
- A marine facility, including two LNG berths designed to accept LNG vessels up to 266,000 m^3, each with three liquid loading arms and one vapor return arm.
- A material off-loading facility (MOF) consisting of a modified/improved existing concrete dock to transport large pieces of equipment and construction materials to the site by barge.
- A Pioneer Dock consisting of a modified/improved existing concrete dock to transport bulk aggregate materials (e.g., rock, gravel) to the site by barge.
- Common utilities and auxiliary systems needed to support the process (e.g., hot oil, diesel, utility air, instrument air and nitrogen).

Subject to the receipt of a FERC Certificate and all other applicable permits, authorizations, and approvals, PAPL anticipates it would begin construction of the Texas Connector Project in the fourth quarter of 2019 and initiate service in the third quarter of 2022. The Texas Connector Project would consist of the following key facilities as described in more detail in section 2.0:

- Construction and operation of two 42-inch-diameter pipelines, one about 26.6 miles and the other about 6.7 miles long.
- Construction and operation of 42-inch-diameter lateral and tie-in pipelines of varying lengths; and custody transfer stations connecting with the existing Kinder Morgan Louisiana Pipeline LLC (KMPL), Natural Gas Pipeline Company of America (NGPL), Houston Pipeline Company LP (HPL), Texas Eastern Transmission, LP (TETCO), Florida Gas Transmission Company, LLC (FGT), and Golden Triangle Storage, Inc./Centana Intrastate Pipeline, LLC (GTS/CIPCO) pipeline systems.
- Construction and operation of two compressor stations with a total of about 65,000 horsepower (hp).
- Construction and operation of one delivery point meter station at the proposed liquefaction site.
- Construction of miscellaneous auxiliary and appurtenant facilities.

Subject to the receipt of a FERC Certificate and all other applicable permits, authorizations, and approvals, PAPL anticipates it would begin construction of the Louisiana Connector Project in the second quarter of 2021 and initiate service in the second quarter of 2023. The Louisiana Connector Project would consist of the following key facilities as described in more detail in section 2.0:

- Construction and operation of a 42-inch-diameter pipeline about 130.8 miles long.
- Construction and operation of lateral and tie-in pipelines, all 42 inches in diameter, of varying lengths and custody transfer stations connecting with the existing Centana Interstate Pipeline, LP (Centana), TETCO, Tennessee Gas Pipeline Company (TGP), Market Hub Partners – Egan (Egan), Pine Prairie Energy Center (Pine Prairie), Texas Gas Transmission, LLC (TGT), ANR Pipeline Company (ANR), and Columbia Gulf Transmission, LLC (CGT) pipeline systems.
- Construction and operation of one compressor station with a total of about 89,900 hp.
- Construction and operation of one delivery point meter station at the proposed liquefaction site.
- Construction of miscellaneous auxiliary and appurtenant facilities.

1.1 PROJECT PURPOSE AND NEED

The Liquefaction Project's purpose as stated by PALNG is to receive and liquefy domestic natural gas into LNG for export to foreign markets under the authorities granted it by the U.S. Department of Energy, Office of Fossil Energy (DOE). The Texas Connector and Louisiana Connector Projects' purposes as stated by PAPL are to provide a total of 2.0 bscfd of feed gas to the Liquefaction Project.

Under section 3 of the NGA, the Commission considers as part of its decision to authorize natural gas facilities all factors bearing on the public interest. Specifically, regarding whether to authorize natural gas facilities used for importation or exportation, 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, gas supply, environmental impact, long-term feasibility, and other issues concerning a proposed project.

1.1.1 Basic Project Purpose and Water Dependency Determination[7]

Basic Project Purpose and Water Dependency Determination: According to U.S. Army Corps of Engineers (USACE) regulations governing project purpose, the basic project purpose is to discharge fill material into wetlands for the construction of facilities to transport, liquefy, and export domestic natural gas as LNG to the global market. Construction of the marine basin, the Pioneer Dock, and the MOF are considered to be a water dependent activities. All other aspects of the proposed Projects are considered to be non-water dependent, these include the terminal facilities, pipelines, and other ancillary features.

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7 As further discussed in section 1.2.2, the USACE is a cooperating agency on the Projects. The USACE could adopt the EIS in compliance with Title 40 of the Code of Federal Regulations, Part 1506.3 and, as such, a project purpose and water dependency determination are required as part of the USACE permitting requirements.

Overall Project Purpose: For USACE permit consideration, the overall project purpose is to discharge fill material into wetlands to: 1) construct the pipelines, laterals, compressor stations, meter stations, and associated facilities necessary to transport natural gas to a liquefaction terminal; and 2) construct the liquefaction terminal and associated equipment and facilities necessary for the production and exportation of LNG.

1.2 PURPOSE AND SCOPE OF THIS EIS

The principal purposes in preparing an EIS are to:

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

This EIS focuses on the facilities that are under FERC's jurisdiction (that is, the new proposed liquefaction and pipeline facilities). The topics addressed in this EIS include geology; soils; water use and quality; wetlands; vegetation; wildlife; fisheries and essential fish habitat (EFH); threatened, endangered, and special status species; land use, recreation, and visual resources; socioeconomics; cultural resources; air quality; noise; reliability and safety; cumulative impacts; and alternatives. This EIS describes the affected environment as it currently exists, discusses the potential environmental consequences of the proposed Projects, and compares the Projects' potential impact to that of identified alternatives. This EIS also presents our conclusions and recommended mitigation measures.

The Energy Policy Act of 2005 (EPAct 2005) provides that the FERC shall act as the lead agency for coordinating all applicable authorizations related to jurisdictional natural gas facilities and for purposes of complying with NEPA. Based on its authority under the NGA, the FERC is the lead agency for preparation of this EIS in compliance with the requirements of NEPA, the Council on Environmental Quality's (CEQ) regulations for implementing NEPA, and FERC regulations implementing NEPA (Title 18 of the Code of Federal Regulations Part 380 [18 CFR 380]). As the lead federal agency for the Projects, FERC is required to comply with section 7 of the Endangered Species Act of 1973 (ESA), as amended; the Magnuson-Stevens Fishery Conservation and Management Act (MSA); section 106 of the National Historic Preservation Act (NHPA); and section 307 of the Coastal Zone Management Act (CZMA). Each of these statutes has been taken into account in the preparation of this EIS. The FERC will use this document to consider the environmental impacts that could result if it issues an authorization to PALNG under section 3(a) of the NGA and Certificates to PAPL under section 7(c) of the NGA.

1.2.1 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 PALNG's and PAPL's applications. The identification of environmental impacts related to the construction and operation of the Projects, 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 Projects are approved, the Order would specify that the liquefaction terminal, pipelines, and related facilities can be constructed and operated under the authority of sections 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 Projects going into service.

As the lead federal agency, we prepared this EIS to assess the environmental impacts that could result from constructing and operating the Projects. This document was prepared in compliance with the requirements of NEPA, the CEQ's regulations implementing procedural provisions of NEPA in 40 CFR 1500-1508, and the FERC's regulations implementing NEPA in 18 CFR 380. As applicable, this EIS is also intended to fulfill the cooperating federal agencies' NEPA obligations (see section 1.2.2).

The Commission will consider the findings contained herein as well as non-environmental issues in its review of PALNG's and PAPL's applications. Approvals will be granted only if the FERC finds that the evidence produced on technical competence, financing, rates, market demand, gas supply, environmental impact, long-term feasibility, and other issues demonstrates that the Projects are in the public interest and/or required by the public convenience and necessity, as applicable. Environmental impact analyses and mitigation development are important factors in the overall public interest determination.

The FERC may impose conditions on any Certificate or authorization granted (if it chooses to do so) for the Projects. These conditions could include requirements and mitigation measures identified in this EIS to minimize environmental impacts associated with the Projects (see section 5.2). We will recommend to the Commission that these requirements and mitigation measures (indicated with bold type in the text) be included as conditions to any Order approving Certificates or authorization issued for the Projects. Further, PALNG and PAPL would be required to implement the construction procedures and mitigation measures it has proposed in its filings with the FERC, including those in appendices of this EIS, unless specifically modified by other Certificate or authorization conditions.

Other regulatory agencies also may include terms and conditions or stipulations as part of their permits or approvals. While there would be jurisdictional differences between the FERC's and other agencies' conditions, PALNG's and PAPL's environmental inspection program for the Projects would address all environmental or construction-related conditions or other permit requirements placed on PALNG and PAPL by all regulatory agencies.

1.2.2 Cooperating Agencies

The regulations that implement NEPA and establish the CEQ's regulations call on federal, state, and local government agencies to cooperate in the preparation of environmental documents (40 CFR 1501.6). A "cooperating agency" is another agency participating in the NEPA process that has jurisdiction by law over all or part of the project and/or one that has special expertise with respect to environmental issues. Cooperating agencies are intended to have a significant role in shaping plans and environmental analyses according to their particular jurisdiction and expertise. The review of the proposed Projects herein was undertaken with the participation and assistance of the USACE, U.S. Coast Guard (USCG), DOE, U.S. Environmental Protection Agency (EPA), and U.S. Department of Transportation (DOT), Pipeline and Hazardous Materials Safety Administration (PHMSA) as cooperating agencies under NEPA because they have specific permitting requirements and/or special expertise on environmental resources associated with the Projects.[8] The roles of the FERC, USACE, USCG, DOE, EPA, and DOT PHMSA in the Projects' review process are described below.

The EIS provides a basis for coordinated federal decision making in a single document, avoiding duplication among federal agencies in the NEPA environmental review process. In addition to the lead and cooperating agencies, other federal, state, and local agencies may use this EIS in approving or issuing permits for all or part of the proposed Projects. Federal, state, and local permits, approvals, and consultations for the Projects are discussed in section 1.5.

1.2.2.1 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, section 1344 [33 USC 1344]), which governs the discharge of dredged or fill material into Waters of the United States (WOUS), as well as section 10 of the Rivers and Harbors Act of 1899 (RHA; 33 USC 403), which regulates any work or structures that potentially affect the navigable capacity of a waterbody. Because the USACE would need to evaluate and approve several aspects of the Projects and must comply with the requirements of NEPA before issuing permits under the above statutes, it has elected to participate as a cooperating agency in the preparation of this EIS. The USACE could adopt the EIS in compliance with 40 CFR 1506.3 if, after an independent review of the document, it concludes that the EIS satisfies the USACE's comments and suggestions.

The proposed Projects are within the Galveston District of the USACE Southwestern Division and the New Orleans District of the USACE Mississippi Valley Division. Staff from the Galveston District participated as a cooperating agency in the NEPA review, and both USACE districts will evaluate USACE authorizations, as applicable.

The primary decisions to be addressed by the USACE include:

- issuance of section 404 Permits for dredging activities and wetland impacts associated with construction of the Projects; and
- issuance of a section 10 Permit for construction activities within navigable WOUS.

The USACE will consider information contained in this EIS to help reach decisions on these issues. Through the coordination of this document and its own permitting process, the USACE will obtain the views of the public and natural resource agencies prior to reaching its decisions on the Projects. The USACE must also carry out its public interest review process before it can issue a standard permit. This EIS does not serve as a public notice for any USACE permits or take the place of the USACE's permit review process.

As an element of its review, the USACE must consider whether a proposed project avoids, minimizes, and compensates for impacts on existing aquatic resources, including wetlands, to strive to achieve a goal of no overall net loss of function to wetlands and WOUS. The CWA section 404(b)(1) Guidelines provide substantive criteria that the USACE uses to determine whether a proposed site is suitable for discharge of dredged or fill material and whether a proposed discharge of dredged or fill material (activity) is eligible for authorization under section 404. Central to the guidelines is a tiered approach designed to minimize impacts on wetlands and other WOUS. Specifically, applicants are required to: 1)

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8 Cooperating agencies for the Liquefaction Project and Texas Connector Project include the Galveston District of the USACE, Coast Guard, DOE, EPA, and DOT PHMSA. Cooperating agencies for the Louisiana Connector Project include the Galveston District of the USACE and EPA.

avoid impacts where possible; 2) minimize unavoidable impacts; and 3) compensate for any remaining impacts that can neither be avoided nor minimized such that overall project impacts on the aquatic environment are minimal on both an individual and cumulative basis. The USACE must also evaluate whether or not a project, or components of a project, are "water dependent."[9] In addition, the USACE must assess the proposed project alternatives, and determine the Least Environmentally Damaging Practicable Alternative (LEDPA).

The USACE would issue a Record of Decision to formally document its decisions on the proposed action, including the LEDPA, section 404(b)(1) analyses and required compensatory mitigation.

1.2.2.2 U.S. Coast Guard

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. The USCG exercises regulatory authority over LNG facilities that affect the safety and security of port areas and navigable waterways under Executive Order 10173 (*Regulations Relating to the Safeguarding of Vessels, Harbors, Ports, and Waterfront Facilities of the United States*, enacted October 18, 1950); the Magnuson Act (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 (MTSA; 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 (FSP) 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 seaward from the coastline (i.e., within the territorial seas).

As required by its regulations, the USCG is responsible for issuing a Letter of Recommendation (LOR) as to the suitability of the waterway for LNG marine traffic following a Waterway Suitability Assessment (WSA). The process of preparing the LOR begins when an applicant submits a Letter of Intent to the local Captain of the Port (COTP). In a letter dated March 17, 2015, PALNG submitted its Letter of Intent and WSA to the USCG as required by 33 CFR 127.007.

In a letter dated September 11, 2015, the USCG issued the LOR for the Port Arthur Liquefaction Project, which stated that the Sabine Neches River Ship Channel is considered suitable for LNG marine traffic in accordance with the guidance in USCG Navigation and Vessel Inspection Circular 01-2011, dated January 24, 2011.

1.2.2.3 U.S. Department of Energy

The DOE must meet its obligation under section 3 of the NGA to review the proposed import or export of natural gas, including LNG. By law, exports to countries with which the U.S. has a free trade agreement requiring national treatment for trade in natural gas (Free Trade Agreement [FTA] countries) are deemed to be consistent with the public interest and must be authorized by DOE. For exports to non-FTA countries, DOE must authorize a proposed export unless it finds that the export is not consistent with the public interest.

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9 The CWA's section 404(b)(1) Guidelines define water dependency in terms of an activity requiring access or proximity to or siting within a special aquatic site to fulfill its basic project purpose. Special aquatic sites (as defined in 40 CFR 230.40-230.45) are: (1) sanctuaries and refuges; (2) wetlands; (3) mud flats; (4) vegetated shallows; (5) coral reefs; and (6) riffle and pool complexes.

PALNG seeks to export LNG from the liquefaction site to any country:

1) with which the United States has, or in the future may have, a free trade agreement requiring national treatment for trade in natural gas;

2) with which the United States does not have a free trade agreement requiring the national treatment for trade in natural gas and LNG;

3) that has, or in the future develops, the capacity to import LNG; and

4) with which trade is not prohibited by United States law or policy.

PALNG filed an application with the DOE (Fossil Energy [FE] Docket No. 15-53-LNG) on March 20, 2015 (supplemented on April 9, 2015), seeking authorization to export up to 517 billion cubic feet (bcf) per year of natural gas, in the form of LNG (equivalent to approximately 10 million MTPA of LNG) to FTA countries for a 25-year period, commencing the earlier of either the date of first export or 7 years from the date of issuance of the requested authorization.

Section 3(c) of the NGA, as amended by section 201 of the Energy Policy Act of 1992 (Public Law 102-486), requires that applications to the DOE requesting authorization of the import or export of natural gas, including LNG, from or to a nation with which there is in effect an FTA requiring national treatment for trade in natural gas, be deemed consistent with the public interest and granted without modification or delay. On August 20, 2015, the DOE issued an order granting authorization to PALNG to export LNG by vessel from the liquefaction site to any country that has or in the future develops the capacity to import LNG via ocean-going carrier and with which the United States has, or in the future enters into, an FTA requiring national treatment for trade in natural gas.

On June 15, 2015, PALNG filed a second application with the DOE (FE Docket No. 15-96-LNG) seeking authorization to export up to 517 bcf per year of natural gas, in the form of natural gas (equivalent to approximately 10 MTPA of LNG) to non-FTA countries for a 20-year period, commencing the earlier of either the date of first export or 7 years from the date of issuance of the requested authorization.

In the case of LNG export applications to non-FTA countries, section 3(a) of the NGA requires the DOE to conduct a public interest review and to grant the applications unless the DOE finds that the proposed exports would not be consistent with the public interest. Additionally, NEPA requires the DOE to consider the environmental impacts of its decisions on non-FTA export applications. The application of PALNG to export LNG by vessel to non-FTA countries is currently pending before the DOE. A decision would not be made until after a final EIS is issued.

1.2.2.4 U.S. Environmental Protection Agency

The EPA has delegated water quality certification (section 401 of the CWA) to the jurisdiction of individual state agencies, but the EPA may assume this authority if no state program exists, if the state program is not functioning adequately, or at the request of a state. For the Projects, this authority is assumed by Texas and Louisiana with EPA oversight. In addition, the EPA has the authority to review and veto USACE decisions on section 404 permits. Water used for hydrostatic testing of pipelines that is point-source discharged into waterbodies requires a National Pollutant Discharge Elimination System (NPDES) Permit (section 402 of the CWA) issued by the state with EPA oversight.

The EPA also has jurisdictional authority to control air pollution under the Clean Air Act (CAA) (42 USC 85) 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. The EPA has delegated the authority to implement these regulations to state and local agencies, while state and local agencies are allowed to develop their own regulations for non-major sources. The EPA also establishes general conformity applicability thresholds; a federal agency can use these thresholds to determine whether a specific action requires a general conformity assessment. In addition to its permitting responsibilities, the EPA is responsible for implementing certain procedural provisions of NEPA (e.g., publishing the Notices of Availability of the draft and final EISs in the Federal Register) to establish statutory timeframes for the environmental review process.

1.2.2.5 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 federal pipeline safety statutes codified in 49 USC 60101 *et seq*, and under 49 CFR 192, Transportation of Natural or Other Gas by Pipeline: Minimum Federal Safety Standards.

The DOT also establishes the minimum federal safety standards for LNG facilities in compliance with 49 USC 60101 *et seq*. Those standards are codified in 49 CFR 193 and apply to the siting, design, construction, operation, maintenance, and security of LNG facilities. The National Fire Protection Association (NFPA) Standard 59A (2001 edition), "Standard for the Production, Storage, and Handling of Liquefied Natural Gas," is incorporated into these requirements by reference, with regulatory preemption in the event of conflict. On August 31, 2018, FERC and DOT signed an MOU to streamline LNG project reviews and eliminate duplicative efforts.[10] The DOT will issue a LOD to FERC on the 49 CFR 193 Subpart B regulatory requirements. The LOD will provide PHMSA's analysis and conclusions the Subpart B regulatory requirements. The DOT's conclusion on the siting and hazard analysis required by Part 193 would be based on preliminary design information, which may be revised as the engineering design progresses to final design. DOT regulations also contain requirements for the design, construction, installation, inspection, testing, operation and maintenance, and contingency plans for LNG facilities, which would be completed during later stages of the project. If the facilities are approved and constructed, final compliance with the requirements of 49 CFR 193 will be subject to DOT's inspection and enforcement programs. Informal consultation between PALNG and the DOT regarding additional LNG and pipeline safety and federal safety standards is currently ongoing.

1.3 PUBLIC REVIEW AND COMMENT

1.3.1 Pre-filing Process and Scoping

1.3.1.1 Liquefaction and Texas Connector Projects

On March 20, 2015, PALNG and PAPL filed requests with FERC to use our pre-filing review process for the Liquefaction Project and Texas Connector Project (formerly referred to as the Port Arthur Pipeline Project). FERC established its pre-filing process to encourage early involvement of interested stakeholders, facilitate interagency cooperation, and identify and resolve environmental issues before an application is filed with the FERC and facility locations are formally proposed. The requests to use our pre-filing review process were approved on March 31, 2015. Docket Nos. PF15-18-000 and PF15-19-000 were established for the Liquefaction Project and Texas Connector Project, respectively, to place information filed by PALNG and PAPL and related documents issued by the FERC into the public record,

10 https://www.ferc.gov/legal/mou/2018/FERC-PHMSA-MOU.pdf

as well as comments from the public, agencies, tribes, organizations, and other stakeholders into the public record. At that time, we selected Merjent, Inc. as our third-party environmental contractor to assist us in the preparation of this EIS.[11] In addition, Merjent staff, under FERC direction, attended open houses, public meetings, reviewed Resource Reports, and drafted environmental information request questions.

PALNG and PAPL held public open houses in Port Arthur, Texas on May 28, 2015. FERC staff participated in those meetings to describe the FERC process and provide those attending with information on how to file comments with FERC. FERC staff also visited the proposed liquefaction project site.

On June 24, 2015, the FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Port Arthur Liquefaction Project and Port Arthur Pipeline Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Meeting* (NOI). This notice was sent to 441 interested parties including federal, state, and local officials; agency representatives; conservation organizations; Native American tribes; local libraries and newspapers in the area of the projects; and property owners in the vicinity of project facilities. Publication of the NOI established a 30-day public comment period for the submission of comments, concerns, and issues related to the environmental aspects of the projects.

On July 13, 2015, we conducted two public scoping meetings in Port Arthur, Texas to provide an opportunity for the public to learn more about the projects and provide comments on environmental issues to be addressed in the EIS. One person provided comments during the meetings, expressing support for the projects. On July 14, 2015, FERC staff visited the proposed pipeline routes and compressor station sites.

In total, three letters from federal agencies (USACE, EPA, and U.S. Department of Agriculture [USDA]), three letters from state agencies (Texas Parks and Wildlife Department [TPWD], Texas Commission on Environmental Quality [TCEQ], and Louisiana Department of Wildlife and Fisheries [LDWF]), and one stakeholder comment were received in response to the PALNG and PAPL NOI. After the end of the NOI comment period, the U.S. Department of Defense (DOD) Siting Clearinghouse provided a letter stating no opposition to the projects, and the Choctaw Nation of Oklahoma requested consulting party status for the portion of the projects lying in Cameron Parish, Louisiana. The Commission also received a second letter from the EPA after the NOI comment period, which included comments on aquatic resources, dredge disposal, alternatives, and cumulative impacts. After PALNG and PAPL filed their respective FERC applications, we received comment letters from the LDWF and two landowners.

On May 27, 2015, we attended an interagency meeting hosted by PALNG and PAPL to discuss the projects and FERC process with representatives from the Texas Department of Transportation (TDOT), Texas General Land Office (TGLO), and TPWD. On July 15, 2015, we held a joint interagency meeting for the projects and met with representatives of the USACE, USCG, and National Marine Fisheries Service (NMFS), and PALNG and PAPL representatives to discuss coordination of agency review, permit requirements and status, each agency's interest in participating in our environmental review as a cooperating agency, and impacts on EFH and wetlands. On September 29, 2016, we conducted another agency meeting and met with representatives of the USACE, USCG, NMFS, U.S. Fish and Wildlife Service (FWS), EPA, DOT PHMSA, TPWD, J.D. Murphree Wildlife Management Area (WMA), Jefferson County, and the City of Port Arthur, as well as representatives of PALNG and PAPL, to reacquaint the agencies with the projects and FERC process; provide an update on PALNG's and PAPL's applications to

11 Third-party contractors are selected by Commission staff and funded by project applicants. Third-party contractors work solely under the direction of FERC staff, who directs the scope, content, quality, and schedule of the contractor's work. FERC staff independently evaluates the results of the third-party contractor's work, and the Commission, through its staff, bears ultimate responsibility for full compliance with the requirements of NEPA.

FERC; and to discuss resource concerns related to EFH, wetlands, migratory birds, and threatened and endangered species.

1.3.1.2 Louisiana Connector Project

On February 27, 2017, PAPL a filed request with FERC to use our pre-filing review process for another project that would provide feed gas to the liquefaction site. The request to use our pre-filing review process was approved on March 13, 2017. Pre-filing Docket No. PF17-5-000 was established for the Louisiana Connector Project to place information filed by PAPL and related documents issued by FERC into the public record, as well as comments from the public, agencies, tribes, organizations, and other stakeholders into the public record.

PAPL held public open houses in Kinder and Sulphur, Texas on May 2 and 3, 2017. The FERC staff participated in those meetings to describe the FERC process and provide those attending with information on how to file comments with FERC.

On May 25, 2017, the FERC issued a NOI for the Louisiana Connector Project. This notice was sent to 1,299 interested parties including federal, state, and local officials; agency representatives; conservation organizations; Native American tribes; local libraries and newspapers in the project area; and property owners in the vicinity of project facilities. Publication of the NOI established a 30-day public comment period for the submission of comments, concerns, and issues related to the environmental aspects of the proposed project. In total, two letters from the TPWD were received in response to the PAPL NOI.

On June 12, 13, and 14, 2017, we conducted three public scoping sessions in Sulphur, Kinder, and Eunice, Louisiana, respectively, 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. Four persons provided comments during the sessions, one of which expressed support for the project, one of whom noted he is not affected, and two of which expressed environmental concerns. On June 12, 2017, FERC staff visited the proposed pipeline route.

On June 13, 2017, we attended a meeting hosted by the Coushatta Tribe of Louisiana to discuss the project and FERC process with representatives from PAPL.

1.3.1.3 Issues Identified During Scoping

Issues identified after the open houses and during and after the public comment periods are summarized in table 1.3-1 along with a listing of the EIS sections that address the comments. Non-environmental comments, such as those declaring general support for the Projects, were noted but are considered outside the scope of the EIS.

TABLE 1.3-1 **Environmental Issues and Concerns Raised During Public Scoping for the Projects**	
Issue/Concern	EIS Section Addressing Issue
GENERAL	
Purpose and Need	1.2
Beneficial use of dredge material	4.4.4
SOILS	
Soil testing and analysis at liquefaction site	4.2.1.6
WATERBODIES AND WETLANDS	
Impacts on wetlands and wetland mitigation; cumulative impacts	4.4.2; 4.4.4; 4.13.2.5
Impacts on surface water quality and use; impaired waters	4.3.2
Impacts on groundwater	4.3.1
VEGETATION, WILDLIFE, AND PROTECTED SPCIES	
Impacts on critical habitats including coastal prairie, oysters, colonial waterbird nesting areas, and submerged aquatic vegetation	4.5.2.2; 4.5.4; 4.6.2; 4.6.1.3; 4.6.1.2
Impacts on protected species and critical habitat	4.7
Potential spread of invasive species	4.5.3
LAND USE	
Hazardous wastes	4.8.7
Use of eminent domain	4.8.3
SOCIOECONOMICS	
Identify if any impacts on minority and low-income communities	4.9.8
CULTURAL RESOURCES	
Tribal outreach process	4.10.3
AIR QUALITY	
Impacts on air quality; nonattainment areas	4.11.1
Greenhouse gas emissions from liquefaction facilities	4.11.1
Effects to climate change	4.13.2.14
ALTERNATIVES	
Use of other existing liquefaction site	3.2.1
Reduction of or justification for wetland impacts	3.3; 3.4; 4.4

In July 2016, we mailed a Project Update to 508 interested parties, including federal, state, and local officials; agency representatives; conservation organizations; Native American tribes; local libraries and newspapers in the project area; and property owners in the vicinity of proposed Liquefaction Project and Texas Connector Project facilities. This update provided information on the proposed projects, a list of the primary concerns that were raised during scoping, information on the status of the environmental review process and the next steps in the process, and information on how to stay informed about the progress of the review process.

1.3.2 Public Review of the Draft EIS

This draft EIS was filed with the EPA and a Notice of Availability for the draft EIS was mailed to federal, state, and local government agencies; elected officials; Native American tribes; affected landowners; local libraries and newspapers; intervenors in the FERC's proceeding; and other interested parties (i.e., miscellaneous individuals who provided scoping comments or asked to be on the mailing list). The distribution list for the Notice of Availability is provided in appendix A. A formal notice indicating that the draft EIS is available for review and comment will be published in the Federal Register. Also, this draft EIS was posted to FERC's eLibrary for public review. The public has 45 days after the date of publication of the EPA's formal notice to comment on the draft EIS both in the form of written comments and at public comment sessions held along the pipeline route. All comments received on the draft EIS related to environmental issues will be addressed in the final EIS.

1.4 NONJURISDICTIONAL FACILITIES

Under section 7 of the NGA, 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 "nonjurisdictional" facilities may be integral to the need for the proposed facilities, or they may be merely associated as minor components of the jurisdictional facilities that would be constructed and operated as a result of authorization of the proposed facilities. The nonjurisdictional facilities associated with the Projects are described below and shown on the figures in appendix B.

The following nonjurisdictional actions were identified in association with the proposed Liquefaction Project:

- Relocation of approximately 3.3 miles of State Highway (SH) 87 to a location west of the Liquefaction Project site.
- Relocation or abandonment of five pipelines owned by third parties to a location west of the Liquefaction Project site, including:
  - 3.3 miles of 6-inch-diameter Buckeye Dev. & Logistics I LLC gas pipeline;
  - 3.3 miles of 10-inch-diameter Centana Intrastate Pipeline, LLC gas pipeline;
  - 3.3 miles of 12-inch-diameter Centana Intrastate Pipeline, LLC gas pipeline;
  - 3.3 miles of 24-inch-diameter Cameron Highway Oil Pipeline Company oil pipeline; and
  - 3.3 miles of 8-inch-diameter ONEOK Transmission Company gas pipeline.[12]
- Relocation of existing utilities to a location west of the Liquefaction Project, including:
  - 3.3 miles of electric power distribution line;
  - 3.3 miles of 16-inch-diameter water main line; and
  - 3.3 miles of communication (telephone and cable) lines.

These facilities are described in more detail in section 2.1, and the environmental impacts associated with these actions are addressed in each resource discussion in section 4.0 of this EIS.

Nonjurisdictional actions identified in association with the proposed Louisiana Connector Project consist of electric lines to the compressor station that would be built by Central Louisiana Electric Company

12 This pipeline is currently not operating. It would be abandoned in place and/or removed by PALNG.

(CLECO) and Beauregard Electric CO-OP Inc. (BECi) in Allen Parish, Louisiana. PAPL, CLECO, and BECi are currently investigating two options. Option One would tap into the existing CLECO distribution line at the intersection of SH 165 and Green Oak Cemetery Road then extend about 0.25 mile along the north side of Green Oak Cemetery Road to the proposed compressor station site. Option Two would tap into the existing BECi three phase distribution line at the intersection of Green Oak Cemetery Road and Green Oak Road then extend about 0.75 mile along the south side of Green Oak Cemetery Road before crossing Green Oak Cemetery Road to the proposed compressor station site. Both options have been assessed for their potential cumulative impacts on resources in section 4.13.

1.5 PERMITS, APPROVALS, AND REGULATORY REVIEWS

FERC has exclusive authority for siting interstate natural gas pipeline projects; however, other agencies also have responsibilities for other federal authorizations. As federal agencies, FERC and the USACE are required to comply with a number of regulatory statutes including, but not limited to, NEPA, section 7 of the ESA, the MSA, the CAA, the CWA, the RHA, section 106 of the NHPA, and section 307 of the CZMA. Each of these statutes has been taken into account in the preparation of this draft EIS. The major permits, approvals, and consultations for the Projects are identified in tables 1.5-1, 1.5-2, and 1.5-3.

Section 7 of the ESA states that any project authorized, funded, or conducted by any federal agency should not "…jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined…to be critical…" (16 USC 1536[a][2][1988]). The FERC, or PALNG and PAPL as non-federal parties, is/are required to determine whether any federally listed or proposed endangered or threatened species or their designated critical habitat occur in the vicinity of the proposed Projects, and conduct consultations with the FWS and/or NMFS, if necessary. If, upon review of existing data or data provided by PALNG and PAPL, FERC determines that these species or habitats may be affected by the Projects, FERC is required to prepare a Biological Assessment (BA) to identify the nature and extent of adverse impacts, and to recommend measures that would avoid the habitat and/or species, or would reduce potential impact to acceptable levels. Section 4.7 provides information on the status of this review.

The Migratory Bird Treaty Act of 1918 (MBTA) implements various treaties and conventions between the United States, Mexico, Canada, Japan, and Russia for the protection of migratory birds. Birds protected under the MBTA include all common songbirds, waterfowl, shorebirds, hawks, owls, eagles, ravens, crows, native doves and pigeons, swifts, martins, swallows, and others, including their body parts (e.g., feathers, plumes), nests, and eggs. The act makes it unlawful to pursue, hunt, take, capture, or kill; attempt to take, capture, or kill; possess, offer to or sell, barter, purchase, deliver, or cause to be shipped, exported, imported, transported, carried, or received any migratory bird, part, nest, egg, or product, manufactured or not, without a permit. The MBTA is discussed further in in section 4.6.1.3.

The Bald and Golden Eagle Protect Act of 1940, as amended (BGEPA) prohibits taking without a permit, or taking with wanton disregard for the consequences of an activity any bald or golden eagle or their body parts, nests, chicks, or eggs, which includes collection, molestation, disturbance, or killing. The BGEPA protections include provisions not included in the MBTA, such as the protection of unoccupied nests and a prohibition on disturbing eagles. The BGEPA includes limited exceptions to its prohibitions through a permitting process, including exceptions to take golden eagle nests that interfere with resource development or recovery operations. We discuss compliance with the BGEPA in section 4.6.1.3.

The MSA, 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 (FMP). The MSA requires federal agencies to consult with NMFS on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH (MSA

§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 statues, 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 this consultation process, the FERC staff prepared an EFH Assessment. This assessment and the status of the EFH consultation are provided in section 4.6.3.

Section 106 of the NHPA requires that the FERC take into account the effects of its undertakings on properties listed, or eligible for listing, in the National Register of Historic Places (NRHP), including prehistoric or historic sites, districts, buildings, structures, objects, or properties of traditional religious or cultural importance, and to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on the undertaking. PALNG and PAPL, as non-federal parties, are assisting the FERC in meeting our obligations under section 106 by preparing the necessary information, analyses, and recommendations under ACHP regulations in 36 CFR 800. EIS section 4.10 provides information on the status of this review.

PALNG and PAPL must comply with sections 401 and 404 of the CWA. Water quality certification (section 401) has been delegated to the state agencies, with review by the EPA. Water used for hydrostatic testing that is point-source discharged into waterbodies would require a NPDES permit (section 402) issued by the Louisiana Department of Environmental Quality (LDEQ). The USACE has responsibility for determining compliance with all regulatory requirements associated with section 404 of the CWA. The EPA also independently reviews section 404 applications for wetland dredge-and-fill applications for the USACE and has section 404(c) veto power for wetland permits issued by the USACE. The section 404 permitting process regulates the discharge of dredged and fill material associated with the construction of pipelines across streams and in wetlands. Before an individual section 404 permit can be issued, the CWA requires completion of a section 404(b)(1) guideline analysis. FERC, in the NEPA review represented by this draft EIS, has analyzed all technical issues required for the section 404(b)(1) guideline analyses, including analysis of natural resources and cultural resources that would be affected by the Projects, as well as analyses of alternatives. The results of our analysis of alternatives are provided in section 3.0 of this draft EIS, and a summary of wetland impacts is provided in section 4.4. In addition to CWA responsibilities, the USACE has jurisdiction over section 10 permits, which would be required for all construction activities in navigable waterways under the RHA. Waterbody crossing methods and impacts are summarized in EIS section 4.3.

Section 404 and section 10 permits are required for proposed Pipeline Projects, while a section 404 permit is required for only the Liquefaction Project. PALNG's and PAPL's section 404 and section 10 permit applications are under review by the USACE.

The EPAct 2005 and section 3 of the NGA require us to consult with the DOD to determine if there would be any impacts associated with the siting, construction, or operation of the liquefaction facilities on military training or activities on any military installations. FERC initiated consultation with a letter to DOD on June 25, 2015. The DOD responded in a letter dated July 28, 2015, concluding the Liquefaction Project would have minimal impact on the military operations conducted in this area and that the DOD would not oppose construction of the Liquefaction Project.

The CZMA calls for the "effective management, beneficial use, protection, and development" of the nation's coastal zone and promotes active state involvement in achieving those goals. As a means to reach those goals, the CZMA requires participating states to develop management programs that demonstrate how those states will meet their obligations and responsibilities in managing their coastal areas. In Texas, the TGLO administers the Coastal Zone Management Program (CZMP); in Louisiana, the Louisiana Department of Natural Resources (LDNR) administers the CZMP. The TGLO and LDNR conducted consistency determinations concurrent with PALNG's and PAPL's filling of applications for a statement of consistency. The CZMP is discussed further in section 4.8.9 of this draft EIS.

The CAA was enacted by Congress to protect the health and welfare of the public from the adverse effects of air pollution. The CAA is the basic federal statute governing air pollution. Federal and state air quality regulations established as a result of the CAA include, but are not limited to, Title V operating permit requirements and Prevention of Significant Deterioration (PSD) Review. The EPA is the federal agency responsible for regulating stationary sources of air pollutant emissions; however, the federal permitting process has been delegated to the TCEQ in Texas and LDEQ in Louisiana. As noted in tables 1.5-1 and 1.5-2, the TCEQ issued air permits for the Liquefaction Project on February 17, 2016; air permits from the TCEQ and LDEQ for the Texas Connector and Louisiana Connector Projects are pending. Air quality impacts that could occur as a result of construction and operation of the Projects are evaluated in EIS section 4.11.1.

Besides FERC, other federal agencies have responsibilities for issuing permits or approvals to comply with various federal laws and regulations. The USCG exercises regulatory authority over the suitability of the Project Waterway for LNG marine traffic. As required by its regulations, the USCG is responsible for issuing an LOR as to the suitability of the waterway for LNG marine traffic. The USCG issued its LOR on September 11, 2015. Impacts on vessel traffic are summarized in section 4.9.6 of this draft EIS.

Tables 1.5-1, 1.5-2, and 1.5-3 list the major permits, consultations, and approvals for the Projects. PALNG and PAPL are responsible for all permits and approvals required to implement the Projects, regardless of whether they appear in tables. FERC encourages cooperation between applicants and state and local authorities; however, state and local agencies, through the application of state and local laws, may not prohibit or unreasonably delay the construction or operation of facilities approved by FERC. Any state or local permits issued with respect to jurisdictional facilities must be consistent with the conditions of any authorization the Commission may issue.[13]

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13 *See* 15 USC 717r(d) (state or federal agency's failure to act on a permit considered to be inconsistent with Federal law); *see also Schneidewind v. ANR Pipeline Co.*, 485 U.S. 293, 310 (1988) (state regulation that interferes with FERC's regulatory authority over the transportation of natural gas is preempted) and *Dominion Transmission, Inc. v. Summers*, 723 F.3d 238, 245 (D.C. Cir. 2013) (noting that state and local regulation is preempted by the NGA to the extent it conflicts with federal regulation, or would delay the construction and operation of facilities approved by the Commission).

TABLE 1.5-1

Permits, Approvals, and Consultations for the Liquefaction Project

Agency	Permit/Authorization	Date Filed *(Anticipated)*	Receipt Date *(Anticipated)*
FEDERAL			
FERC	Certificate of Public Convenience and Necessity	November 2016	*Pending*
USACE	CWA Section 10/404 Permit	November 2016; November 2017	*(December 2018)*
FWS	ESA Section 7 Consultation	November 2016	June 2018
USCG	WSA	July 14, 2015	November 14, 2017
National Oceanic and Atmospheric Administration, NMFS	ESA Section 7 and MSA Consultation; Essential Fish Habitat	November 2016	August 2018
EPA	NPDES Permits – Hydrostatic Test Water Discharge/Operational Stormwater	*(January 2019)*	*(August 2019)*
DOE	Authorization to Export (Free Trade Agreement Countries)	March 20, 2015	August 20, 2015
	Authorization to Export (Non-Free Trade Agreement Countries)	June 15, 2015	*(June 2019)*
STATE			
TCEQ	PSD Permit	April 9, 2015; June 6, 2017	February 17, 2016; July 7, 2017
	New Source Review Permit	April 9, 2015; June 6, 2017	February 17, 2016; July 7, 2017
	Title V Operating Permit	April 9, 2015; June 6, 2017	February 17, 2016; July 7, 2017
	General Construction Stormwater Permit (Nonjurisdictional Facilities only)	*(November 2018)*	*(March 2019)*
Railroad Commission of Texas (Texas RRC)	CWA 401 Certification	November 2016	*(December 2018)*
	Section 402 Hydrotest Discharge Permit	*(January 2019)*	*(July 2019)*
Texas Historical Commission (State Historic Preservation Office)	NHPA Section 106 Consultation	May 19, 2015	June 2, 2015
Texas General Land Office	Statement of Consistency with the Coastal Management Program / Miscellaneous Easement	November 2016; November 2017	*(December 2018)*
TDOT	Road Crossing/ Construction in Right-Of-Way Permit	*(February 2019)*	*(May 2019)*
TPWD	Protected Species Consultation and impacts in State WMAs	November 2016	*(November 2018)*
LOCAL			
Jefferson County	Floodplain Development Permit	*(December 2018)*	*(July 2019)*
	Development/ Building Permit	*(December 2018)*	*(July 2019)*
City of Port Arthur	Building Permit (if required)	*(December 2018)*	*(July 2019)*

TABLE 1.5-2

Permits, Approvals, and Consultations for the Texas Connector Project [a]

Agency	Permit/Authorization	Date Filed *(Anticipated)*	Receipt Date *(Anticipated)*
FEDERAL			
FERC	Certificate of Public Convenience and Necessity	November 2016	*Pending*
USACE	CWA Section 10/404 Permit	January 2017; November 2017	*(December 2018)*
FWS	ESA Section 7 Consultation	November 2016	June 2018
National Oceanic and Atmospheric Administration, NMFS	ESA Section 7 and MSA Consultation; Essential Fish Habitat	November 2016	August 2018
EPA	NPDES Permit	*(December 2020)*	*(July 2021)*
STATE			
TCEW	Standard Permit for Oil & Gas Facilities (Air Quality)	*(July 2019)*	*(December 2019)*
Texas RRC	NPDES Permit – Hydrostatic Test Water Discharge	*(December 2020)*	*(July 2021)*
	CWA 401 Certification	January 2017; November 2017	*(December 2018)*
Texas Historical Commission (State Historic Preservation Office)	NHPA Section 106 Consultation	August 2016	September 2016
TGLO	Statement of Consistency with the Coastal Management Program	January 2017; November 2017	*(December 2018)*
TDOT	Road Crossing/ Construction in Right-of-Way Permit	*(January 2020)*	*(March 2020)*
TPWD	Protected Species Consultation	November 2016	November 2017
LDEQ	NPDES Permit – Hydrostatic Test Water Discharge	*(December 2020)*	*(July 2021)*
	CWA 401 Certification	January 2017; November 2017	*(December 2018)*
Louisiana Office of Cultural Development (State Historic Preservation Office)	NHPA Section 106 Consultation	August 2016	September 2016
LDNR	Coastal Use Permit	January 2017; November 2017	*(December 2018)*
	Protected Species Consultation	March 2017	June 2017

[a] Local permits will be determined upon further facilities design.

TABLE 1.5-3

Permits, Approvals, and Consultations for the Louisiana Connector Project [a]

Agency	Permit/Authorization	Date Filed *(Anticipated)*	Receipt Date *(Anticipated)*
FEDERAL			
FERC	Certificate of Public Convenience and Necessity	October 2017	*Pending*
USACE	CWA Section 10/404 Permit	October 2017	*(December 2018)*
FWS	ESA Section 7 Consultation	September 2017	August 2018
National Oceanic and Atmospheric Administration, NMFS	ESA Section 7 and MSA Consultation; Essential Fish Habitat	August 2017	August 2018
Bureau of Indian Affairs	Right-of-Way Grant	June 2018	*(December 2020)*
STATE			
Texas RRC	NPDES Permit – Hydrostatic Test Water Discharge	*(June 2020)*	*(December 2020)*
	CWA 401 Certification	October 2017	*(December 2018)*
Texas Historical Commission (State Historic Preservation Office)	NHPA Section 106 Consultation	June 2017	October 2017
Texas General Land Office	Statement of Consistency with the Coastal Management Program	October 2017	*(December 2018)*
TPWD	Protected Species Consultation	August 2017	*May 2017*
LDEQ	Louisiana Pollutant Discharge Elimination System Permit	*(June 2020)*	*(December 2020)*
	NPDES Permit – Hydrostatic Test Water Discharge	*(June 2020)*	*(December 2020)*
	CWA 401 Certification	October 2017	*(December 2018)*
	Air Permit	September 2017	August 2018
Louisiana Office of Cultural Development (State Historic Preservation Office)	NHPA Section 106 Consultation	September 2017	October 2017
LDNR	Coastal Use Permit	October 2017	*(December 2018)*
	Protected Species Consultation	March 2017	June 2017
	Wild and Scenic Rivers Permit	*(February 2019)*	*(May 2019)*

[a] Local permits will be determined upon further facilities design.

2.0 DESCRIPTION OF THE PROPOSED ACTION

PALNG and PAPL are proposing to construct a natural gas liquefaction and export terminal and feed gas pipeline systems consisting of the following components:

1. Port Arthur Liquefaction Project – development of natural gas liquefaction and LNG export capabilities through construction of new liquefaction facilities on the Port Arthur Canal of the Sabine-Neches Waterway (SNWW) in Jefferson County, Texas.

2. Texas Connector Project – construction of pipeline facilities to provide natural gas supplies to the proposed liquefaction facility, including two pipelines, two compressor stations, six lateral pipelines, six meter stations, and associated facilities in Jefferson and Orange Counties, Texas and Cameron Parish, Louisiana.

3. Louisiana Connector Project – construction of pipeline facilities to provide natural gas supplies to the proposed liquefaction facility, including a pipeline, a compressor station, 7 lateral pipelines, 17 tie-in pipelines, 9 meter stations, and associated facilities in Jefferson and Orange Counties, Texas and Cameron, Calcasieu, Beauregard, Allen, Evangeline, and St. Landry Parishes, Louisiana.

In addition, construction of the marine berth for the Liquefaction Project would require the relocation of 3.3 miles of SH 87 and existing pipelines and utilities that parallel the highway (see appendix B), which are not under FERC's jurisdiction. PALNG would relocate the highway, pipelines, and utilities to its own property.

This section describes the proposed liquefaction and pipeline system facilities, land requirements, construction procedures, schedule, environmental compliance and inspection monitoring, operation and maintenance procedures, and safety controls for the Projects. Figure 2-1 shows the locations of PALNG's proposed Liquefaction Project, PAPL's proposed Texas Connector and Louisiana Connector Projects, and the nonjurisdictional facilities. Detailed maps of the pipeline facilities are in appendix B.

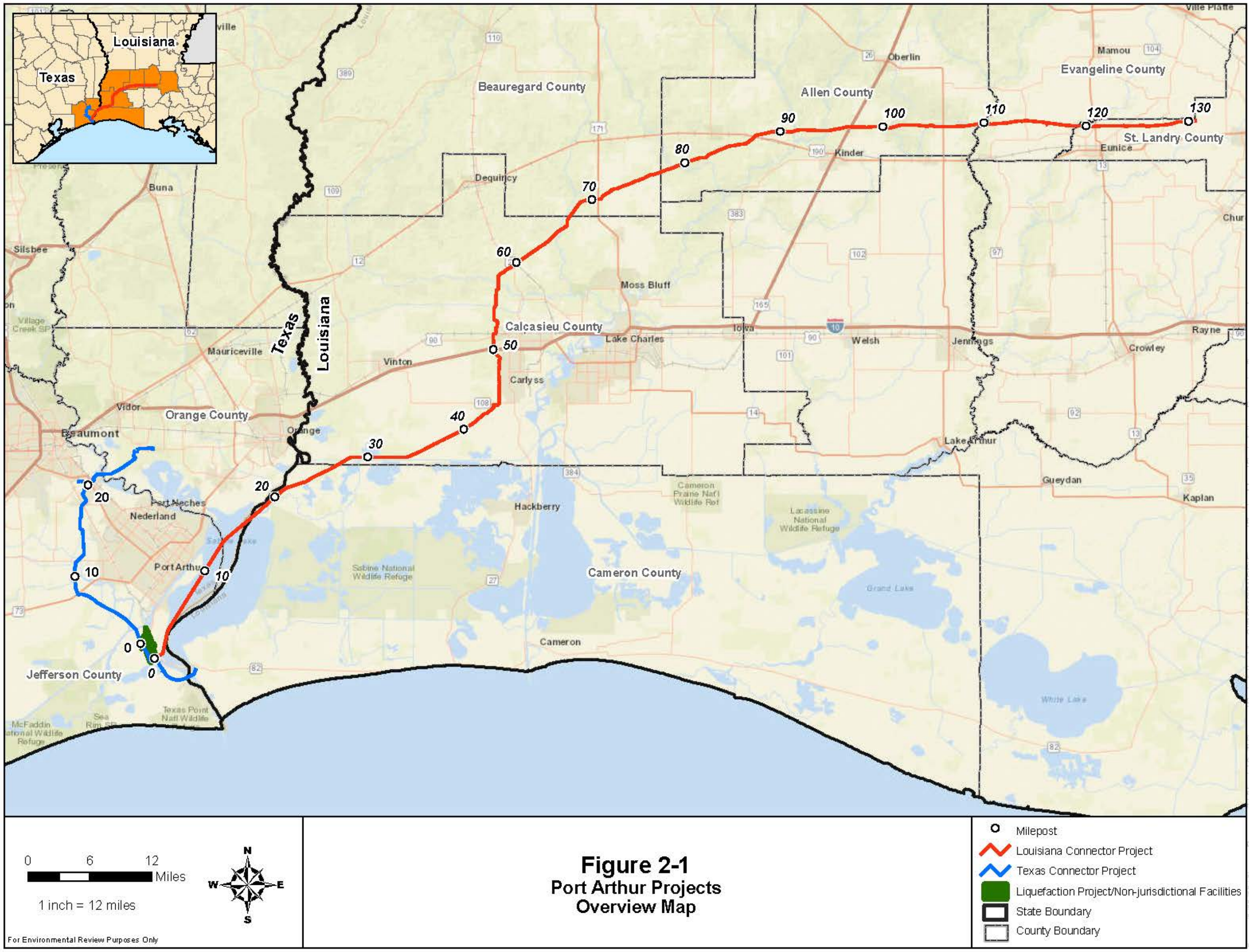

Figure 2-1
Port Arthur Projects
Overview Map

2.1 PROPOSED FACILITIES

2.1.1 Liquefaction Project

The Liquefaction Project would consist of the following facilities:

- Two liquefaction trains,[14] each with a capacity of 6.73 MTPA of LNG for export.
- Three LNG storage tanks, each with a capacity of 160,000 m^3.
- A refrigerant storage area and truck unloading facilities.
- A condensate storage area and truck loading facilities.
- A new marine slip with two LNG vessel berths, an LNG vessel and support vessel maneuvering area, and an LNG transfer system.
- An MOF and Pioneer Dock.
- Other ancillary utilities, buildings, and service facilities.

The liquefaction facilities would collectively be located on about 898 acres of a 2,900-acre property that PALNG has already purchased on the western shore of the Port Arthur Canal, about 5 miles south of Port Arthur, Texas and 6 miles north of Sabine, Texas. In the past, the site was used as a dredge material placement area for materials dredged during maintenance of the Port Arthur Canal. All ship traffic would access the Liquefaction Project via the Port Arthur Canal, while all construction and personnel vehicles would access the site from SH 87. A site plan is included as figure 2.1.1-1.

2.1.1.1 Liquefaction Trains

The two liquefaction trains would be capable of producing a total of 13.5 MTPA of LNG using power supplied by the eight natural gas combustion turbine generators on site, with an additional generator available as a backup during maintenance or shutdowns. Each train would consist of a feed gas pre-treatment unit, heavy hydrocarbon removal unit, and liquefaction unit. Natural gas would be transported via the Texas Connector and Louisiana Connector Projects to the feed gas pre-treatment facilities, which would remove any impurities from the natural gas, including particulates, mercury, hydrogen sulfide (H_2S), carbon dioxide (CO_2), and water. The heavy hydrocarbon removal unit would remove compounds such as natural gas liquids (pentane, hexane, etc.), which would be transferred to the refrigerant and condensate storage area and later transported off site by truck (see sections 2.1.14 and 2.1.1.5). The lighter hydrocarbons would continue through the liquefaction process with a portion being used as makeup fuel in the fuel gas system. After the heavy hydrocarbons and other impurities are removed, the feed gas would be pre-cooled by thermal exchange with propane and further cooled using a mixed refrigerant stream to condense the natural gas into a liquid at -260 degrees Fahrenheit (°F).

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14 Liquefaction and purification facility that condenses natural gas into a liquid at atmospheric pressure.

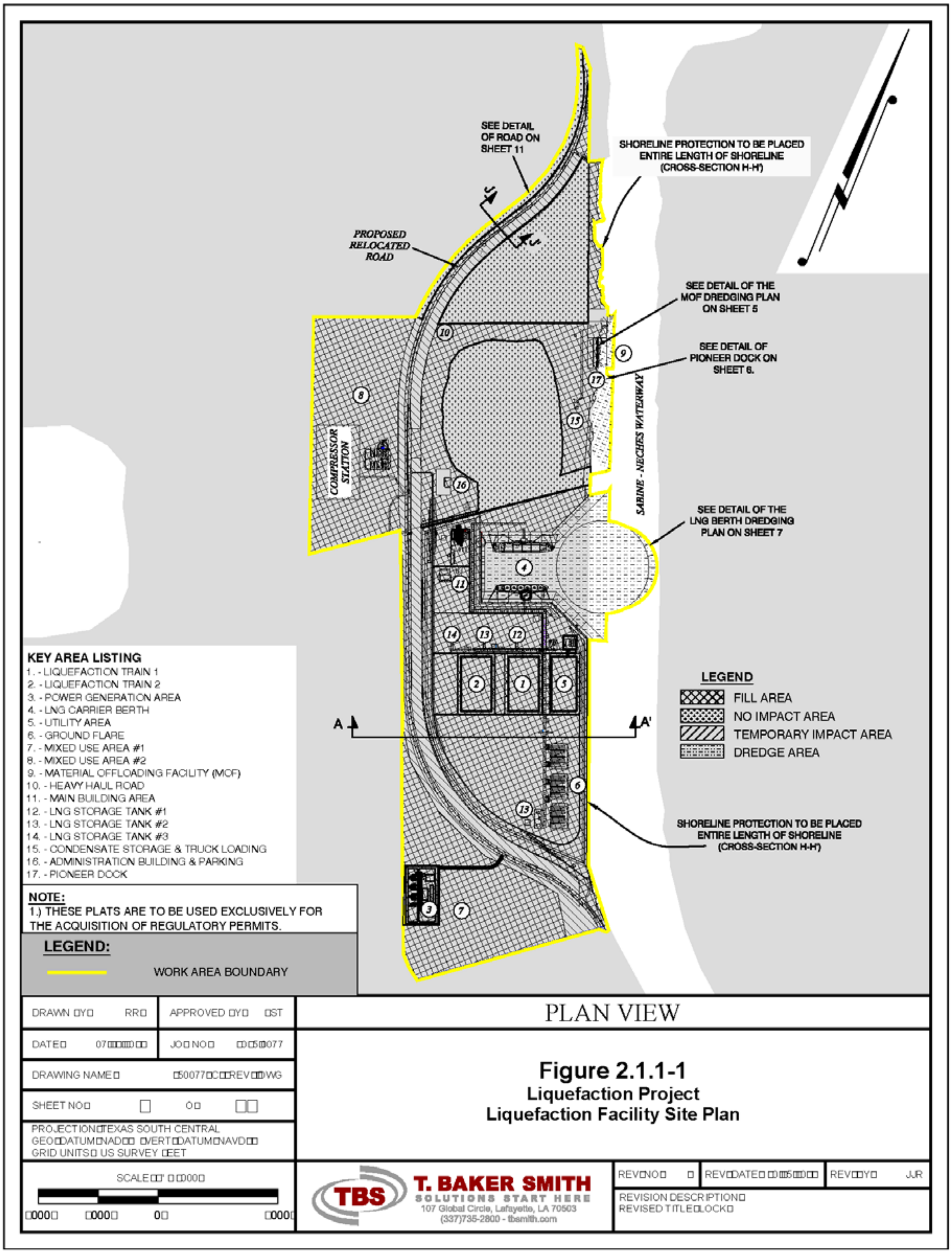

Figure 2.1.1-1
Liquefaction Project
Liquefaction Facility Site Plan

Two flare systems would be used to control unwanted vapor or vent gases created during emergency situations or startup of the Liquefaction Project. A ground flare system consisting of wet flare, low pressure wet flare, dry flare, and a low pressure dry flare would be installed to handle pressure relief valve releases upstream or downstream of molecular sieve dehydrators. A marine flare would also be installed to handle boil-off gas (BOG) generated from the LNG storage tanks and ship loading operation and cool down of warm ships.

2.1.1.2 LNG Storage Tanks

Three full containment LNG storage tanks would be designed to meet the requirements in NFPA 59A, 49 CFR 193, American Petroleum Institute (API) 620, and ACI 318. The tanks would each have a working capacity of 160,000 m^3 (or 480,000 m^3 total for all three tanks) at a temperature of -270°F and normal operating pressure of 1 to 4 pounds per square inch gauge (psig). Each tank would consist of the following:

- A 9 percent nickel steel primary inner tank.
- A pre-stressed reinforced concrete outer container surrounding the primary inner tank.
- A foam glass-insulated reinforced concrete bottom slab.
- A reinforced concrete domed roof.
- An aluminum insulation deck suspended from the domed roof above the primary inner tank.
- Expanded perlite insulation between the primary and secondary containers to help regulate temperature.
- Submerged LNG pumps and associated piping.
- Leak detection and process monitoring instrumentation systems.
- Walkways, platforms, stairways, and ladders for operations and maintenance access.

Both the primary and secondary tanks are self-supporting and capable of independently containing the stored LNG, with the secondary outer tank would be designed to contain 110 percent of the inner tanks' capacity. Pumps would be contained within the tanks and all piping routed through the tank roofs so that a line failure would not cause the tanks to empty. PALNG would install a berm (i.e., 20-foot storm surge barrier) around the LNG storage tank area to prevent liquid in the storage tank area from flowing off-site in the event of an outer tank impoundment failed. In addition, concrete impoundment basins would be installed in the LNG storage area to collect a spill from the process area of liquefaction trains 1 and 2, the main pipe rack, and a portion of the jetty loading line located at the northwest corner of the south berth. PALNG proposes to install another concrete impoundment at the north marine berth area that would collect a potential spill from the remaining portion of the north jetty LNG loading line. For more information on the spill containment systems, see section 4.12.

2.1.1.3 Refrigerant Storage Area and Truck Unloading Facilities

Propane and ethane would be used in the liquefaction trains' refrigeration systems and would be stored on site near the utility area. Liquid propane would be stored in two storage vessels for refrigerant makeup to provide inventory of one liquefaction train. Two additional propane storage vessels would be installed and would remain empty and be available for de-inventorying in the event of a shutdown. The propane storage vessels would normally be filled from the refrigerant self-generation equipment; however, truck unloading facilities would be provided to allow for the import of propane from pressurized tanker trucks.

Liquid ethane would also be stored in an insulated jacketed or double-wall pressurized storage vessel to provide inventory for one liquefaction train. The ethane vessel would normally be filled from the refrigerant self-generation equipment; however, truck unloading facilities would also be provided to allow for the import of ethane from pressurized, refrigerated tanker trucks.

2.1.1.4 Condensate Storage Area and Truck Loading Facilities

Stabilized condensate produced by the heavy hydrocarbon removal units would be stored near the MOF in two low-pressure storage tanks with a capacity of approximately 510,000 gallons. This area would include truck offloading facilities for the average of 14 tanker trucks per week required to remove condensate from the liquefaction terminal and transport it off site using a heavy haul road constructed around Round Lake to the north and west.

2.1.1.5 Marine Berth

The Liquefaction Project would also include construction of marine facilities to berth and load LNG vessels. The ship loading facilities would be designed in accordance with applicable codes and standards, including but not limited to, those of the Oil Companies International Marine Forum, the Society of International Gas Tanker and Terminal Operators, the API, and the American Society of Civil Engineers (ASCE). The marine transfer system, including all facilities associated with the LNG vessels up to the last valve immediately before the LNG storage tanks, would comply with USCG regulations for LNG Waterfront Facilities 33 CFR 127 and Executive Order 10173. The facilities would be designed to provide safe berthing for the receipt and mooring of LNG vessels and to ensure the safe transfer of LNG from the onshore storage facilities to the ships.

Ship Berthing and Maneuvering Area

The marine facilities would consist of an LNG loading slip with two berths and a turning basin approximately 1,700 feet in diameter. Once both liquefaction trains are operational, the marine facilities would be capable of receiving up to four Q-max and/or Q-flex ships with respective LNG storage capacities of 266,000 m^3 and 216,000 m^3 respectively per week, for a total of 180 ships per year or 3 to 4 ships per week. The actual number of ships would be dependent on the size of the ships calling on the liquefaction terminal over time.

The area for the LNG vessel loading slip and berths would be approximately 1,371 feet long and 903 feet wide and dredged to a nominal depth of -45 feet mean lower low water (MLLW). A turning basin with an approximate radius of 850 feet and side slopes with a 3:1 ratio would be located partially within the slip. Construction of the slip, berthing area, and turning basin would require dredging a total of about 7.8 million yd^3 of material.

Each berth would consist of four breasting dolphins and six breasting dolphins equipped with energy absorbing fenders capable of berthing the full range of ships being considered, as well as access ladders to the water and quick release mooring hooks with load monitoring systems. Personnel access bridges would be provided at each berth to connect each breasting dolphin to the lower deck of an unloading platform and to the six mooring dolphins. Mooring dolphins at each berth would also consist of reinforced concrete caps supported on steel piles. Mooring dolphins would be provided with quick release mooring hooks with load monitoring systems, light poles, access ladders to the water, and protective hand railing, except on the mooring line faces. The loading platform at each berth would be supported on piles and be a separate structure than the breasting and mooring dolphins.

LNG Loading and Transfer Facilities

Each loading platform would have four 16-inch-diameter loading arms: two used to load LNG into ship storage tanks, and two hybrid arms that can load LNG onto ships or return vapor to the terminal storage tanks. The loading arms would be designed with swivel joints to provide the required range of movement between the ship and the shore connections. Each arm would be fitted with powered emergency release couplings and valves, as well as a quick connect/disconnect flange, to isolate the arm and the ship in the event of an emergency separation. Additional loading platform equipment would include a ship gangway, area lighting facilities, navigation aids, and firewater monitors.

After loading the ships, pressurized nitrogen gas would be used to de-inventory the LNG in the unloading arms either back to the ship tanks or to the transfer lines. During periods when there is no ship unloading operation in progress or "holding mode," LNG would be continuously circulated through the transfer lines to maintain the lines at cryogenic temperature. This would prevent thermal shock to the piping and the generation of excessive vapor upon initiation of the next loading operation.

2.1.1.6 Material Offloading Facility

Construction equipment and materials would be delivered to the site via barges on the Port Arthur Canal. The MOF would be created by modifying existing concrete dock structures on the western shore of the Port Arthur Canal north of the proposed liquefaction site. Construction of the MOF would require dredging the canal below and around the dock to a depth of -25 feet MLLW, producing about 67,600 yd^3 of dredge material. These spoil placement areas are discussed further in section 4.8. A heavy haul road would be constructed around Round Lake to the north and west to provide a route from the MOF to the other liquefaction facilities. Barge traffic during construction would reach a peak of 175 ships per month. Following construction, the dock would be maintained as a mooring area for tug boats associated with the LNG carrier ships.

2.1.1.7 Pioneer Dock

Bulk rock and gravel materials would be delivered via barges to a Pioneer Dock constructed on the Port Arthur Canal south of the MOF. Similar to the MOF, the Pioneer Dock would also be constructed by modifying existing concrete dock structures on the western shore of the canal. Construction of the Pioneer Dock would require dredging the canal below and around the dock to a depth of -45 feet MLLW, producing about 508,000 yd^3 of dredge material. Maintenance dredging would not be required for the Pioneer Dock during project operation. Aggregate materials would be unloaded from barges and transported over SH 87 to the Liquefaction Project site using an elevated conveyor system (see figure 2.1.1-2).

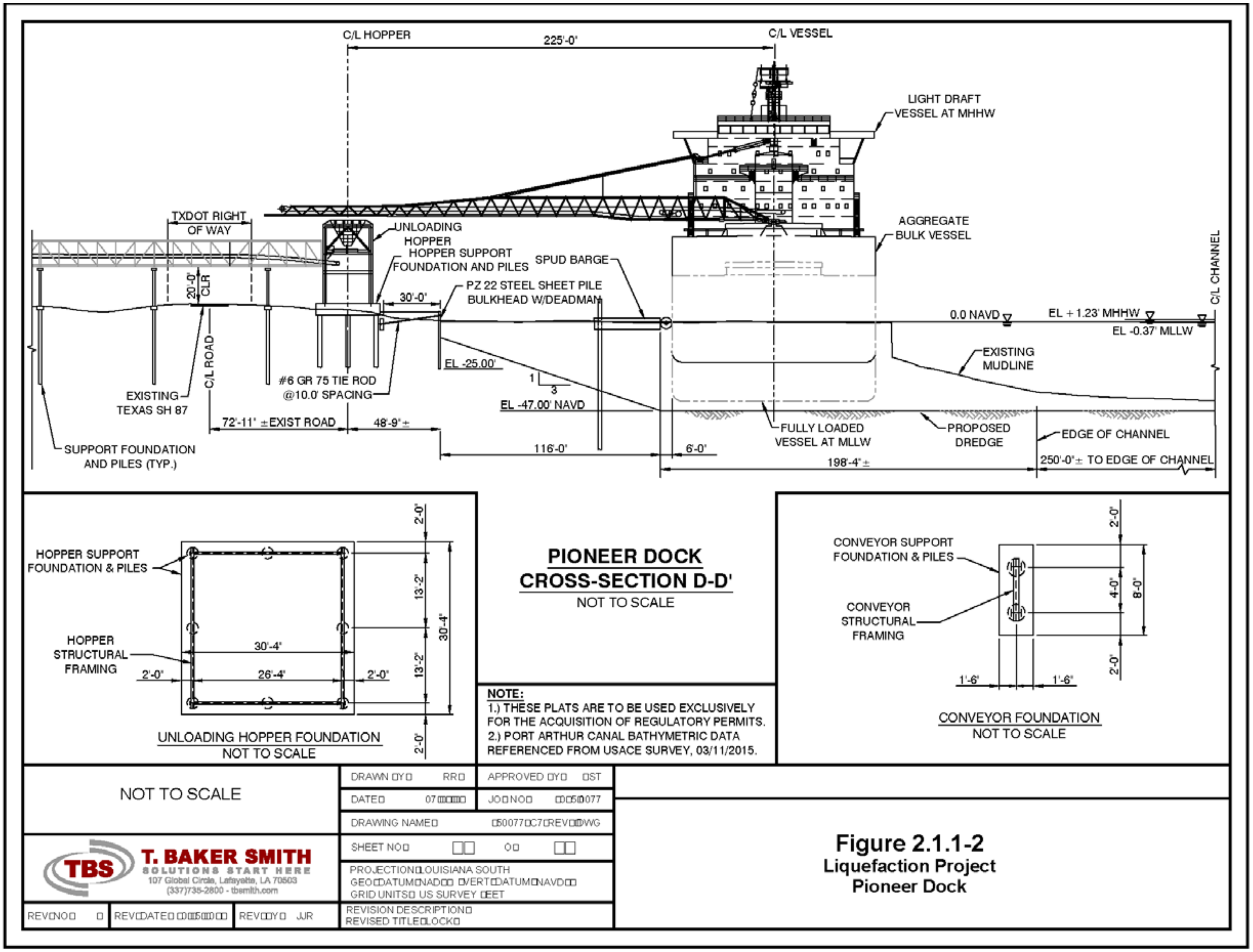

Figure 2.1.1-2
Liquefaction Project
Pioneer Dock

2.1.1.8 Ancillary Utilities, Buildings, and Service Facilities

In addition, the Liquefaction Project would include many utilities and associated auxiliary equipment. The major auxiliary systems required for the operation of the liquefaction facility include BOG, fuel gas, hot oil, flares, instrument and utility air supply, water supply, demineralized water, nitrogen, and backup power. Furthermore, hot oil would be used to provide the heat demand to the plant users, molecular sieve regeneration, amine regeneration, and deethanizer and debutanizer reboilers. There are two types of proposed flare systems, including ground flares and an elevated marine flare stack. The ground flares would be designed to handle the vent gases from the process areas associated with the liquefaction operations, while the elevated marine flare stack would be designed to control vent gases associated with the LNG storage tanks and LNG ship vapor return from the ship during unloading and cooldown operation. Diesel would be stored in dedicated tanks for their respective equipment, which includes essential firewater pumps, stormwater pumps, and three diesel generators. Electric power would be generated on-site but would be located outside the storm levee and would require using eight of nine gas turbine driven generators. Liquid nitrogen vaporizers would be used to supply gaseous nitrogen for various uses in the plant including pre-commissioning and start-up. In addition, aqueous ammonia would be used in the selective catalytic removal process to reduce the nitrogen oxide (NO_X) emissions from the self-generation power turbines proposed as part of the Liquefaction Project.

2.1.1.9 LNG Vessels

The marine facilities would be designed to accommodate LNG carrier ships as large as Q-Max (266,000 m^3 storage capacity), but would typically receive ships with capacities between 125,000 m^3 and 220,000 m^3. An LNG carrier's transit to the terminal would begin at the SNWW, where it would enter the pilot boarding station located approximately 20 miles offshore in the Gulf of Mexico. The LNG carrier then would travel 20 miles north to the entrance of the shipping channel. From here, the LNG carrier would transit approximately 6 nautical miles towards Sabine Lake, before turning left to enter the Port Arthur Ship Canal. Once in the Port Arthur Ship Canal, the LNG carrier would transit approximately 4.3 nautical miles to reach its final destination at PALNG's facility. LNG carriers would return to sea by reversing their travel.

2.1.1.10 Dredge Disposal Areas and Pipelines

The 7.8 million yd^3 of dredge material removed from the Port Arthur Canal for the marine berth, turning basin, MOF, and Pioneer Dock would be deposited on four disposal areas: Dredge Disposal Area 8, Dredge Disposal Area 9A, Dredge Disposal Area 9B, and the J.D. Murphree WMA. Dredge Disposal Areas 8, 9A, and 9B are existing sites located on the Port Arthur Canal north of the Liquefaction Project and are managed by the Sabine-Neches Navigation District (SNND). These areas have received dredge disposal from previous construction and maintenance dredging activities and would accommodate about 4.9 million yd^3 of dredge material from construction of the Liquefaction Project. The remaining 2.9 million yd^3 of dredge material would be placed on the J.D. Murphree WMA, managed by the TPWD, for beneficial use in restoring its marshlands (see section 4.4.4.1). PALNG would acquire all necessary permits and approvals from the TPWD and SNND for dredge disposal in these areas. As further described in section 4.4.2.1, PALNG developed a compensatory mitigation plan commensurate with the amount and type of impact resulting from construction and operation of the Liquefaction Project. Compensatory mitigation would be initiated at the time of the first USACE-jurisdictional impact occurs and based on a timeline established by the USACE.

Dredge material would be transported to these sites via an aboveground, temporary, 30-inch-diameter pipeline laid on the ground surface or, where necessary, floated in water. Figure 2.1.1-3 shows the locations of the dredge disposal areas and associated dredge pipelines, which would cross the Round

Lake Canal (to reach the J.D. Murphree WMA) as well as the Intracoastal Waterway (ICWW) and Port Arthur Canal (to reach Dredge Disposal Areas 8, 9A, and 9B).

2.1.2 Texas Connector Project

2.1.2.1 Northern and Southern Pipelines

PAPL proposes to construct a natural gas pipeline system consisting of 34.2 miles total of new natural gas pipeline in Jefferson and Orange Counties, Texas and Cameron Parish, Louisiana. The pipeline facilities would be comprised of the following:

- Northern Pipeline – 26.6 miles of 42-inch-diameter pipeline entering the liquefaction facilities site from the north and interconnecting with existing facilities near Beaumont, Texas owned by GTS/CIPCO, HPL, TETCO, and FGT.

- Southern Pipeline – 7.6 miles of 42-inch-diameter pipeline entering the liquefaction facilities site from the south to interconnections with an existing KMPL facility in Cameron Parish, Louisiana, and an existing NGPL facility in Jefferson County, Texas.

Figure 2.1.2-1 provides a general location map for the Texas Connector Project while more detailed location maps are included in appendix B.

The Northern and Southern Pipelines would be collocated with existing pipeline and utility rights-of-way for 14.7 miles, or about 43 percent of their total 34.2-mile length. The pipelines would be designed for a maximum allowable operating pressure of 1,400 psig and would contribute to transporting the total capacity of 2.0 bscfd of natural gas to the Liquefaction Project facilities.

2.1.2.2 Laterals

A total of 4.7 miles of 42-inch-diameter lateral pipelines would connect the Northern and Southern Pipelines to six meter stations proposed at existing pipelines that would supply feed gas to the Texas Connector Project (see table 2.1.2-1). The laterals would be collocated with existing pipeline and utility rights-of-way for 3.7 miles, or about 79 percent of their total 4.7-mile length.

TABLE 2.1.2-1

Pipeline Laterals for the Texas Connector Project

Facility	Approximate Milepost at Point of Interconnect with Texas Connector Project	Length (miles)
Northern Pipeline		
GTS/CIPCO Lateral	20.2	1.3
HPL Lateral	25.6	1.0
TETCO Lateral	26.6 (at North Compressor Station)	0.1
FGT Lateral	26.6 (at North Compressor Station)	1.8
	Laterals on Northern Pipeline Total	**4.2**
Southern Pipeline		
NGPL Lateral to Existing Meter Station	3.6	<0.1
NGPL Lateral	3.7	0.3
KMLP Lateral	7.6	0.1
	Laterals on Southern Pipeline Total	**0.4**
	Texas Connector Project Lateral Pipelines Total	**4.7**

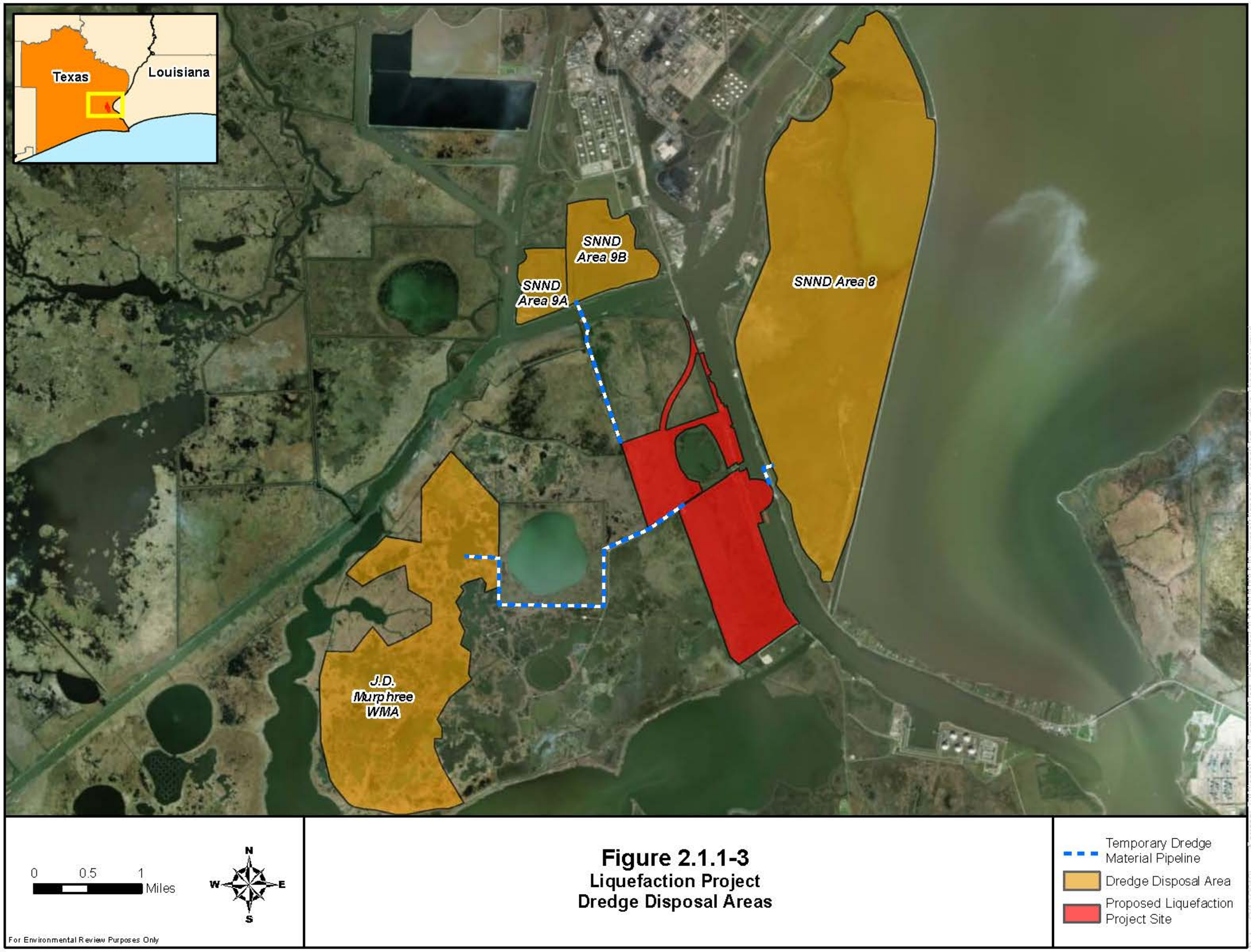

Figure 2.1.1-3
Liquefaction Project
Dredge Disposal Areas

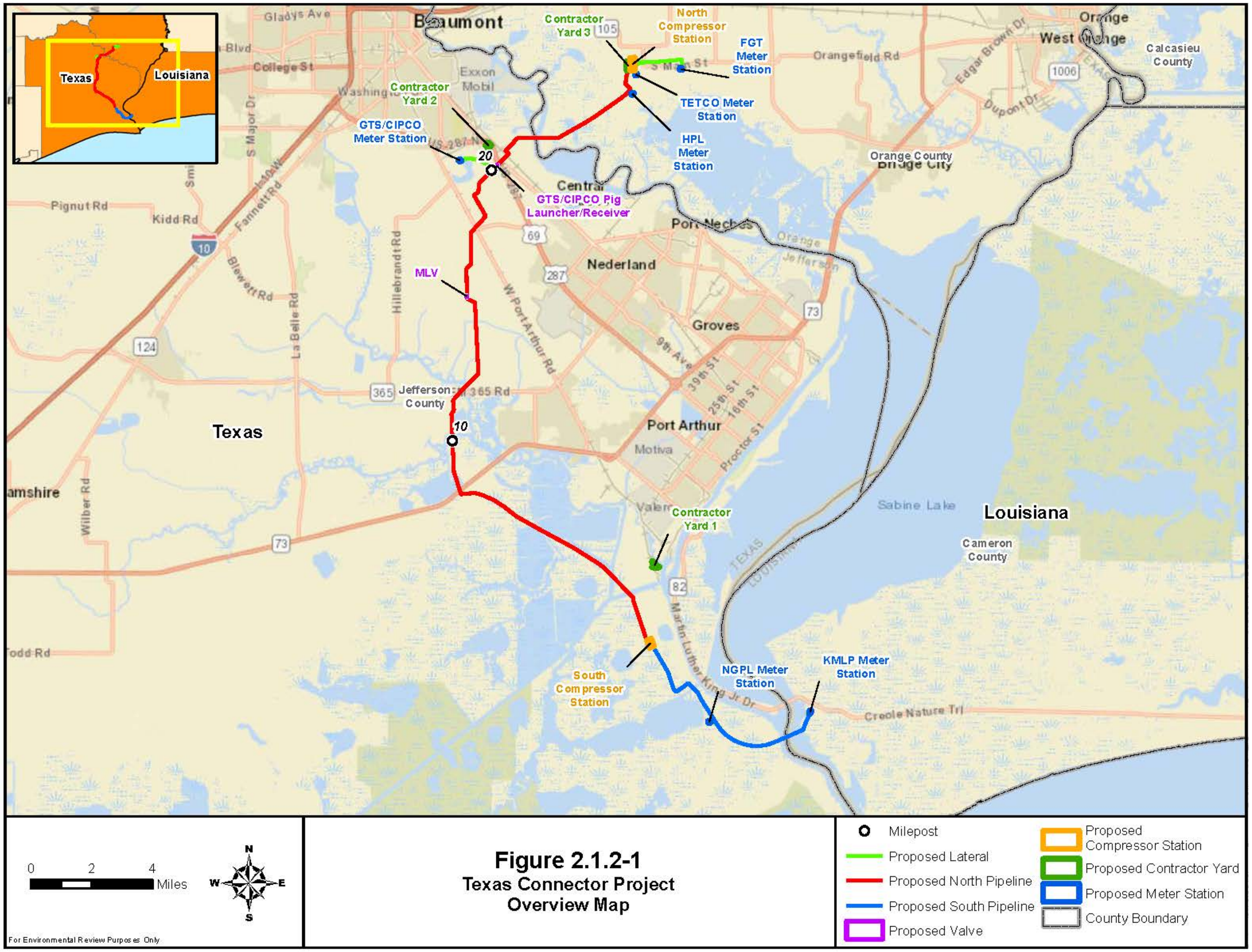

Figure 2.1.2-1
Texas Connector Project
Overview Map

2.1.2.3 Aboveground Facilities

As listed in table 2.1.2-2, the Texas Connector Project would require the construction of the following new aboveground facilities:

- Northern Pipeline – One compressor station, four interconnecting meter stations, one mainline valve (MLV), and four pig launchers/receivers.

- Southern Pipeline – One compressor station, two interconnecting meter stations, one receipt meter station, and four pig launchers/receivers. Of these facilities, the compressor and receipt meter stations would be constructed within the Liquefaction Project property boundaries.

All aboveground facilities would be constructed along the pipeline system within and/or adjacent to the permanent right-of-way and surrounded by fencing for security. Aboveground facilities would be located near existing roads, from which permanent driveways would be installed as part of facility construction.

TABLE 2.1.2-2

Aboveground Facilities for the Texas Connector Project

Facility	Approximate Milepost	County/Parish, State
Northern Pipeline		
MLV	15.3 on Northern Pipeline	Jefferson County, Texas
GTS/CIPCO Pig Launcher/Receiver	20.2 on Northern Pipeline	Jefferson County, Texas
North Compressor Station	26.6 on Northern Pipeline	Orange County, Texas
GTS/CIPCO Meter Station	1.3 on GTS Lateral	Jefferson County, Texas
HPL Meter Station	1.0 on HPL Lateral	Orange County, Texas
TETCO Meter Station	0.1 on TETCO Lateral	Orange County, Texas
FGT Meter Station	1.8 on FGT Lateral	Orange County, Texas
Southern Pipeline		
South Compressor Station	0.0 on Southern Pipeline	Jefferson County, Texas
KMLP Meter Station	7.6 on Southern Pipeline	Cameron Parish, Louisiana
NGPL Meter Station	0.2 on NGPL Lateral	Jefferson County, Texas

Compressor Stations

The two compressor stations would consist of centrifugal compressor units, upstream suction scrubbers, downstream electric motor-driven natural gas coolers, unit and station blowdowns with silencers, above and below ground piping and valves, system utilities (e.g., fuel gas, water and air supplies), control/maintenance buildings with a septic tank/leach field or tie-ins to municipal sewer treatment facilities, and surrounding security fence.

The North Compressor Station would be constructed at milepost (MP) 26.6 along the Northern Pipeline and consist of three gas-driven compressors rated at 16,684 hp each. The compressor station would require approximately 1.3 megawatts (MW) of electric power for auxiliary equipment, which would be supplied by a nearby Entergy power line running across and adjacent to the compressor station property boundary. Personnel and equipment for both the construction and operation phases of the Texas Connector Project would access the compressor station site from South Mansfield Ferry Road located at the south end of the property.

The South Compressor Station would be constructed at MP 0.0 along the Southern Pipeline and consist of three electric-driven compressors rated at 5,000 hp each. The onsite combustion generators used to power the liquefaction facilities would also provide the approximately 12 MW of electricity needed to power the South Compressor Station's compression units and ancillary equipment. Personnel and equipment for both the construction and operation phases of the Texas Connector Project would access the compressor station site from relocated SH 87 to the east.

Meter Stations

One delivery point meter station would be constructed within PALNG's property or the South Compressor Station fence line at the liquefaction site (MP 0.0 of the Northern and Southern Pipelines). Six receipt point meter stations would be constructed, with one at each of the six interconnects with existing pipelines (see table 2.1.2-2). Each receipt point meter station would be constructed within or adjacent to the right-of-way of each existing pipeline supplying feed gas to the Texas Connector Project at its point of interconnection with the lateral pipeline. The lateral pipeline would then extend from the meter station to the mainline where it would be tied-in.

A typical meter station and interconnect site would include a communications facility for each interconnection, generally including service for voice communications and Supervisory Control and Data Acquisition (SCADA) backup. Each site would include electric power for lighting, ventilation, and control equipment. Each meter station would be unmanned and consist of a meter and regulator building, meter and control valve skid, separator, condensate tank, associated above and below ground piping, valve fixtures to tie-in to the proposed pipeline, and surrounding security fence.

Mainline Valves

MLVs are designed to divide a pipeline into segments for safety reasons, including shutting down gas flow and allowing access to the pipeline from the surface. PAPL proposes to construct one MLV at MP 15.2 along the Northern pipeline, which would be consistent with DOT regulations in 49 CFR 192. The MLV would be installed within the permanent right-of-way over the buried pipeline, with the blowdown valve and manual valve operator extending aboveground. The valve site would be brought to level grade, surfaced with gravel or crushed rock, and surrounded by fencing with locked equipment and personnel access gates. At this time, PAPL has not identified whether MLVs would be operated manually, automatically, or remotely from a central control facility via the SCADA system.

Pig Launchers/Receivers

The pig launchers/receivers constructed for the Texas Connector Project would be designed to accommodate pipeline inspection gauges or "pigs," which monitor pipeline integrity by being launched into the gas stream to scan the interior of the pipe for corrosion, cracks, or other irregularities/anomalies. Pig launcher/receivers would be installed within the boundaries of each compressor station and all receipt point meter stations, except for the GTS/CIPCO tie-in location. At that location, the pig launcher/receiver would be constructed at the end of the GTS Lateral where it connects to the Northern Pipeline at MP 20.2.

Other Aboveground Facilities

As needed, cathodic protection facilities (including anode beds, test leads, rectifiers, and test stations) would be installed along the Northern and Southern Pipelines and lateral pipelines to help protect the metal pipe from corrosion. These facilities would be installed within the permanent right-of-way and enclosed by security fencing. PAPL would provide cathodic protection locations to FERC prior to construction of the Texas Connector Project, as locations where the facilities need to be installed are determined.

2.1.3 Louisiana Connector Project

2.1.3.1 Main Pipeline

PAPL proposes to construct a natural gas pipeline system consisting of 130.8 miles total of new 42-inch-diameter natural gas pipeline in Jefferson and Orange Counties, Texas and Cameron, Calcasieu, Beauregard, Allen, Evangeline, and St. Landry Parishes, Louisiana. This pipeline would connect with the existing Centana, TETCO, TGP, Egan, Pine Prairie, TGT, ANR, and CGT pipeline systems. Figure 2.1.3-1 provides a general location map for the Louisiana Connector Project, while more detailed location maps are included in appendix B.

The Louisiana Connector Project would be constructed collocated with existing pipeline and utility rights-of-way for 95.4 miles, or about 73 percent of its total length. The pipeline would be designed for a maximum allowable operating pressure of 1,400 psig and would contribute to the total capacity of 2.0 bscfd of natural gas transported to the Liquefaction Project facilities.

2.1.3.2 Laterals and Tie-Ins

A total of 0.5 mile of 42-inch-diameter lateral and tie-in pipelines would connect the Louisiana Connector Project to eight existing pipelines to supply feed gas to the Liquefaction Project (see table 2.1.3-1). Tie-ins would connect existing pipelines to their respective meter stations, which would be connected by laterals to the Louisiana Connector Project mainline.

TABLE 2.1.3-1

Pipeline Laterals and Tie-ins for the Louisiana Connector Project

Facility	Approximate Milepost at Interconnect with or Adjacent to Louisiana Connector Project	Length (miles)
Centana Tie-in #1	0.1	< 0.1
Centana Tie-in #2	0.1	< 0.1
Compressor Station Lateral #1	96.3	< 0.1
Compressor Station Lateral #2	96.3	< 0.1
TETCO Tie-in #1	96.4	< 0.1
TETCO Tie-in #2	96.4	< 0.1
TGP Lateral	98.1	< 0.1
TGP Tie-in	98.2	< 0.1
Egan Lateral	113.7	< 0.1
Egan Tie-in	113.8	< 0.1
Pine Prairie Lateral	114.8	< 0.1
Pine Prairie Tie-in #1	114.8	< 0.1
Pine Prairie Tie-in #2	114.8	< 0.1
TGT Tie-in #1	115.7	< 0.1
TGT Tie-in #2	115.7	< 0.1
TGT Tie-in #3	115.7	< 0.1
TGT Lateral	115.8	< 0.1
ANR Lateral	116.2	< 0.1
ANR Tie-in #1	116.2	< 0.1
ANR Tie-in #2	116.2	< 0.1
ANR Tie-in #3	116.2	< 0.1
CGT Tie-in #1	130.9	< 0.1
CGT Tie-in #2	130.9	< 0.1
CGT Tie-in #3	130.9	< 0.1
	Lateral and Tie-in Pipelines Total	**0.5**

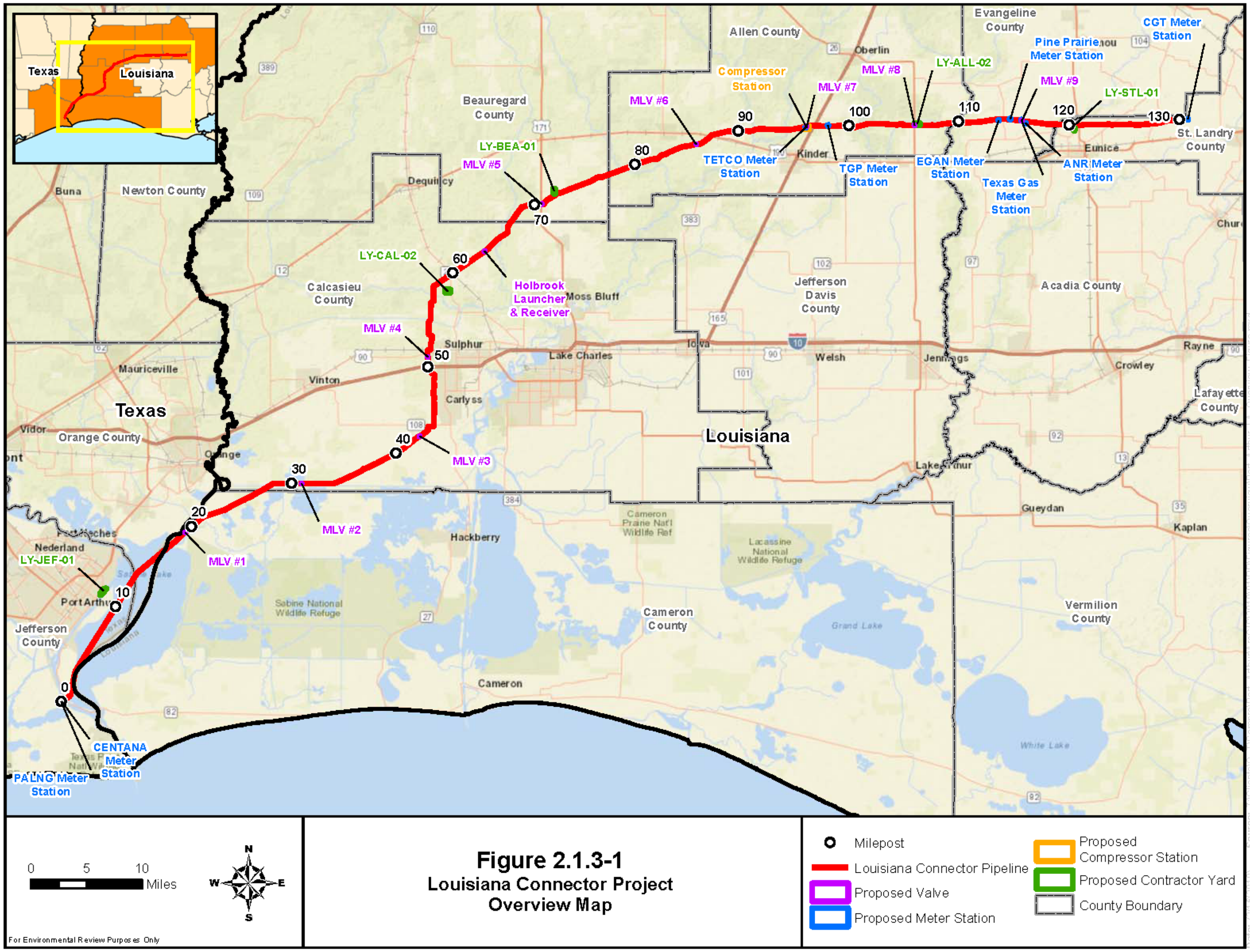

Figure 2.1.3-1
Louisiana Connector Project Overview Map

2.1.3.3 Aboveground Facilities

As listed in table 2.1.3-2, the Louisiana Connector Project would require the construction of one compressor station, nine meter stations, nine MLVs, and four pig launchers/receivers. All aboveground facilities would be constructed along the pipeline system within and/or adjacent to the permanent right-of-way and surrounded by fencing for security. Aboveground facilities would be located near existing roads, from which permanent driveways would be installed as part of facility construction.

TABLE 2.1.3-2

Aboveground Facilities for the Louisiana Connector Project

Facility	Approximate Milepost	County/Parish, State
PALNG Meter Station	0.0 on Pipeline	Jefferson County, Texas
Centana Meter Station	0.1 on Centana Tie-in	Jefferson County, Texas
MLV #1	19.3 on Pipeline	Cameron Parish, Louisiana
MLV #2	31.0 on Pipeline	Calcasieu Parish, Louisiana
MLV #3	42.7 on Pipeline	Calcasieu Parish, Louisiana
MLV #4	51.0 on Pipeline	Calcasieu Parish, Louisiana
MLV #5	70.7 on Pipeline	Beauregard Parish, Louisiana
MLV #6	85.9 on Pipeline	Allen Parish, Louisiana
MLV #7	96.3 on Pipeline	Allen Parish, Louisiana
Compressor Station	96.3 on Pipeline	Allen Parish, Louisiana
TETCO Meter Station	0.1 on TETCO Tie-in	Allen Parish, Louisiana
TGP Meter Station	0.1 on TCP Lateral	Allen Parish, Louisiana
MLV #8	106.0 on Pipeline	Allen Parish, Louisiana
Egan Meter Station	0.1 on Egan Lateral	Evangeline Parish, Louisiana
Pine Prairie Meter Station	0.1 on Pine Prairie Lateral	Evangeline Parish, Louisiana
TGT Meter Station	0.1 on TGT Lateral	Evangeline Parish, Louisiana
MLV #9	115.7 on Pipeline	Evangeline Parish, Louisiana
ANR Meter Station	0.1 on ANR Lateral	Evangeline Parish, Louisiana
CGT Meter Station	0.1 on CGT Tie-in	St. Landry Parish, Louisiana

Compressor Station

One compressor station would be constructed at MP 96.3 and consist of four natural gas turbine driven compressor units rated at 22,475 hp each, upstream suction scrubbers, downstream electric motor-driven natural gas coolers, unit and station blowdowns with silencers, above and below ground piping and valves, system utilities (e.g., fuel gas, water and air supplies), control/maintenance buildings with a septic tank/leach field or tie-ins to municipal sewer treatment facilities, and surrounding security fence. Two 568-kilowatt diesel generators would supply backup power to the compressor station, and diesel fuel would be stored onsite in an aboveground 4,200-gallon double-walled tank with secondary containment. During construction and operation, personnel and equipment would access the compressor station site from Green Oak Cemetery Road from the south and northeast ends of the property.

Meter Stations

One delivery point meter station associated with the Louisiana Connector Project would be constructed within PALNG's property in the southeast portion of the liquefaction site (MP 0.0 of the Louisiana Connector Project). In addition, eight receipt point meter stations would be constructed, with one at each of the eight interconnects with existing pipelines (see table 2.1.3-2). Each receipt point meter station would be constructed within or adjacent to the right-of-way of each existing pipeline supplying feed gas to the Louisiana Connector Project at its point of interconnection with the lateral pipeline. The lateral pipeline would then extend from the meter station to the mainline where it would be tied-in. Meter stations would be constructed with the same typical design parameters as those described in section 2.1.2.3.

Mainline Valves

PAPL proposes to construct nine MLVs at locations along the pipeline consistent with DOT regulations in 49 CFR 192 (see table 2.1.3-2). All MLVs would be installed within the permanent right-of-way over the buried pipeline and constructed with the same typical design parameters as those described in section 2.1.2.3. At this time, PAPL has not identified whether MLVs would be operated manually, automatically, or remotely from a central control facility via the SCADA system.

Pig Launchers/Receivers

Four pig launchers/receivers would be constructed for the Louisiana Connector Project: one at each end of the pipeline, one at MP 63.4, and one at MP 96.3. Pig launchers/receivers would be constructed within the boundaries of an aboveground facility or in the permanent pipeline right-of-way.

Other Aboveground Facilities

As needed, cathodic protection facilities (including anode beds, test leads, rectifiers, and test stations) would be installed along the mainline and lateral pipelines to help protect the metal pipe from corrosion. These facilities would be installed within the permanent right-of-way. PAPL would provide cathodic protection locations to FERC prior to construction of the Louisiana Connector Project, as locations where the facilities need to be installed are determined.

2.1.4 Nonjurisdictional Facilities

Nonjurisdictional facilities associated with the Liquefaction Project and Louisiana Connector Project area summarized below. PAPL has not identified any nonjurisdictional facilities required for the Texas Connector Project.

2.1.4.1 Liquefaction Project

SH 87, five third-party gas and petroleum pipelines, two telecommunications lines, one electric transmission line, and one water main currently run parallel in a corridor along the western shore of the Port Arthur Canal. PALNG’s proposed location for its marine berth on the Port Arthur Canal would require approximately 3.3 miles of these existing utilities to be relocated around the western side of the liquefaction site prior to construction of the liquefaction facilities (see appendix B and section 2.4.6). PALNG would work with TDOT to restore traffic flow to the new highway segment once it is complete and dispose of the old highway materials at an approved facility. Following relocation of the utilities and pipeline, the respective owners of each utility would be responsible for interconnecting the new facilities with the old, for abandoning the unused utility and pipeline segments per industry and regulatory requirements, and for all future operations of the facilities.

Because PALNG would conduct the relocation activities, we have included the environmental impacts associated with these actions in our analysis in section 4.0 of this EIS.

2.1.4.2 Louisiana Connector Project

The nonjurisdictional facilities associated with the Louisiana Connector Project include an electric power supply line to serve the proposed compressor station. The power line would be built by CLECO and BECi in Allen Parish, Louisiana. PAPL, CLECO, and BECi are currently investigating two options. Option One would tap into the existing CLECO distribution line at the intersection of SH 165 and Green Oak Cemetery Road and extend about 0.25 mile along the north side of Green Oak Cemetery Road to the proposed compressor station site. Option Two would tap into the existing BECi three phase distribution line at the intersection of Green Oak Cemetery Road and Green Oak Road and extend about 0.75 mile along the south side of Green Oak Cemetery Road before crossing Green Oak Cemetery Road to the proposed compressor station site. Both options have been assessed and would have similar impacts on environmental resources.

The proposed power supply line to the compressor station would not fall under FERC's jurisdiction, but it is an integral component of the Louisiana Connector Project. Although limited information is available about these facilities, we included them in our cumulative impacts analysis of this EIS (see section 4.13). We note that the power line also may be required to undergo an environmental review by the State of Louisiana.

2.2 LAND REQUIREMENTS

PALNG and PAPL would require 10,611.7 acres of land and open water for construction of the Projects (see table 2.2-1). Operation of the Projects would require a total of 7,952.5 acres, which would be maintained as new permanent right-of-way or new aboveground facility area. About 2,659.2 acres of temporary workspace would revert to preconstruction use and condition. See section 4.8 for more detailed information regarding land uses affected by the Projects.

TABLE 2.2-1

Land Use Summary for the Port Arthur Projects

Project, State, Facility	Construction Impacts (acres)	Operation Impacts (acres)
LIQUEFACTION PROJECT		
Texas		
Liquefaction Site Facilities	948.0	898.1
Dredge Material Disposal/Beneficial Reuse		
J.D. Murphree WMA	1,910.3	1,910.3
Sabine Neches Areas 8, 9A, and 9B [a]	4,141.8	4,141.8
Dredge Pipelines	19.1	0.0
Nonjurisdictional Facilities	121.0	45.2
Liquefaction Project Total	**7,140.0**	**6,995.4**
TEXAS CONNECTOR PROJECT		
Louisiana		
South Pipeline		
Pipeline Right-of-Way	2.9	1.8
ATWS	5.2	0.0
KMPL Lateral		
Pipeline Right-of-Way	1.3	0.5
ATWS	0.5	0.0
Aboveground Facilities		
KMPL Meter Station	3.0	3.0
Access Roads	3.4	1.2

TABLE 2.2-1 (cont'd)

Land Use Summary for the Port Arthur Projects

Project, State, Facility	Construction Impacts (acres)	Operation Impacts (acres)
Texas		
Southern Pipeline		
Pipeline Right-of-Way	40.4	16.1
ATWS	7.6	0.0
Northern Pipeline		
Pipeline Right-of-Way	242.1	92.7
ATWS	110.0	0.0
NGPL Lateral		
Pipeline Right-of-Way	3.4	1.3
ATWS	0.6	0.0
NGPL Lateral to Existing Meter Station		
Pipeline Right-of-Way	0.6	0.2
ATWS	0.0	0.0
GTS/CIPCO Lateral		
Pipeline Right-of-Way	10.5	4.0
ATWS	6.5	0.0
HPL Lateral		
Pipeline Right-of-Way	0.7	0.5
ATWS	0.2	0.0
TETCO Lateral		
Pipeline Right-of-Way	1.8	0.7
ATWS	0.1	0.0
FGT Lateral		
Pipeline Right-of-Way	20.6	6.1
ATWS	2.8	0.0
Aboveground Facilities		
North Compressor Station	40.3	40.3
South Compressor Station [b]	0.0	0.0
NGPL Meter Station	3.0	3.0
GTS/CIPCO Meter Station	2.8	2.8
GTS/CIPCO Pig Launcher/Receiver [c]	0.0	0.0
HPL Meter Station	3.0	3.0
TETCO Meter Station	2.8	2.8
FGT Meter Station	3.0	3.0
MLV Site	0.1	0.1
Access Roads	100.2	2.6
Pipe/Contractor Yard	44.8	0.0
Texas Connector Project Total	**664.7**	**186.1**
LOUISIANA CONNECTOR PROJECT		
Louisiana		
Pipeline		
Right-of-Way	1,482.3	600.9
ATWS	158.9	0.0
Laterals and Tie-ins		
Right-of-Way	2.9	1.3
ATWS	0.2	0.0
Aboveground Facilities		
Louisiana Connector Compressor Station	54.0	45.1
TETCO Meter Station	3.1	3.0
TGP Meter Station	3.3	3.1
Egan Meter Station	3.3	3.1
Pine Prairie Meter Station	3.8	3.3
TGT Meter Station	2.9	2.7
ANR Meter Station	3.5	3.2

TABLE 2.2-1 (cont'd)

Land Use Summary for the Port Arthur Projects

Project, State, Facility	Construction Impacts (acres)	Operation Impacts (acres)
CGT Meter Station	3.3	3.1
Holbrook Pig Launcher/Receiver [d]	0.0	0.0
MLV Sites	0.8	0.8
Access Roads	144.9	8.2
Pipe/Contractor Yards	270.8	0.0
Texas		
Pipeline		
Right-of-Way	575.0	93.2
ATWS	25.0	0.0
Aboveground Facilities		
PALNG Meter Station [b]	0.0	0.0
Centana Meter Station [b]	0.0	0.0
Access Roads [b]	0.0	0.0
Pipe/Contractor Yard	69.0	0.0
Louisiana Connector Project Total	**2,807.0**	**771.0**
Total for all Facilities in Louisiana	**2,154.3**	**684.3**
Total for all Facilities in Texas	**8,457.6**	**7268.2**
Port Arthur Projects Total	**10,611.7**	**7,952.5**

a Consists of the entire existing placement site.

b The Centana Meter Station, PALNG Meter Station, South Compressor Station, associated tie-in facilities, access roads, and construction workspace would be constructed within the liquefaction facility property boundaries; therefore, their impacts are not included here.

c The GTS/CIPCO Pig Launcher/Receiver would be constructed within the Northern Pipeline right-of-way on the Texas Connector Project; therefore, its impacts are not included here.

d The Holbrook Pig Launcher/Receiver would be constructed within the Louisiana Connector Project pipeline right-of-way; therefore, its impacts are not included here.

Note: Addends may not sum due to rounding.

2.2.1 Liquefaction Project

Of the total 2,900-acre property owned by PALNG, 948.0 acres would be used for construction of the project facilities, of which 153.5 acres would be for the marine facilities (e.g., ship berths, MOF, Pioneer Dock). Fencing would be used to permanently enclose the entire area of the liquefaction facilities following completion of construction activities. During operations, PALNG would maintain 898.1 acres of the site with concrete, gravel, and vegetation cover, and would permanently convert the area to industrial use. Vehicle traffic would access the liquefaction site via relocated SH 87, and ship traffic would access it from the Port Arthur Canal. About 725.7 acres of estuarine emergent (EEM), palustrine emergent (PEM), and palustrine scrub-shrub (PSS) wetlands would be permanently affected by construction and operation of the liquefaction facilities. The liquefaction facilities are shown on figure 2.1.1-1. Land requirements for the Liquefaction Project are summarized in table 2.2-1.

Dredge materials removed from the Port Arthur Canal as part of the Liquefaction Project would be transported to three approved disposal areas for beneficial reuse. Up to 4,141.8 acres of existing Dredge Disposal Areas 8, 9A, and 9B would receive approximately 4.9 million yd^3 of dredge material. A 1,900-acre area of the J.D. Murphree WMA would receive 2.9 million yd^3 of dredge material for beneficial reuse, resulting in the restoration of 1,268.8 acres of degraded coastal marshlands.

2.2.2 Texas Connector Project

2.2.2.1 Pipeline Right-of-Way and Additional Temporary Workspace

PAPL proposes to use a 125-foot-wide construction right-of-way for the Northern and Southern Pipelines and laterals. At wetland crossings, PAPL is requesting a modification of the Commission's Procedures (section VI.A.3) to allow for the use of a 100- to 125-foot-wide right-of-way to avoid the potential safety hazards associated with saturated and/or granular soils, including shifting soils and trench wall collapse. Our review of PAPL's proposed modifications to the Commission's *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) is discussed further in sections 4.3 and 4.4. Appendix C summarizes the variations in construction right-of-way widths by milepost across the Texas Connector Project and provides a condition or construction method for each. Construction of the Northern and Southern Pipelines and laterals would temporarily affect 324.3 acres of land.

FERC regulations (18 CFR 380.15[d][1]) give primary consideration to the use, enlargement, or extension of existing rights-of-way over developing a new right-of-way to reduce potential impacts on sensitive resources. In general, installation of new pipeline along existing rights-of-way that have been previously cleared (such as pipelines, power lines, roads, or railroads) may be environmentally preferable to the development of new rights-of-way. Construction-related effects and cumulative impacts can normally be reduced by use of previously cleared rights-of-way; however, in congested or environmentally sensitive areas, it may be advantageous to deviate from an existing right-of-way. Additionally, collocation may be infeasible in some areas due to a lack of or unsuitably oriented existing corridors, engineering and design considerations, or constructability or permitting issues. A total of 19.3 miles of the Texas Connector pipeline construction right-of-way would be collocated with existing foreign pipeline and utility permanent rights-of-way, of which 11.2 miles would overlap and 8.1 miles would be adjacent to existing rights-of-way (see section 4.8.1 for details). Figure 2.2.3-1 depicts the typical proposed construction right-of-way cross sections adjacent to an existing pipeline.

In addition to the construction right-of-way, ATWS would be required during construction in areas such as the following:

- Roadway, waterbody, wetland, or other utility crossings.
- Points of intersection and crossovers.
- Entry and exit locations for the horizontal directional drill (HDD) construction method.
- Push-pull construction methods in wetlands.

Appendix D lists each ATWS area proposed on the Texas Connector Project. In total, ATWSs would temporarily require 133.5 acres of land. Although PAPL identified areas where ATWS would be required, additional or alternative areas could be identified in the future due to changes in site-specific construction requirements. PAPL would be required to file information on each of those areas for review and approval by FERC and other applicable federal agencies prior to use.

Following construction, PAPL would retain a 50-foot-wide permanent right-of-way along both pipeline segments. The permanent right-of-way would require 123.9 acres of land. All temporary construction workspace, including ATWS, would be reseeded and allowed to revert to preconstruction conditions in accordance with PAPL's *Environmental Plan* (see section 2.4).

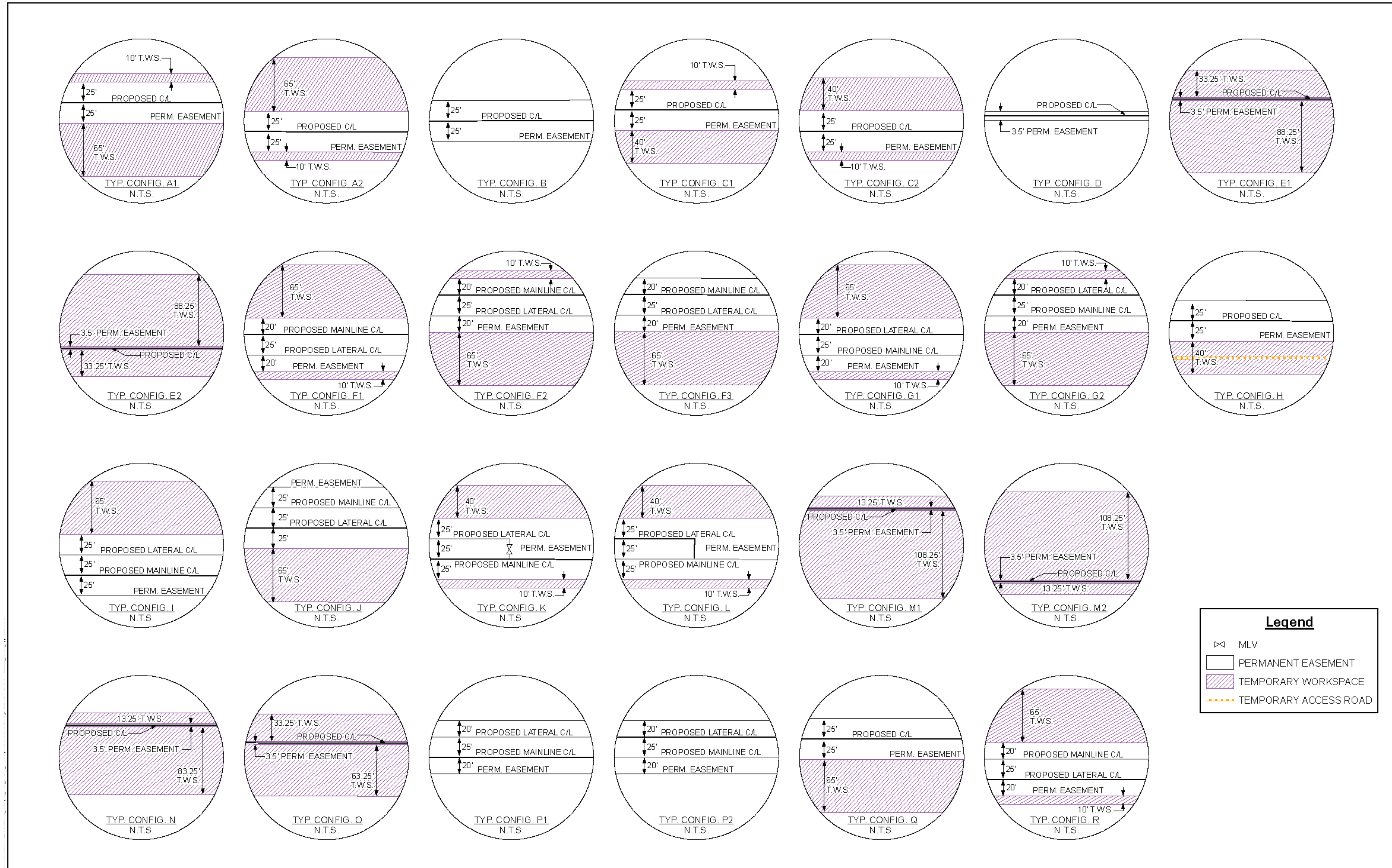

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Figure 2.2.3-1
Texas Connector and Louisiana Connector Projects
Typical Right-of-Way Configurations

TABLE 2.2.2-1			
Aboveground Facilities for the Texas Connector Project [a]			
Facility	Milepost	County/Parish, State	Property Size (acres)
Northern Pipeline			
MLV	15.3 on Northern Pipeline	Jefferson County, Texas	0.1
GTS/CIPCO Pig Launcher/ Receiver	20.2 on Northern Pipeline	Jefferson County, Texas	0.2
North Compressor Station	26.6 on Northern Pipeline	Orange County, Texas	40.4
GTS/CIPCO Meter Station	1.3 on GTS Lateral	Jefferson County, Texas	3.0
HPL Meter Station	1.0 on HPL Lateral	Orange County, Texas	3.0
TETCO Meter Station	0.1 on TETCO Lateral	Orange County, Texas	2.8
FGT Meter Station	1.8 on FGT Lateral	Orange County, Texas	3.0
		Northern Pipeline Total	**52.4**
Southern Pipeline			
South Compressor Station [b]	0.0 on Southern Pipeline	Jefferson County, Texas	0.0
KMLP Meter Station	7.6 on Southern Pipeline	Cameron Parish, Louisiana	3.0
NGPL Meter Station	0.2 on NGPL Lateral	Jefferson County, Texas	3.0
		Southern Pipeline Total	**6.0**
		Aboveground Facilities Total	**58.3**

[a] With the exception of the GTS/CIPCO tie-in location, pig launchers/receivers and the delivery point meter station would be constructed within the permanent pipeline right-of-way or new facility boundaries; therefore, their impacts are associated with those other facilities.

[b] The South Compressor Station would be constructed within the liquefaction facility property boundaries; therefore, its impacts are not included in the totals.

Note: Addends may not sum due to rounding.

2.2.2.2 Access Roads

PAPL would use 47 access roads during construction of the new pipeline facilities, including 29 for the Northern Pipeline, 10 for the Southern Pipeline, and 8 for the laterals, which together would temporarily affect 103.6 acres. Access roads would typically be no more than 40 feet wide. Eight of the access roads would be new roads constructed in open land; the remainder are existing dirt paths or roads. Grading, graveling, side vegetation trimming, and/or deployment of construction mats would possibly be required to improve the roads for project use based on site-specific conditions at the time of construction. Following construction, seven roads would be permanently maintained for project operations, affecting 3.8 acres of land. Appendix E identifies each road improvement proposed for the Texas Connector Project.

2.2.2.3 Contractor Yards

PAPL is proposing to use three contractor yards to house temporary field offices; stage and store equipment, pipe, materials, and vehicles; prepare pipe; and serve as field assembly areas. The contractor yards would be located in areas zoned for industrial activities along the Northern Pipeline and would be accessed via existing roads. These yards would temporarily impact 44.8 acres and PAPL would restore the entire area of each yard to pre-construction conditions (open land, industrial/commercial) after completion of construction. Appendix B shows the locations of the contractor yards.

2.2.3 Louisiana Connector Project

2.2.3.1 Pipeline Right-of-Way and Additional Temporary Workspace

For the mainline, laterals, and tie-ins on the Louisiana Connector Project, PAPL proposes to use a 125-foot-wide construction right-of-way in upland areas, 100- to 125-foot-wide rights-of-way in wetlands, and a 300-foot-wide right-of-way for in-water construction in Sabine Lake. PAPL is requesting a modification of the Commission's Procedures (section VI.A.3) to allow for a greater than 75-foot-wide construction right-of-way in wetlands; our review of PAPL's proposed modifications to the Commission's Procedures is discussed further in sections 4.3 and 4.4. Construction of the main pipeline, laterals, and tie-ins would temporarily affect 2,807.0 acres of land.

A total of 95.4 miles of the Louisiana Connector construction right-of-way would be collocated with existing foreign pipeline and utility permanent rights-of-way (see section 4.8.1 for details). Figure 2.2.3-1 depicts the typical proposed construction right-of-way cross sections adjacent to an existing pipeline.

As described in section 2.2.2-1, ATWS would be required during construction, including at crossings, points of intersection, HDDs, and push-pulls. ATWS for the Louisiana Connector Project would temporarily require 184.1 acres of land (see appendix D for a list of each ATWS area). As noted previously, PAPL would be required to request FERC/applicable agency approval for any additional or alternative ATWS areas prior to use.

Following construction, PAPL would retain a 50-foot-wide permanent right-of-way over the pipeline, which would require 771.0 acres of land. All temporary construction workspace, including ATWS, would be reseeded and allowed to revert to preconstruction conditions in accordance with PAPL's *Environmental Plan* (see section 2.4).

2.2.3.2 Aboveground Facilities

Construction of the aboveground facilities would affect a total of 78.0 acres, of which 67.4 acres would be permanently maintained for operation. Temporary construction areas would be reseeded and allowed to revert to preconstruction condition and use. Table 2.2.3-1 identifies the land requirements for the proposed aboveground facilities.

2.2.3.3 Access Roads

PAPL would use 154 temporary access roads affecting 144.9 acres during construction of Louisiana Connector Project facilities, 17 of which would be routes traveled by boat. Land access roads would typically be no more than 40 feet wide. Nineteen (19) of the land access roads would be permanently improved, 62 would be temporarily used during construction, and 56 would be improved minimally or not at all. Grading, graveling, side vegetation trimming, and/or deployment of construction mats would possibly be required to improve existing roads for project use based on site-specific conditions at the time of construction. Following construction, 19 permanent access roads would be maintained for project operations, affecting 8.2 acres of land. Appendix E identifies each road improvement proposed for the Louisiana Connector Project.

TABLE 2.2.3-1

Aboveground Facilities for the Louisiana Connector Project

Facility	Approximate Milepost	County/Parish, State	Property Size (acres) [a]
PALNG Meter Station [b]	0.0 on Pipeline	Jefferson County, Texas	0.0
Centana Meter Station [b]	<0.1 on Centana Tie-in	Jefferson County, Texas	0.0
MLV #1	19.3 on Pipeline	Cameron Parish, Louisiana	<0.1
MLV #2	31.0 on Pipeline	Calcasieu Parish, Louisiana	<0.1
MLV #3	42.7 on Pipeline	Calcasieu Parish, Louisiana	<0.1
MLV #4	51.0 on Pipeline	Calcasieu Parish, Louisiana	<0.1
MLV #5	70.7 on Pipeline	Beauregard Parish, Louisiana	<0.1
MLV #6	85.9 on Pipeline	Allen Parish, Louisiana	<0.1
MLV #7	96.3 on Pipeline	Allen Parish, Louisiana	<0.1
Compressor Station	96.3 on Pipeline	Allen Parish, Louisiana	45.1
TETCO Meter Station	<0.1 on TETCO Tie-in	Allen Parish, Louisiana	3.0
TGP Meter Station	<0.1 on TCP Lateral	Allen Parish, Louisiana	3.1
MLV #8	106.0 on Pipeline	Allen Parish, Louisiana	<0.1
Egan Meter Station	<0.1 on Egan Lateral	Evangeline Parish, Louisiana	3.1
Pine Prairie Meter Station	<0.1 on Pine Prairie Lateral	Evangeline Parish, Louisiana	3.3
TGT Meter Station	<0.1 on TGT Lateral	Evangeline Parish, Louisiana	2.7
MLV #9	115.7 on Pipeline	Evangeline Parish, Louisiana	<0.1
ANR Meter Station	<0.1 on ANR Lateral	Evangeline Parish, Louisiana	3.2
CGT Meter Station	7.6 on Southern Pipeline	Cameron Parish, Louisiana	3.1
		Aboveground Facilities Total	**67.4**

[a] Pig launchers/receivers would be constructed within the pipeline right-of-way or new facility boundaries; therefore, they are included here as part of the impacts calculated for those other facilities.

[b] Facility would be constructed within the liquefaction facility property boundaries; therefore, its impacts are not included in this table.

2.2.3.4 Contractor Yards

PAPL is proposing to use five contractor yards for the reasons generally described in section 2.2.2.4. Yards would temporarily impact 339.7 acres and PAPL would restore the entire area of each yard to pre-construction conditions after completion of construction (see table 4.8.1-3 for land use types). Appendix B shows the locations of the contractor yards.

2.2.4 Nonjurisdictional Facilities

A 295-foot-wide temporary and 120-foot-wide permanent right-of-way would be required for the relocation of SH 87 and utilities along a new 3.6-mile-long area located entirely within PALNG-owned property. The relocated facilities would be collocated with an existing electric transmission line that arcs around the western side of the Liquefaction Project site. Relocation would temporarily affect 121.0 acres of land during construction, and 45.3 acres would be retained as permanent right-of-way. The TDOT and utility owners would resume operation of their respective facilities following relocation.

2.3 CONSTRUCTION SCHEDULE

The Projects would be constructed in four separate phases on the following schedules, assuming receipt of all certifications, authorizations, and necessary permits:

1. Relocation of SH 87 and its collocated utilities would take about 16 months from the initiation of construction.

2. Site preparations for the Liquefaction Facilities would start after receipt of applicable permits with a phased approach for the first and second liquefaction trains. Engineering and constructing all facilities for the Liquefaction Project would last approximately 5 years from the initiation of construction.

3. The Texas Connector Project would be constructed in two spreads concurrently over a 32-month period from the initiation of construction to begin supplying the Liquefaction Project's liquefaction trains.

   - Spread 1 would consist of the area between MPs 0.0 and 11.6 of the Northern Pipeline, the entire length of the Southern Pipeline, the South Compressor Station, the NGPL facilities and lateral pipeline, and the KMPL facilities and lateral pipeline.

   - Spread 2 would consist of the area between MPs 11.6 and 26.6 of the Northern Pipeline, the North Compressor Station, the GTS/CIPCO facilities and lateral pipeline, the HPL facilities and lateral pipeline, the TETCO facilities and lateral pipeline, and the FGT facilities and lateral pipeline.

4. The Louisiana Connector Project would be constructed in three spreads concurrently over a 21-month period from the initiation of construction.

   - Spread 1 would consist of the area between MPs 0 and 40 of the mainline, the PALNG and Centana Meter Stations, one pig launcher/receiver, and two MLVs.

   - Spread 2 would consist of the area between MPs 40 and 90 of the mainline, the Holbrook pig launcher/receiver, and four MLVs.

   - Spread 3 would consist of the area between MPs 90 and 130 of the mainline; the compressor station; the TETCO, TGP, EGAN, Pine Prairie, Texas Gas, ANR and CGT Meter Stations, two pig launcher/receivers, and three MLVs.

The construction workforce for the Liquefaction Project would expand gradually to a peak of 3,000 employees around the 33rd month and average of 1,300 workers over the 60-month construction period. About 200 permanent employees would be hired for project operations. Relocation of SH 87 and its collocated utilities would require about 150 workers for construction, but none would be retained since operation of these facilities would resume with their respective owners following construction.

For the Texas Connector Project, PAPL would employ an average of 623 workers with a peak of about 750 during the 12-month construction phase, and retain about 20 full-time employees for operations.

The Louisiana Connector Project would employ an average of 474 workers (600 at peak) during its 21-month construction phase, and operations would require about 10 full-time employees.

Construction crews typically would work 10 hours per day, 6 days per week. Work would be conducted during daylight hours, except where the pipe would be installed using the HDD and bore methods, which require around-the-clock operations and typically last a few days to a few weeks. In addition, some time-sensitive construction activities, such as hydrostatic testing, waterbody crossings, and tie-ins, could also require nighttime work.

2.4 CONSTRUCTION PROCEDURES

PALNG and PAPL prepared an *Environmental Plan*[15] for their respective projects based on the Commission's Plan and Procedures. The intent of PALNG's and PAPL's *Environmental Plan* is to identify baseline mitigation measures for minimizing erosion and enhancing revegetation in upland areas; and to identify project-specific baseline mitigation measures for minimizing the extent and duration of construction-related disturbance on waterbodies and wetlands.

PALNG's *Environmental Plan* also includes additional plans and measures PALNG would use to avoid or reduce the various Liquefaction Project impacts:

- *Spill Notification & Agency Contacts*
- *Unanticipated Hazardous Waste Discovery Plan*
- *Unanticipated Discoveries Plan*
- Commission's *Upland Erosion Control, Revegetation and Maintenance Plan* (Plan)
- *Project Specific Wetland & Waterbody Construction & Mitigation Procedures* (PALNG's Procedures)

PAPL's *Environmental Plan* also includes additional plans and measures PAPL would use to avoid or reduce the various Texas Connector and Louisiana Connector Projects impacts:

- *Spill Notification & Agency Contacts*
- *Unanticipated Hazardous Waste Discovery Plan*
- *Unanticipated Discoveries Plan*
- Commission's *Plan*
- *PAPL Wetland & Waterbody Construction & Mitigation Procedures* (PAPL's Procedures)
- *Horizontal Directional Drilling Contingency Plan*

PALNG's and PAPL's respective *Environmental Plans* include certain modifications to the Commission's Procedures that PALNG or PAPL believes are appropriate to these Projects. These

15 *Environmental Plans* for the Liquefaction Project, Texas Connector Project, and Louisiana Connector Project were filed on November 29, 2016; December 12, 2017; and October 16, 2017, respectively. These plans can be found on the FERC eLibrary website using Accession Numbers 20161129-5254 (Liquefaction Project), 20171212-5147 (Texas Connector Project), and 20171016-5210 (Louisiana Connector Project).

modifications are specifically identified in PALNG's Procedures and PAPL's Procedures, which are attachments to their *Environmental Plans*.

Sections 4.3.2.3 and 4.4.3 outline the measures in PALNG's and PAPL's *Environmental Plans* that differ from the Commission's Procedures. Our Plan and Procedures are available on the FERC Internet website at http://www.ferc.gov/industries/gas/enviro/guidelines.asp. Generally, while we believe that PALNG's and PAPL's *Environmental Plans* meet the best management practices outlined in the Commission's Plan and Procedures, and would reduce impacts on the environment, we have identified several circumstances that we believe require additional environmental protection measures. These measures, along with our additional recommendations, are discussed throughout section 4.0.

In addition to its *Environmental Plan*, PAPL has developed Residential Construction Plans (RCP) for constructing near houses within 50 feet of the construction right-of-way (see appendix F).

2.4.1 Liquefaction Project

2.4.1.1 Site Preparation

Prior to clearing, crews would survey and mark the Liquefaction Project's site boundaries and facility component locations. Perimeter protections and initial erosion controls would also be installed at this time, in accordance with the PALNG's *Environmental Plan*. The entire 937.2-acre site would be cleared of all vegetation, which would be hauled offsite and/or burned in accordance with applicable Texas open burning laws. The topsoil layer would then be stripped and replaced with structural fill to raise the site to a final grade of 9 feet AMSL. The topsoil removed during this process would be used as fill in the mixed use area in the southwest corner of the site. Concrete berms with a height of 20 feet AMSL would be constructed around all areas containing critical process equipment, including the liquefaction trains and LNG storage tanks.

Once the site has been filled, the MOF and Pioneer Dock would be installed by improving existing concrete dock structures on the western shore of the Port Arthur Canal at the northeast end of the site. A concrete batch plant would be constructed in the mixed use area nearby to produce concrete for modifying the dock and for other foundational needs at the liquefaction site. To accommodate ships delivering construction materials and equipment to the MOF and Pioneer Dock, dredge material would be removed from the Port Arthur Canal and disposed of at the SNND Dredge Disposal Areas 8, 9A, and 9B and J.D. Murphree WMA. A permanent heavy haul road for construction vehicles would be constructed between the MOF and the liquefaction and LNG storage facilities.

The foundations of equipment that may be affected by earth movement or settling would be supported on piles driven 70 to 160 feet deep, pending the results of geotechnical investigations. Piles would be driven from land as practicable using standard techniques, although some in-water pile driving may be required for the marine facilities. Reinforced concrete pile caps would be installed to a top elevation of 9 feet ASML and would provide a stable base for reinforced concrete foundations, which would typically be prefabricated and delivered from offsite. Process equipment would be aligned and secured to these foundations before connecting the liquefaction systems using prefabricated pipe cut to fit and attached or welded in place. All piping leading into and installed on-site would be hydrostatically or pneumatically pressure tested prior to operation as per state and federal regulations; non-cryogenic piping would typically be hydrostatically tested using water obtained from a municipal source. Underground piping would then be backfilled, and aboveground piping would be painted or insulated as necessary.

2.4.1.2 Liquefaction Terminal

Marine Facilities

To construct the marine berth and turning basin, sheet pilings would be driven along the shore at the berth location to isolate the landside portion of the excavation area from the Port Arthur Canal. Conventional excavation techniques would be used to remove topsoil and subsoil to a depth of -45 feet MLLW, and then soil improvements involving shallow mixing of the top 8 feet of the remaining soil horizon would be performed to strengthen soils that would eventually be flooded for the berth. Ships would then use cutterhead suction dredge equipment to excavate the remaining section of the marine berth and the ship turning basin within the Port Arthur Canal. All fill and dredge material removed during excavation of the marine berth would be disposed of in the approved disposal areas discussed in section 2.5.1.4.

Structural work would include pile driving and foundation construction, starting on one berth and continuing in the same manner on the second. Next, structures and equipment for the loading platform, access trestle, breasting and mooring dolphins, and walkways would be installed. Finally, riprap would be placed on slopes along the shoreline to prevent erosion from wave action in the Port Arthur Canal.

Liquefaction Trains

The liquefaction trains would be designed, constructed, operated, and maintained in accordance with the DOT Federal Safety Standards for Liquefied Natural Gas Facilities at 49 CFR 193 and would meet the LNG Standards under NFPA 59A. Prefabricated pieces of the liquefaction trains would be delivered to the liquefaction site by truck or unloaded from barges at the MOF. Additional parts would be fabricated on site as necessary, then the trains would be assembled and moved into position.

LNG Storage and Processing Facilities

After site preparation is completed, each of the three LNG storage tanks would be installed on reinforced concrete foundations supported by 160-foot-deep piles using conventional construction techniques. Following the installation of the foundation, construction of the tank base and post-tensioning of the outer concrete container wall would occur. In parallel to construction of the outer concrete container wall, the steel dome roof and suspended deck would be constructed on temporary supports inside the outer container of each storage tank, to be later air-raised into position. The bottom carbon steel vapor liner would then be installed. On top of the outer concrete container wall, the steel dome roof compression ring would be cast into the concrete and then the steel dome roof would be air-raised into position and secured to the compression ring. Roof nozzles, penetrations, and studs would be installed, and steel reinforcement and concrete covering of the steel dome roof would occur. Concurrent with the installation of roof nozzles and penetrations, work would begin on the inner 9 percent nickel steel container, including the secondary bottom, bottom corner protection, and inner container annular and bottom plates. Internal accessories such as pump columns, bottom and top fill, instrument wells, and purge and cool-down piping would be installed, followed by installation of roof platforms, walkways, pipework, and pipe supports.

To ensure that the tanks are capable of operating at the design pressure, the inner and outer tanks would be tested in accordance with the API Standard 620. The integrity of the outer tanks would be pneumatically tested, and process piping would be installed from the tank top down to grade. The inner 9-percent nickel steel containers of the three LNG storage tanks would be independently hydrostatically tested using a total of 87 million gallons of water for all tanks. After hydrostatic testing is completed for each storage tank, the water would be discharged through an energy dissipation device into the Port Arthur Canal or onto vegetated uplands that drain to the canal.

Following testing, the required instrumentation would be installed inside the tank and annular space. Perlite insulation would be expanded into the tank annular space using vibration methods, and the suspended deck blanket insulation and external piping insulation would be installed, which would be followed by a visual inspection. The LNG pumps would then be installed, and the storage tanks would be purged with nitrogen to a positive gauge pressure, followed by purge and cool-down.

Piping and Equipment Installation

PALNG would fabricate and install piping in accordance with American Society of Mechanical Engineers (ASME) B31.3. Flanges or similar leak-minimization devices would be incorporated into the design of cryogenic pipes. Process equipment would be set on its foundations, roughly aligned, and secured before piping installation and final welding. PALNG would hydrostatically or pneumatically test each piping system as it is finished. Hydrostatic test water would be acquired from a municipal source. All piping and equipment would be coated with corrosion-resistant material according to the manufacturer's specifications and painted with PALNG's color identification system.

After the piping, mechanical, electrical, and instrumentation equipment is installed and completed, the following pre-commissioning activities would begin:

- Conformity checks and calibration of each part and piece of equipment to ensure proper installation.
- Flushing and cleaning of piping and equipment.
- Leak testing all hydrocarbon piping and associated equipment.

Once pre-commissioning activities are completed, PALNG would clean and test piping in accordance with applicable pipe design specifications, then purge the system with nitrogen.

Site Restoration

Following construction, the mixed-use areas and other locations not occupied by LNG process equipment, buildings, or access roads (see figure 2.1.1-1) would be restored in accordance with PALNG's *Environmental Plan*. Mixed use areas would be paved or covered in compacted aggregate, and all other areas would be restored with native vegetation recommended by the USDA's Natural Resources Conservation Service (NRCS) and maintained as open upland. Weather and soil conditions permitting, these areas would be seeded within 6 working days after final grading is complete. Seeding permanent vegetation is expected to occur during the growing season; however, if seeding occurs outside the growing season, temporary erosion control measures would be left in place until the next growing season, when reseeding efforts would take place. Revegetated areas would be monitored following construction for the first and second (as necessary) growing seasons.

2.4.1.3 Dredge Disposal/Beneficial Reuse Placement Areas

During construction of the marine facilities, the approximately 4.9 million yd^3 of material dredged from the Port Arthur Canal would be transported via a temporary 30-inch-diameter aboveground pipeline about 3 miles northeast to the Dredge Disposal Areas 9A and 9B and about 0.2 mile east to Dredge Disposal Area 8, all managed by the SNND (see figure 2.1.1-3). To transport material to Dredge Disposal Areas 9A and 9B, the dredge material pipeline would be placed within the corridor for the Northern Pipeline associated with the Texas Connector Project up to the southern bank of the ICWW. To transport material to Dredge Disposal Area 8, the dredge material pipeline would be placed across the Port Arthur Canal near where the LNG vessel berth would be located. PALNG would use a combination of floating, submerged, and/or disconnecting dredge pipeline segments to cross the ICWW and Port Arthur Canal using methods similar to that use by the USACE for maintenance dredging, which would allow vessel traffic to continue unrestricted.

The remaining 2.9 million yd^3 of dredge material would be transported to the J.D. Murphree WMA using a temporary 30-inch-diameter aboveground pipeline floated in Round Lake Canal (see figure 2.1.1-3). PALNG would work with the TPWD to limit interruption of public use at the WMA during this restoration project, per an April 10, 2017 letter and November 14, 2017 meeting. Dredge material would be spread across the WMA using conventional grading techniques and restored using root stock prescribed in the TPWD's June 13, 2017 letter.

2.4.2 Texas Connector and Louisiana Connector Projects

Construction and operation of the Texas Connector and Louisiana Connector Projects would be conducted using similar, industry-recognized methods and mitigation measures. As such, the following discussions apply to both pipeline projects. Differences in methods are described separately by project as appropriate.

PAPL would design, construct, operate, and maintain its pipelines in accordance with DOT regulations under 49 CFR 192 (Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards) and other applicable federal and state regulations. The DOT regulations specify pipeline material selection; minimum design requirements; protection from internal, external, and atmospheric corrosion; and qualification procedures for welders and operations personnel, in addition to other design standards. PAPL also would comply with the siting and maintenance requirements in 18 CFR 380.15 (Siting and Maintenance Requirements) and other applicable federal and state regulations, including the requirements of the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA). These safety regulations are intended to ensure adequate protection of the public, pipeline workers, contractors, and employees, and to prevent natural gas pipeline accidents and failures.

Constructing the pipelines would generally be completed using sequential pipeline construction techniques, which include survey and staking; clearing and grading; trenching; pipe stringing, bending, and welding and coating; lowering-in and backfilling; hydrostatic testing; commissioning; and cleanup and restoration (see figure 2.4.2-1). These construction techniques would generally proceed in an assembly line fashion and construction crews would move down the construction right-of-way as work progresses. Construction at any single point along the pipelines, from surveying and staking to cleanup and restoration, would last approximately 8 to 12 weeks for any given segment of the pipeline.

2.4.2.1 Survey and Staking

The first step of construction involves survey crews staking the limits of the construction right-of-way, the centerline of the proposed trench, ATWSs, other approved work areas, approved access roads using temporary, the limits of approved disturbance on any access roads requiring widening, and other environmentally sensitive areas (e.g., waterbodies, cultural resources, sensitive species), where appropriate. PAPL would contact Texas811 and Louisiana One Call to locate, identify, and flag and existing underground utilities within the workspace to prevent accidental damage during pipeline construction.

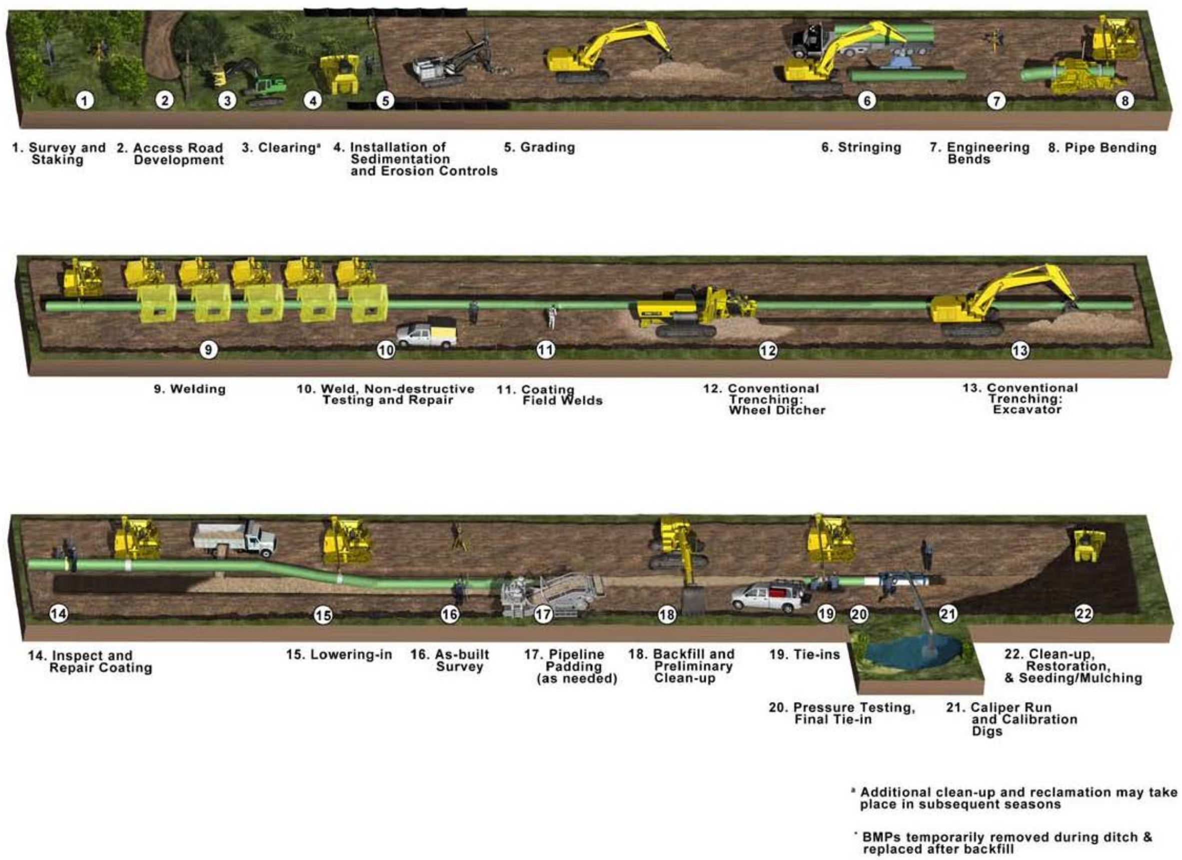


Figure 2.4.2-1
Texas Connector and Louisiana Connector Projects
Typical Pipeline Construction Sequence

2.4.2.2 Clearing and Grading

Clearing and grading would remove trees, shrubs, brush, roots, and large rocks from the construction work area and would level the right-of-way surface to allow operation of construction equipment. Vegetation would generally be cut or scraped flush with the surface of the ground, leaving rootstock in place where possible. Brush and other materials cleared from the construction corridor would be burned, chipped, or mulched within the construction right-of-way, or hauled to an appropriate disposal location. Burning would be conducted in accordance with applicable state and local regulations and project plans.

Grading would be conducted where necessary to provide a reasonably level work surface. Extensive grading may be required in uneven terrain and where the rights-of-way traverse steep slopes and side slopes; however, these conditions are not anticipated on the pipeline projects. PAPL would remove at least the top 12 inches of topsoil where 12 or more inches of topsoil is present, or the entire topsoil layer in areas with less than 12 inches of topsoil. Topsoil and spoil would remain segregated throughout construction and replaced in their original soil horizons during backfilling. PAPL may import topsoil in residential areas in lieu of soil segregation.

Temporary erosion controls would be installed along the construction right-of-way immediately after initial disturbance of the soil and would be maintained throughout construction. Temporary erosion control measures would remain in place until permanent erosion controls are installed or restoration is completed. PAPL has committed to employing Environmental Inspectors (EI) during construction to help determine the need for erosion controls and ensure that they are properly installed and maintained. Additional discussion of EI responsibilities is provided in section 2.5.

2.4.2.3 Trenching

Soil and bedrock would be removed to create a trench into which the pipeline would be placed. A rotary trenching machine, track-mounted excavator, or similar equipment would be used to dig the pipeline trench. When rock is encountered, tractor-mounted mechanical rippers or rock trenchers would be used to fracture the rock prior to excavation. Blasting would be required in areas where mechanical equipment cannot break up or loosen the bedrock. Excavated materials would be stockpiled along the right-of-way on the side of the trench away from the construction traffic.

The trench would be excavated to a depth that would provide sufficient cover over the pipeline in accordance with DOT standards in 49 CFR 192.327. Typically, the trench would range from 6 to 8 feet deep, depending on the substrate and resource being crossed. Excavations could be deeper in certain locations, such as at road and stream crossings or where foreign lines are located. Generally, the pipeline would be installed with a minimum of 3 feet of cover, except where consolidated rock prevents this depth of cover from being achieved. Additional cover would be provided at road and waterbody crossings. Additional cover (above DOT standards) could also be negotiated at a landowner’s request to accommodate land use practices. Additional depth of cover generally requires a wider construction right-of-way to store the additional spoil.

PAPL would adhere to strict safety precautions during blasting and would exercise care to prevent damage to nearby structures, utilities, wells, springs, and other important resources. Blasting would only be conducted during daylight hours and would not begin until landowners and tenants have been provided sufficient advanced notice to protect property or livestock. Blasting mats or padding would be used where necessary to prevent fly rock from scattering. All blasting activities would be performed in compliance with federal, state, and local codes, ordinances, and permits; the manufacturers’ prescribed safety procedures; and industry practices. Impacts of blasting on various resources and details about the measures to mitigate the impacts of blasting on these resources are discussed in sections 4.1, 4.3, 4.6, and 4.7.

2.4.2.4 Pipe Stringing, Bending, Welding, and Coating

After trenching, sections of pipe typically between 40 and 80 feet long (also referred to as "joints") would be transported to the right-of-way by truck and strung beside the trench in a continuous line. The pipe would be delivered to the job site with a protective coating of fusion-bonded epoxy or other approved coating that would inhibit corrosion by preventing moisture from coming into direct contact with the steel.

Individual sections of pipe would be bent to conform to the contours of the ground after the joints of pipe sections are strung alongside the trench. Workers would use a track-mounted, hydraulic pipe-bending machine to bend the pipe. Where multiple or complex bends are required, bending would be conducted at the pipe fabrication factory, and the pipe would be shipped to project areas pre-bent.

After the pipe joints are bent, they would be aligned, welded together into a long segment, and placed on temporary supports at the edge of the trench. PAPL would use welders who are qualified according to applicable standards in 49 CFR 192 Subpart E, American Petroleum Standard 1104, and other requirements.

Once the welds are made, a coating crew would coat the area around the weld before the pipeline is lowered into the trench. Prior to application, the coating crew would thoroughly clean the bare pipe with a power wire brush or sandblast machine to remove dirt, mill scale, and debris. The crew would then apply the coating and allow the coating to dry. The pipeline would be inspected electronically for faults or voids in the coating and would be visually inspected for scratches and other defects. PAPL would repair any damage to the coating that may have occurred before the pipeline is lowered into the trench.

2.4.2.5 Lowering-In and Backfilling

The trench would be inspected to be sure it is free of rocks and other debris that could damage the pipe or protective coating before the pipe would be lowered into the trench. Trench dewatering may be necessary to inspect the bottom of the trench in areas where water has accumulated. Trench water discharges would be directed to well-vegetated areas and away from waterbodies to minimize the potential for runoff and sedimentation. The pipeline would then be lowered into the trench by a series of side-boom tractors (tracked vehicles with hoists on one side and counterweights on the other), which would carefully lift the pipeline and place it on the bottom of the trench.

Trench breakers (stacked sand bags or polyurethane foam) would then be installed in the trench on slopes at specified intervals to prevent subsurface water movement along the pipeline. The trench would then be backfilled using the excavated material. At locations where topsoil had been separated from subsoil during the clearing process, subsoil would be returned to the trench first, followed by topsoil. An up to 1-foot-high crown of soil about the width of the trench may be left over the trench in non-agricultural areas to compensate for settling. Appropriately spaced breaks may be left in the crown to prevent interference with stormwater runoff.

In rocky areas or where the trench contains bedrock, padding material such as sand, approved foam, or other protective materials would be placed in the bottom of the trench to protect the pipeline. Once the pipe is sufficiently covered with suitable material, the excavated rocky soil would be used for backfill within the original rocky soil horizon. Topsoil would not be used for padding.

2.4.2.6 Hydrostatic Testing

PAPL would hydrostatically test the pipelines after backfilling to ensure the system is capable of withstanding the operating pressure for which it was designed. Hydrostatic testing typically involves filling the pipeline with water to a designated test pressure and maintaining that pressure for approximately 8 hours. Actual test pressures and durations would be consistent with the requirements of 49 CFR 192. Any leaks would be repaired and the section of pipe retested until the required specifications are met.

Water for hydrostatic testing would be obtained from surface waterbodies and municipal water sources. Following satisfactory completion of hydrostatic testing, the test water would typically be discharged into vegetated upland areas through a dewatering structure designed to slow the flow of water. If discharging directly to receiving waters, PAPL would use diffusers (energy diverters) to minimize the potential for stream scour. All testing activities would be conducted within the parameter of the applicable water withdrawal and discharge permits. Section 4.3.2 provides more information on hydrostatic testing.

2.4.2.7 Cleanup and Restoration

Within 20 days of backfilling the trench (10 days in residential areas) all work areas would be graded and restored to preconstruction contours and natural drainage patterns as closely as possible. If seasonal or other weather conditions prevent compliance with these timeframes, temporary erosion controls would be maintained until conditions allow completion of final cleanup. Topsoil and subsoil would be tested for compaction at regular intervals in agricultural and residential areas disturbed by construction activities. Severely compacted agricultural areas would be plowed and appropriate soil compaction mitigation would be performed in residential areas. Cut and scraped vegetation would be spread back across the right-of-way. Some large shrubs and trees cut during clearing may be spread back across the right-of-way to impede vehicular traffic and other unauthorized access, or hauled away for disposal in accordance with applicable laws. Surplus construction material and debris would be removed from the right-of-way unless the landowner or land-managing agency approves otherwise. Excess rock and stone would be removed from at least the top 12 inches of soils in agricultural and residential areas and, at the landowner's request, in other areas, such that the size, density, and distribution of rock on the construction right-of-way would be similar to adjacent non-right-of-way areas. Landowners may be able to negotiate certain specific construction requirements and restoration measures directly with PAPL.

PAPL would conduct restoration activities in accordance with landowner agreements, permit requirements, and written recommendations on seeding mixes, rates, and dates obtained from the local conservation authority or other duly authorized agency and in accordance with PAPL construction and restoration plans. The right-of-way would be seeded within 6 working days following final grading, weather and soil conditions permitting. Alternative seed mixes specifically requested by the landowner or required by agencies may be used. Any soil disturbance that occurs outside the permanent seeding season or any bare soil not stabilized by vegetation would be mulched in accordance with PAPL's construction and restoration plans. Additional discussion of restoration activities is provided in section 4.2.2.

Markers showing the location of the pipeline would be installed at fence and road crossings to identify the owner of the pipeline and convey emergency information in accordance with applicable governmental regulations, including DOT safety requirements. Special markers providing information and guidance for aerial patrol pilots would also be installed.

Landowners would be compensated for damages in accordance with individual landowner agreements. Following construction, temporary access roads would be restored to their preconstruction condition unless the landowner or land-managing agency requests that the improvements be left in place.

2.4.2.8 Commissioning

Test manifolds would be removed and final pipeline tie-ins completed after hydrostatic testing. The pipeline then would be cleaned and dried using mechanical tools (pigs) that are moved through the pipeline with pressurized dry air. Pigs also would be used to internally inspect the pipeline to detect any abnormalities or damage. Any problems or concerns would be addressed as appropriate. Pipeline commissioning would then commence. Commissioning involves verifying that equipment has been properly installed and is working, verifying that controls and communications systems are functioning, and confirming that the pipeline is ready for service. In the final step, the pipeline would be prepared for service by purging the pipeline of air and loading it with natural gas. PAPL would not be authorized to place the pipeline facilities into service until they have received written permission from the Director of the FERC's Office of Energy Projects (OEP).

2.4.3 Special Pipeline Construction Procedures

Special construction techniques are required when a pipeline is installed across waterbodies, wetlands, roads, major utilities, steep slopes, residences, agricultural lands, and other sensitive environmental resources. In general, ATWS adjacent to the construction right-of-way would be used at most of these areas for staging construction, stockpiling spoil, storing materials, maneuvering equipment, and fabricating pipe.

2.4.3.1 Waterbody Crossings

Waterbody crossings would be completed in accordance with the measures described in PAPL's construction plans as summarized below and in accordance with federal, state, and local permits. PAPL's proposed waterbody crossing methods are discussed in section 4.3.2.

ATWS necessary for waterbody crossings would be located a minimum of 50 feet from the waterbody edge, except where adjacent upland consists of actively cultivated or rotated cropland or other disturbed land. The 50-foot setback would be maintained unless site-specific approval for a reduced setback is granted by the FERC and other jurisdictional agencies (see section 4.3.2.3).

To prevent sedimentation caused by equipment traffic crossing through waterbodies, PAPL would install temporary equipment bridges. Bridges may include clean rock fill over culverts, equipment pads, wooden mats, free-spanning bridges, and other types of spans. Equipment bridges would be maintained throughout construction. Each bridge would be designed to accommodate normal to high streamflow (from storm events) and would be maintained to prevent soil from entering the waterbody and to prevent restriction of flow during the period of time the bridge is in use.

Sediment barriers would be installed immediately after initial disturbance of the waterbody or adjacent upland. Sediment barriers would be properly maintained throughout construction and reinstalled as necessary until replaced by permanent erosion controls or restoration of adjacent upland areas is complete and revegetation has stabilized the disturbed areas.

For waterbodies without flow at the time of construction, PAPL would utilize the general construction methods described in section 2.4.2. After backfilling, the streambanks would be re-established to approximate preconstruction contours and stabilized, and erosion and sediment control measures would be installed across the construction right-of-way to reduce streambank and upland erosion and sediment transport into the waterbody.

Flume Construction Method

The flume method is a standard dry-ditch waterbody crossing method that involves diverting the flow of water across the in-stream construction work area through one or more flume pipes placed in the waterbody. The first step in the flume crossing method involves placing a sufficient number of adequately sized flume pipes in the waterbody to accommodate the highest anticipated flow during construction. After placing the pipe in the waterbody, sand bags or equivalent dam diversion structures are placed in the waterbody upstream and downstream of the trench area. These devices serve to dam the stream and divert the water flow through the flume pipes, thereby isolating the water flow from the construction area between the dams. Flume pipes are generally left in place during pipeline installation until final cleanup of the streambed is complete.

Dam and Pump Construction Method

The dam and pump method is another dry-ditch crossing method, similar to the flume crossing method except that pumps and hoses are used instead of flumes to move water across the in-stream construction work area. The technique involves damming of the waterbody with sandbags and/or clean gravel with a plastic liner upstream and downstream of the trench area. Pumps are set up at the upstream dam with the discharge line routed through the construction area to discharge water immediately downstream of the downstream dam. An energy dissipation device is commonly used to prevent scouring of the streambed at the discharge location. Water flow is maintained through all but a short reach of the waterbody at the actual crossing. The pipeline is then installed and backfilled. After backfilling, the dams are removed and the banks restored and stabilized.

Conventional Bore Method

The conventional bore method is a trenchless crossing method that involves excavating large bell holes on each side of a waterbody that are deep enough for the bore equipment to auger a hole horizontally from one bell hole to the other a minimum of 5 feet below the bed of a waterbody. Once the bore hole has been created, the pipeline is pushed or pulled through the hole. Due to the depth of the bell holes and proximity to water resources, this method may require use of sheet pile to maintain the integrity of the bell holes, and use of well point dewatering systems to avoid flooding of the bell holes.

Horizontal Directional Drill Construction Method

An HDD is a trenchless crossing method that involves drilling a hole under the waterbody (or other sensitive features) and installing a pre-fabricated pipe segment through the hole. To avoid wetlands, waterbodies, roadways, existing structures, and other utilities, PAPL proposes to use the HDD method at 24 locations for the Texas Connector Project and 26 locations for the Louisiana Connector Project (see table 2.4.3-1).

TABLE 2.4.3-1

HDD Crossings for the Texas Connector and Louisiana Connector Projects

Feature Crossing	Entry Milepost	Exit Milepost	Crossing Length (miles)
TEXAS CONNECTOR PROJECT			
Northern Pipeline			
ICWW and Bayou Outfall Canals	2.6	1.5	1.1
Big Hill Bayou Canal	6.2	5.2	1.0
Derring Gully	5.2	4.1	1.1
McFaddin Reservoir and SH 73	8.9	8.2	0.7
Taylor Bayou Wetlands	10.9	10.0	0.9

TABLE 2.4.3-1 (cont'd)

HDD Crossings for the Texas Connector and Louisiana Connector Projects

Feature Crossing	Entry Milepost	Exit Milepost	Crossing Length (miles)
Hillebrandt Bayou Wetlands and Highway 365	11.6	12.2	0.7
Hillebrandt Bayou Wetlands and Unnamed Canal	13.0	13.3	0.2
Gallier Canal	14.2	14.4	0.2
Johns Gully and Farm-to-Market Road	17.5	18.1	0.6
Johns Gully and Beaumont	18.5	18.2	0.3
Spindletop Oil Field Wetlands	19.0	18.6	0.4
Northern Spindletop Oil Field Wetlands	20.2	19.6	0.6
U.S. Highway 69 and SH 347 Wetlands	20.8	20.3	0.5
Neches River	21.6	22.4	0.8
Anderson Gully	23.7	22.9	0.7
Unnamed wetland, stream, and pond	25.2	24.6	0.6
	Northern Pipeline Subtotal		**10.3**
Southern Pipeline			
Keith Lake and Lost Lake Canals	1.0	0.1	0.9
Keith Lake Cut	2.2	2.5	0.4
SH 87	2.9	3.7	0.8
Sabine Pass	7.0	6.0	1.0
Aboveground infrastructure and wetlands	7.5	7.1	0.4
	Southern Pipeline Subtotal		**3.5**
GTS Lateral			
Unnamed Canal and Amco Road Ext	0.8	0.5	0.3
Unnamed Drainage and Spindletop Ave	0.8	1.1	0.3
	GTS Lateral Subtotal		**0.6**
FGT Lateral			
Unnamed canal and wetlands	1.2	0.8	0.4
	FGT Lateral Subtotal		**0.4**
	Texas Connector Project Total		**14.8**
LOUISIANA CONNECTOR PROJECT			
SH 87 / Port Arthur Canal / SH 82 / S Levee Road	0.0	0.8	0.8
Foreign Pipelines	4.3	4.8	0.5
Sabine Lake	18.1	17.5	0.6
East Pass	18.2	19.2	1.0
Foreign Pipelines	27.2	26.5	0.7
ICWW	27.5	28.3	0.9
Vinton Drainage Canal	30.9	30.6	0.2
Unnamed Waterbody	38.7	39.1	0.5
Waterbody / Canal / Unnamed Road	40.5	40.2	0.3
Bayou Choupique	42.5	42.0	0.5
Walker Rd	47.9	47.5	0.4
Foreign Pipeline	48.5	48.2	0.3
Interstate Highway 10	50.3	50.0	0.3
Houston River Canal	54.6	54.8	0.2
Houston River	56.8	57.4	0.6
State Route 27 / Bankens Road / Kansas City Southern Railroad	60.2	59.7	0.5
Little River	60.5	60.8	0.3
Beckwith Creek	63.9	64.3	0.4
Hickory Branch	65.0	65.4	0.4
Barnes Creek	79.4	78.8	0.7
Whisky Chitto Creek	91.1	91.2	0.2
Calcasieu River	94.7	94.5	0.2
U.S. Highway 165 / Union Pacific Railroad	96.9	96.7	0.3
Nezpique Bayou	110.1	109.9	0.2

TABLE 2.4.3-1 (cont'd) **HDD Crossings for the Texas Connector and Louisiana Connector Projects**			
Feature Crossing	Entry Milepost	Exit Milepost	Crossing Length (miles)
Pond	110.3	110.6	0.3
Des Cannes Bayou	119.0	119.2	0.2
Louisiana Connector Project Total			**11.5**
Texas Connector and Louisiana Connector Projects Total			**26.3**

The first step in an HDD is to drill a small diameter pilot hole from one side of the crossing to the other using a drill rig. As the pilot hole progresses, segments of drill pipe are inserted into the hole to extend the length of the drill. The drill bit is steered and monitored throughout the process until the desired pilot hole had been completed. The pilot hole is then enlarged using several passes of successively larger reaming tools. Once reamed to a sufficient size, a pre-fabricated segment of pipe is attached to the drill string on the exit side of the hole and pulled back through the drill hole toward the drill rig. Depending on the substrate, drilling and pull back can last anywhere from a few days to a few weeks.

The HDD method uses a slurry referred to as drilling mud, which is composed of water and bentonite, a naturally occurring clay mineral that can absorb up to 10 times its weight in water. Bentonite-based drilling mud is a non-toxic, non-hazardous material that is also used to construct potable water wells throughout the United States. The drilling mud is pumped under pressure through the inside of the drill pipe, and flows back (returns) to the drill entry point along the outside of the drill pipe. The purpose of the drilling mud is to lubricate the drill bit and convey the drill cuttings back to the drill entry point where the mud is reconditioned and re-used in a closed, circulating process. It also forms a cake on the rock surface of the borehole, which helps to keep the drill hole open and maintain circulation of the drilling mud system. Because the drilling mud is pressurized, it can seep into the surrounding matrix, resulting in an inadvertent release of fluid if the drill path encounters fractures or fissures that offer a path of least resistance, or near the drill entry and exit points where the drill path has the least amount of ground cover.

The potential for an inadvertent release is typically greatest during drilling of the initial pilot hole, and decreases once the pilot hole has been completed. The volume of mud lost would be dependent on a number of factors, including the size of the fault, the permeability of the geologic material, the viscosity of the drilling mud, and the pressure of the drilling system. A drop in drilling pressure would indicate that an inadvertent release may be occurring and if the mud moves laterally, the release may not be evident from the ground surface. For a release to be evident there must be a fault or pathway extending vertically to the surface.

In the event of a drilling mud release, pits or containment structures could be constructed to contain drilling mud released to the surface of the ground, and a pump may be required to transfer the drilling mud from the pit or the structure to a containment vessel. A release underground would be more difficult to contain and would be addressed by thickening the drilling mud, stopping drilling all together, or continuing to drill past the fault or blockage to re-establish the bore hole as the path of least resistance. In the event of lost drilling mud, PAPL may introduce additives into the drilling mud to stop or reduce the amount of drilling mud loss. These additives could include walnut shells, paper, other biodegradable solids, or approved polymers that would increase the viscosity and gel strength of the drilling mud. In the event of an inadvertent release of drilling mud, PAPL would implement the corrective actions and clean up measures described in the *HDD Contingency Plan* (included in its *Environmental Plan*) and further discussed in section 4.3.2.2.

It is possible for HDD operations to fail, primarily due to encountering unexpected geologic conditions during drilling or the pipe becoming lodged in the hole during pullback operations. PAPL would be required to seek approval from the Commission and other applicable agencies prior to abandoning any

HDD crossing in favor of a new location, or using another construction method should a second attempt fail. If any of the HDD crossings are found to be infeasible, PAPL would be required to submit specific proposed alternate construction methods for review and approval by the Commission and other applicable agencies.

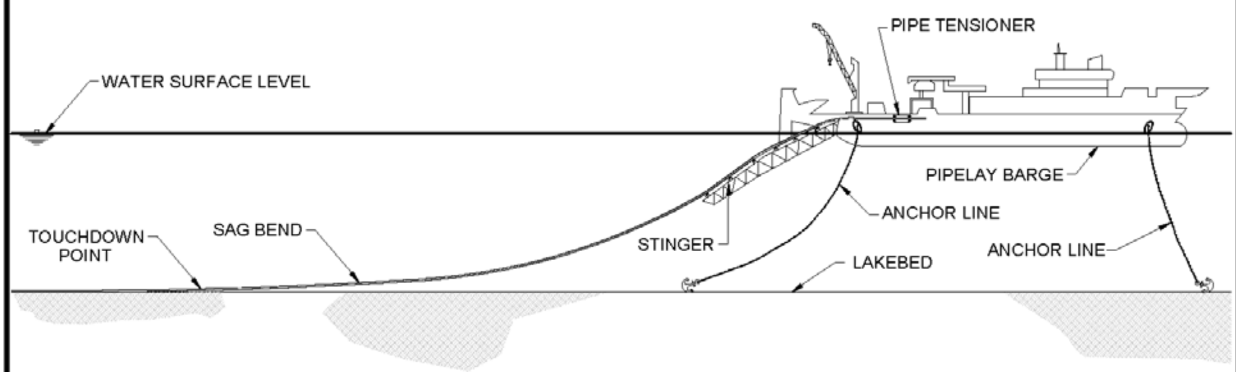
Sabine Lake Crossing

The Louisiana Connector Project would require installation of pipeline across the bottom of Sabine Lake using of a variety of construction methods. The pipeline would enter and exit the lake via HDDs drilling from the shore and surfacing in the lake bottom. The pilot hole would be reamed to the appropriate diameter and a dredge barge would excavate material before and after the drill exit points so the pipe can lay in the ditchline without an overbend. Pipe strung from a barge would be connected to the HDD drill stem at each drill exit hole and the pipe string pulled back through to the land side. The remaining pipeline would be trenched into the Sabine Lake bottom using open-cut or jetting methods with a minimum depth of cover of 4 feet. Pipe would be welded and installed using the "S-lay" method, where concrete-coated pipe joints would be strung and coated on pipelay barges, then mechanically rolled off onto the lakebed as the barges move along the centerline, forming an S-shaped curve (see figure 2.4.3-1).

Construction activities within Sabine Lake would require a variety of barge vessels and equipment types. All barges would be moved by tugboat at a speed no greater than 8 knots and no ballast water exchanges are anticipated during construction. Trenching and backfilling would occur from barges each measuring 50 feet by 150 feet by 50 feet, which would typically draw about 6 feet of water. Barges measuring 40 feet by 140 feet by 7 feet with a 3.5- to 4-foot draft would transport pipe segments from the LY-JEF-01 contractor storage yard on the Sabine Naches Canal to the three pipelaying barges. Two of the pipelay barges would be 40 feet by 140 feet by 7 feet and one would be 40 feet by 150 feet by 7 feet; both would draw 3.5- to 4-foot of water. The HDD barge would be 40 feet by 150 feet by 10 feet with a draft of 6 feet. Sabine Lake and Sabine Naches Canal are deep enough to accommodate vessel drafts, and PAPL stated that the creation of floatation channels is not anticipated during construction.

Similar to upland construction, Sabine Lake would first be surveyed and staked for foreign-line crossings, access points, and the pipeline centerline. The construction right-of-way would be 300 feet wide and the permanent right-of-way would be 50 feet wide. The pipeline trench would be excavated using open-cut or jetting methods and spoil materials would be temporarily stored alongside the trench. PAPL would install BMPs, such as turbidity curtains, along the trenched pipeline and at the HDD segments tie-ins to minimize impacts on aquatic resources. Pipe segments would be coated with concrete at the LY-JEF-01 contractor storage yard then loaded onto pipe barges and transported via tugboat to the lay barges positioned above the trench. Pipe would be offloaded to the lay barges where it would be stored until it can be welded onto the end of the pipeline string. While on the lay barge, pipe segments would be welded, coated, non-destructively tested, and hydrotested, then the pipeline would be filled with water and sunk into the trench. The trench would be backfilled with spoil as the lay barges move down the line. Following backfill, the construction right-of-way would be restored to preconstruction condition and contours.

Existing foreign pipelines on the bottom of Sabine Lake would be crossed using the HDD method from MP 4.3 to 4.8. A 40-foot by 150-foot by 10-foot spud barge with an HDD rig and drilling fluid tanks would install the pipeline to a depth of at least 20 feet below the foreign pipelines. Thirty-foot by 120-foot by 7-foot support barges, one storing water for the drilling fluid tanks and the other bringing water from a freshwater source, would accompany the spud barge. Similar to the procedure described above, a lay barge would assemble the pipeline for pullback, coat and test the pipeline, fill it with water, and sink it into place. Once pulled through the bore hole, the pipeline on each side of the HDD would be brought to the surface for tie-in, coating, and testing.



ELEVATION VIEW

UNIVERSAL ENSCO, INC. - LOUISIANA ENGINEERING
FIRM LIC. # EF.0001688
UNIVERSAL ENSCO, INC. - TEXAS ENGINEERING
FIRM LIC. # F-1942

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Figure 2.4.3-1
Louisiana Connector Project
S-Lay Method

NO	REVISION	DATE	DRAWN	CHKD	APPD
B	ISSUE FOR APPROVAL	07/31/2017	DTT	GLE	CAS
A	ISSUE FOR REVIEW	07/06/2017	DTT	GLE	CAS

DRAWN		DATE	6/2017
CHKD	GLE	DATE	07/06/2017
APPD	CAS	DATE	07/06/2017
JOB NO.	23707	SHEET	1 OF 1
LOCATION	-----	STATE	LA/TX
SCALE	NTS	REV	B
DWG NO.	23707-507-TYP-20013		
CLIENT JOB NO.	N/A		

2.4.3.2 Wetland Crossings

Wetland crossings would be completed in accordance with federal and state permits and follow the measures described in PAPL's construction plans. In addition, the EPA recommended that PALNG and PAPL stake wetland areas based on a verified wetland delineation. The wetlands that would be crossed are discussed further in section 4.4.1.

Clearing of vegetation in wetlands would be limited to trees and shrubs, which would be cut flush with the surface of the ground and removed from the wetland. Stump removal, grading, topsoil segregation, and excavation would be limited to the area immediately over the trenchline. A limited amount of stump removal and grading may be conducted in other areas to ensure a safe working environment.

During clearing, sediment barriers, such as silt fence and staked straw bales, would be installed and maintained adjacent to wetlands and within temporary extra workspaces as necessary to minimize the potential for sediment runoff. Sediment barriers would be installed across the full width of the construction right-of-way at the base of slopes adjacent to wetland boundaries. Silt fence or straw bales installed across the working side of the right-of-way would be removed during the day when vehicle traffic is present and would be replaced each night. Sediment barriers would also be installed within wetlands along the edge of the right-of-way, where necessary, to minimize the potential for sediment to run off the construction right-of-way and into wetland areas outside the construction work area. If trench dewatering is necessary in wetlands, the trench water would be discharged in stable, vegetated, upland areas and/or filtered through a filter bag or siltation barrier. No heavily silt-laden water would be allowed to flow into a wetland.

Construction equipment working in wetlands would be limited to that essential for right-of-way clearing, excavating the trench, fabricating and installing the pipeline, backfilling the trench, and restoring the right-of-way. The method of pipeline construction used in wetlands would depend largely on the stability of the soils at the time of construction. In areas of saturated soils or standing water, low-ground-weight construction equipment and/or timber riprap, pre-fabricated equipment mats, or terra mats would be used to reduce rutting and the mixing of topsoil and subsoil. In unsaturated wetlands, the top 12 inches of topsoil from the trenchline would be stripped and stored separately from the subsoil. Topsoil segregation generally would not be possible in saturated soils.

PAPL is requesting a deviation from the Commission's Procedures (section VI.A.3) to allow for the use of a 100- to 125-foot-wide right-of-way on both the Texas Connector and Louisiana Connector Projects to avoid potential safety hazards associated with saturated and/or granular soils, including shifting soils and trench wall collapse (see section 4.7). In addition, PAPL is requesting a deviation from the Commission's Procedures (section VI.B.1) to locate ATWS less than 50 feet from or within wetlands at specific waterbody and road crossings (see section 4.4.2) associated with both the Texas Connector and Louisiana Connector Projects. These are discussed further in sections 4.3 and 4.4.

Where wetland soils are saturated and/or inundated, the pipeline may be installed using the push-pull technique (see table 2.4.3-2). The push-pull technique involves stringing and welding the pipeline outside of the wetland and excavating the trench through the wetland using a backhoe supported by equipment mats. The water that seeps into the trench is used as the vehicle to "float" the pipeline into place together with a winch and flotation devices that would be attached to the pipe. After the pipeline is floated into place, the floats are removed, allowing the pipeline to sink into the trench. Pipe installed in saturated wetlands is typically coated with concrete or equipped with set-on weights to provide negative buoyancy. After the pipeline sinks to the bottom of the trench, a trackhoe working on equipment mats would backfill the trench and complete cleanup.

TABLE 2.4.3-2 **Push-pull Locations for the Texas Connector and Louisiana Connector Projects**		
Starting Milepost	Ending Milepost	Crossing Length (miles)
TEXAS CONNECTOR PROJECT		
Northern Pipeline		
0.0	1.5	1.5
2.6	4.1	1.5
6.2	7.8	1.6
8.9	9.7	0.8
23.8	24.4	0.6
	Northern Pipeline Subtotal	**6.0**
Southern Pipeline		
1.7	2.1	0.4
3.7	6.0	2.3
	Southern Pipeline Subtotal	**2.7**
	Texas Connector Project Total	**8.7**
LOUISIANA CONNECTOR PROJECT		
18.1	18.2	< 0.1
19.2	22.2	3.0
22.3	24.8	2.6
24.9	25.3	0.4
26.2	26.5	0.4
27.2	27.5	0.3
28.3	30.6	2.3
30.9	33.7	2.9
	Louisiana Connector Project Total	**12.7**
	Texas Connector and Louisiana Connector Projects Total	**21.4**

Prior to backfilling, trench breakers would be installed where necessary to prevent the subsurface drainage of water from wetlands. Where topsoil has been segregated from subsoil, the subsoil would be backfilled first followed by the topsoil. Equipment mats, terra mats, and timber riprap would be removed from wetlands following backfilling.

Where wetlands are located at the base of slopes, permanent interceptor dikes and trench plugs would be installed in upland areas adjacent to the wetland boundary. Temporary sediment barriers would be installed where necessary until revegetation of adjacent upland areas is successful. Once revegetation is successful, sediment barriers would be removed from the right-of-way and disposed of properly.

2.4.3.3 Road and Railroad Crossings

Construction across roads would be conducted in accordance with the applicable laws, regulations, and requirements of road and railroad crossing permits obtained by PAPL. Generally, paved roads, unpaved roads where traffic cannot be detoured, and railroads would be crossed by boring beneath the road or railroad without disturbing the road or rail bed or disrupting traffic. Boring involves excavating a pit on each side of the road or railroad, placing the boring equipment in the pit, and then boring a hole under the road or railroad that is at least equal to the diameter of the pipe. Once the hole is bored, a pre-fabricated section of pipe is then pushed through the borehole. At particularly long crossings, pipe sections may be welded onto the pipe string just before being pushed through. Bore crossings for the Projects would typically occur during normal construction work hours. However, if necessary as required by field conditions, borings could be conducted 24 hours per day, 7 days per week until completed. Each bore crossing typically would require between 2 and 10 days to complete from start to finish.

Most gravel and dirt roads would be crossed by the open-cut method, which generally requires temporary lane or road closures and the establishment of detours. Roads would be closed only where allowed by permit or landowner/land-managing agency consent. Most open-cut road crossings require only 1 or 2 days to complete, although resurfacing could require several weeks to allow for soil settlement and compaction. In residential areas, landowners would be provided continued access to their properties throughout construction.

PAPL would construct all road and railroad crossings in accordance with DOT safety standards and would coordinate traffic control measures with the appropriate state and local agencies. Where heavy equipment is known to use a road crossed by the pipeline, special safety measures, such as thicker-walled pipe or additional cover over the pipe, would be required.

2.4.3.4 Agricultural Areas

About 16 percent of the Texas Connector Project's total acreage and about 15 percent of the Louisiana Connector Project's total acreage would affect agricultural land, as identified in section 4.8. PAPL would conserve and segregate topsoil in all actively cultivated and rotated croplands, pastures, and hayfields, or import certified weed- and pest-free topsoil approved by the landowner. PAPL would also segregate topsoil at the specific request of the landowner or land management agency. The topsoil would be stored in separate windrows on the construction right-of-way. The depth of the trench would vary with the stability of the soil, but in all cases, it would be sufficiently deep to allow for at least 3 feet of cover over the pipe. Irrigation systems are not usually used in this part of Texas and none have been identified at this time; however, landowners are encouraged to disclose their locations. If any irrigation systems are damaged during construction, PAPL would attempt to make repairs within 1 week unless otherwise negotiated with the landowner.

2.4.3.5 Major Utilities

The pipelines would be constructed across or parallel to numerous utility lines. Prior to construction, PAPL's construction contractors would use the One Call systems in each state to identify and flag buried utilities before ground-disturbing activities. PAPL would install the pipeline with at least 12 inches of clearance from any other buried utility or underground structure not associated with the pipeline, as required by 49 CFR 192.325. Section 4.9 discusses the major utilities that would be crossed by the Texas Connector and Louisiana Connector Projects.

2.4.3.6 Residential Construction

Construction through or near residential areas would be done in a manner to ensure that all construction activities minimize adverse impacts on residences and that cleanup is prompt and thorough. Access to homes would be maintained, except for the brief periods essential for laying the new pipeline.

PAPL would implement the measures identified in its *Environmental Plan* to minimize construction-related impacts on all residences and other structures located within 50 feet of the construction right-of-way, including:

- attempting to maintain a minimum distance of 25 feet between any residence and the edge of the construction work area;
- installing safety fence at the edges of the construction right-of-way and work areas for a distance of 100 feet on either side of the residence or business establishment to ensure that

construction equipment and materials, including the spoil pile, remain within the construction work area;

- attempting to leave mature trees and landscaping intact within the construction work area unless the trees and landscaping interfere with the installation techniques or present unsafe working conditions;

- ensuring piping is welded and installed as quickly as reasonably possible to minimize the amount of time a neighborhood is affected by construction;

- backfilling the trench as soon as possible after the pipe is laid or temporarily place steel plates over the trench;

- completing final cleanup, grading, and installation of permanent erosion control devices within 10 days after backfilling the trench, weather permitting; and

- restoring private property such as fences, gates, driveways, and roads disturbed by pipeline construction to original or better condition upon completion of construction activities.

In addition, PAPL has provided site-specific RCPs to inform affected landowners of proposed measures to minimize disruption and to maintain access to the residences located within 50 feet of the construction work area. These plans are described in section 4.8.5 and included in appendix F. We invite landowners to comment on their respective plans, if there are concerns.

Construction in residential areas would potentially require use of the drag section or stove pipe techniques to minimize the length of time the pipeline trench remains open across a driveway. The drag section method involves welding several segments of pipe together prior to trenching and backfilling. The stove pipe method is similar but involves trenching, lowering-in, and backfilling each pipe segment one at a time. For the Projects, both methods would typically be completed within 24 hours, and steel plates would be installed over trenches as necessary for temporary driveway access.

2.4.4 Aboveground Facilities Construction Procedures

Construction activities at the Texas Connector Project's North and South Compressor Station and the Louisiana Connector's compressor station sites would include access road construction; site clearing; grading; installing concrete foundations; erecting metal buildings; installing compressors, metering facilities, and appurtenances; and enclosing the property with a security fence. Initial work at the compressor stations would focus on preparing foundations for the buildings and equipment. Building foundations and pipe trenches would be excavated with standard construction earthmoving equipment. Following foundation work, station equipment and buildings would be brought to the site and installed, using any necessary trailers or cranes for delivery and installation. Following installation of the buildings and primary facilities, associated equipment, piping, and electrical systems would be installed. Necessary equipment testing and start-up activities would occur on a concurrent basis, including hydrostatic testing of piping and related facilities.

Construction of the other proposed aboveground facilities, including the meter stations, MLV, and pig launchers/receivers, would involve site clearing and grading as needed to establish appropriate contours for the facilities. Following installation of the equipment, the sites would be graveled, as necessary, and fenced. MLVs would be installed at intervals specified by the DOT or as needed for customer deliveries.

2.4.5 Access Roads

PAPL would use existing roads to access the construction right-of-way as practicable, and improve existing or construct new access roads as necessary to have a 40-foot width and bear the weight of construction vehicle traffic. Following construction, existing access roads would be returned to preconstruction conditions unless otherwise requested by the landowner; new access roads not being used to permanently access a facility would also be returned to preconstruction conditions.

2.4.6 Nonjurisdictional Facilities Construction Procedures

PALNG would relocate approximately 3.3 miles of the existing SH 87 and its collocated utilities prior to constructing the liquefaction facilities to allow ships to access to the marine berth from the Port Arthur Canal. The new 3.6-mile corridor for the highway and utilities would follow an existing electric transmission line around the western boundaries of the liquefaction site. PALNG would acquire all necessary regulatory approvals and agreements with facility owners prior to construction.

For the relocation of SH 87, PALNG would work with the TDOT to design and construct a new highway using standard road construction techniques that traverses around the proposed liquefaction site and connects to the existing highway on either side. Traffic would be allowed to continue as normal on the existing highway while the new roadway is constructed. Once completed and approved, the TDOT would divert traffic onto the new highway and allow PALNG to remove the old road materials and transport them to an approved offsite disposal facility. All aspects of the highway relocation would be subject to TDOT review and approval.

PALNG would also relocate nine existing pipelines and other utilities to run parallel to the relocated SH 87 corridor using construction methods standard for each utility, including the methods for pipeline construction described earlier in this EIS. PALNG would construct new facilities within the relocated corridor while allowing the existing utilities to operate as normal. Once construction is complete, the respective owners of each utility would tie-in the new facilities to the old, abandon any unused utility and pipeline segments per industry and regulatory requirements, and resume operations of the facilities.

As discussed in section 1.4, the power line associated with the Louisiana Connector Project's compressor station would be constructed by another party and, while details regarding this activity are limited, we have considered the impacts associated with the power line in our cumulative impacts analysis.

2.5 ENVIRONMENTAL COMPLIANCE

2.5.1 Compliance Monitoring

The FERC may impose conditions on any Certificate or Authorization granted for the Projects. These conditions could include requirements and mitigation measures identified in this EIS to minimize environmental impacts associated with the Projects (see section 5.2). We will recommend to the Commission that these requirements and mitigation measures (indicated with bold type in the text) be included as conditions to any approving Certificate or Authorization issued for each of the Projects. Once the Projects are authorized, FERC staff would monitor compliance by conducting on-site inspections, reviewing post-authorization filings, weekly, monthly and semi-annual reports depending on the project phase. Further, PALNG and PAPL would be required to implement the construction procedures and mitigation measures it has proposed in its filings with the FERC, including those in appendices of this EIS, unless specifically modified by other Certificate/Authorization conditions.

Other regulatory agencies also may include terms and conditions or stipulations as part of their permits or approvals. While there would be jurisdictional differences between the FERC's and other agencies' conditions, the environmental inspection program for the Projects would address all environmental or construction-related conditions or other permit requirements placed on the Projects by all regulatory agencies.

PALNG would employ one full-time EI for the Liquefaction Project, and PAPL would employ at least four EIs for the Texas Connector and Louisiana Connector Projects (one per spread). The responsibilities of the EIs are described in PALNG's and PAPL's respective *Environmental Plans*.

The EIs' responsibilities include ensuring the environmental obligations, conditions, and other requirements of permits and authorizations for the Projects are met. PALNG's and PAPL's EIs would inspect all construction and mitigation activities to ensure environmental compliance. EIs may also oversee cultural resource and/or biological monitors that monitor and evaluate construction impacts on resources as specified in this EIS.

The FERC staff would also conduct field inspections during construction. Other federal and state agencies may also conduct oversight of inspection to the extent determined necessary by the individual agency. After construction is completed, the FERC staff would continue to conduct oversight inspection and monitoring during operation of the Project to ensure successful restoration. Additionally, the FERC staff would conduct bi-annual engineering safety inspections of the LNG facility operations.

2.6 OPERATION, MAINTENANCE, AND SAFETY PROCEDURES

2.6.1 Liquefaction Project

2.6.1.1 Liquefaction Facilities

The Liquefaction Project would be operated and maintained in accordance with 49 CFR 193, 33 CFR 127, NFPA 59A, and other applicable federal and state regulations.

The estimated 200 personnel employed during operation of the liquefaction facilities would be trained to properly and safely perform their assigned duties. Operators would be trained in the handling of potential hazards associated with LNG, cryogenic operations, and the proper operation of all the equipment. The operators would meet all the training requirements of the USCG, DOT, State Fire Marshall offices of Texas and Louisiana, and other applicable regulatory entities.

The liquefaction site's fulltime maintenance staff would conduct routine maintenance and minor overhauls as necessary. Major overhauls and other major maintenance would be handled by outside maintenance contractors specifically trained to perform the required services. All scheduled and unscheduled maintenance would be entered into a computerized maintenance management system.

2.6.1.2 LNG Vessels

Although LNG carriers and their operation are directly related to the use of the proposed liquefaction facilities, they are not subject to the section 3 authorization sought in this application. LNG carriers arriving at the liquefaction site must comply with all federal and international standards regarding LNG shipping. LNG vessels would travel from the Gulf of Mexico up the Sabine Pass Channel to the Liquefaction Project site along the Port Arthur Canal. The vessel/carriers would depart using the reverse of this course once loaded with LNG. Tug boats would be used to maneuver LNG vessels to and from place at the berths, and would dock at the MOF during LNG loading operations.

LNG vessels transiting the Port Arthur Canal and SNWW are typically designated to have a moving security zone during transit per USCG regulations at 33 CFR 165.805(a)(2). While in transit, LNG vessels are accompanied by a moving security zone that extends 2 miles ahead, 1 mile astern, and from shoreline to shoreline on the SNWW. As a safety and security precaution, no vessels are allowed to meet, cross, or overtake LNG vessels in transit or otherwise enter the security zone without the express permission of the USCG. At its discretion, the USCG may elect to provide escort boats during LNG carrier transits to enforce the moving security zone.

2.6.1.3 Maintenance Dredging

The USACE is responsible for regular maintenance dredging of the Port Arthur Canal and SNWW. PALNG would be responsible for maintenance dredging of its berthing area and turning basin, which could require material removal every 4 to 5 years based on past shoaling rates within the Port Arthur Canal. PALNG would prefer to use the J.D. Murphree WMA for the maintenance dredging during project operations, if opportunities remain for the beneficial use of the dredge material to create marsh habitats. Alternatively, existing dredge disposal areas could be used similar to other projects in the area. PALNG would work with USACE to determine maintenance dredging requirements and obtain long-term maintenance dredging capacity.

2.6.2 Texas Connector and Louisiana Connector Projects

The pipelines and aboveground facilities associated with the Texas Connector and Louisiana Connector Projects would be operated and maintained in accordance with DOT regulations in 49 CFR 192, the Commission’s guidance in 18 CFR 380.15, and PAPL’s construction and restoration plans.

2.6.2.1 Pipeline Surveys and Inspections

As required by 49 CFR 192.615, PAPL would establish an operation and maintenance plan as well as an emergency plan that includes procedures to minimize the hazards in a natural gas pipeline emergency. As a part of pipeline operations and maintenance, PAPL would conduct regular patrols of the pipeline rights-of-way in accordance with DOT requirements, including aerial and ground patrols of the pipeline facilities to survey surface conditions on and adjacent to the pipeline right-of-way for evidence of leaks, unauthorized excavation activities, erosion and wash-out areas, areas of sparse vegetation, damage to permanent erosion control devices, exposed pipe, missing markers and signs, new residential developments, and other conditions that might affect the safety or operation of the pipeline. Any cathodic protection systems would also be inspected to ensure they are functioning properly. In addition, pigs would be sent through the pipeline to check for corrosion and irregularities in the pipe in accordance with DOT requirements. The MLVs located along the pipeline are typically installed with equipment such that it may be remotely operated from a control center. PAPL would be required to keep detailed records of all inspections and supplements to the corrosion protection system as necessary to meet the requirements of 49 CFR 192.

PAPL would also maintain regular contact with the appropriate fire, police, and public officials as part of each of their emergency operating procedures. Communications with these parties would include the potential hazards associated with PAPL’s facilities located in their service area and prevention measures undertaken, the types of emergencies that may occur on or near the new pipeline facilities, the purpose of pipeline markers and the information contained on them, pipeline location information, recognition of and response to pipeline emergencies, and procedures to contact PAPL for more information.

In addition, PAPL would install a SCADA system for the pipeline system that would continuously monitor gas pressure, temperature, and volume at specific locations along the pipeline. These systems would be continuously monitored from PAPL's gas control center and threshold and alarm values would be established to warn operators if critical parameters are exceeded.

2.6.2.2 Right-of-Way Maintenance

In addition to the survey, inspection, and repair activities described previously, operation of the pipelines would include right-of-way maintenance. Rights-of-way would be allowed to revegetate after restoration; however, larger shrubs and brush may be periodically removed near the pipeline. The frequency of the vegetation maintenance would depend upon the vegetation growth rate, and PAPL would regularly mow or clear vegetation from its permanent pipeline rights-of-way and at aboveground facilities in most land uses types. To facilitate periodic corrosion and leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be maintained in an herbaceous state. Vegetation management is discussed further in section 4.5.2.

Pipeline facilities would be clearly marked at line-of-sight intervals and at crossings of roads, railroads, and other key points. The markers would clearly indicate the presence of the pipeline and provide a telephone number and address where a company representative may be reached in the event of an emergency or prior to any excavation in the area of the pipeline by a third party. PAPL would participate in the national and state One Call systems in both Texas and Louisiana.

3.0 ALTERNATIVES

In accordance with CEQ regulations for complying with NEPA (at 40 CFR 1502.14), this EIS compares the environmental impacts of the proposed action against a range of alternatives. Each of the cooperating agencies with obligations under NEPA can use this alternatives analysis as part of its decision-making process. Individual agencies would ensure consistency with their own administrative procedures prior to accepting the conclusions in this EIS.

In accordance with NEPA and Commission policy, we evaluated alternatives to the Projects to determine whether any would be reasonable and have significant environmental advantages compared to the proposed action. The alternatives analyzed consisted of the No-Action Alternative, system alternatives for the Projects, alternative liquefaction terminal locations, alternative pipeline routes, and alternative aboveground facility sites.

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

- the technical and economic feasibility and practicality of each alternative;
- the significance of each alternative's environmental advantages and disadvantages relative to the proposed undertaking;
- the ability of each alternative to reasonably meet PAPL's primary objective of providing up to 2.0 bscfd of natural gas to the Liquefaction Project within a timeframe that would allow contractual obligations to be met; and
- the ability of each alternative to reasonably meet PALNG's primary objective of exporting up to 517 bcf per year of LNG to FTA countries and up to 517 bcf per year of LNG to non-FTA countries.

PALNG and PAPL participated in our pre-filing process during the preliminary design stage for the Projects (see section 1.3). This process emphasized identification of potential stakeholder issues, as well as identification and evaluation of alternatives that could avoid or minimize impacts. We analyzed each alternative based on scoping comments and guidance received from federal, state, and local regulatory agencies. Additional input used during the analysis of alternatives included information provided by PALNG's and PAPL's field surveys, aerial photographs, U.S. Geological Survey (USGS) topographic maps, National Wetlands Inventory (NWI) maps, agency consultations, and other publicly available information. Identical data sources were used when comparing the alternative to the Projects (e.g., NWI maps were used for analyses of both the alternatives and the Projects). The scope, methodology, and results of our alternatives analyses are discussed in the following sections.

It is important to recognize that not all conceivable alternatives are technically and economically feasible and practical. Some alternatives may be impracticable because they are unavailable or incapable of being implemented after taking into consideration costs, existing technologies, and the overall purposes of the Projects.

The FERC or FERC staff does not design LNG terminal and natural gas pipeline projects. Rather, companies propose and design projects in response to market conditions. In turn, we analyze these proposals and identify and disclose a reasonable range of alternatives. In conducting this analysis, it is important to recognize the environmental advantages and disadvantages of the proposed actions in order to focus the analysis on reasonable alternatives that may reduce impacts and offer a significant environmental advantage. A detailed discussion of the environmental consequences of the Projects (both adverse and beneficial) is included in section 4.

It should be noted that we conducted an analysis of the proposed Liquefaction Project site in 2006 (FERC Docket No. CP05-83-000). Although the project proposed in 2006 was to import LNG, similar siting criteria needs are also applicable to an LNG export project. The 2006 analysis concluded that the impacts associated with the Liquefaction Project were acceptable because the project would be mostly located on land that has been historically used for dredge material placement, best fulfilled the technical and economic criteria required to meet the project objectives and had received support of the community and elected officials. Conditions at the Liquefaction Project site have not changed significantly since 2006. Further, although the current proposal is to export LNG, the same criteria that made it an environmentally acceptable site in 2006 exist today, including receiving support from the community and elected officials.

3.1 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, the Projects would not be developed and PALNG's and PAPL's objectives 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). The No-Action Alternative could require that potential end users make different arrangements to meet their needs. Liquefaction terminal and pipeline system expansions of similar scope and magnitude to the Projects would likely result in environmental impacts of comparable significance, especially those projects in a similar regional setting. Therefore, we have dismissed the No-Action Alternative as a reasonable alternative to meet the objectives of the Projects.

3.2 SYSTEM ALTERNATIVES

System alternatives would make use of other existing, modified, proposed, or planned LNG facilities and/or pipeline systems to meet the stated objectives of the proposed Projects. A system alternative generally makes it unnecessary to construct all or part of a proposed project; however, some modifications or additions to another existing system may be necessary to meet the project's purpose and need. Such modifications or additions may result in environmental impacts that could be less than, similar to, or greater than those associated with construction of a proposed project. The purpose of identifying and evaluating system alternatives is to determine whether potential environmental impacts associated with construction and operation of proposed facilities could be avoided or reduced while still meeting the basic objectives of the proposed project.

We reviewed system alternatives to evaluate the ability of existing, modified, proposed, or planned[16] facilities to meet the stated objectives of the Projects, and to determine if a system alternative exists that would have less significant adverse environmental impacts than those associated with the Projects. 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. Our analysis of the system

16 "Proposed projects" are projects for which the proponent has submitted a formal application with the FERC or, for deepwater port projects, with the DOT's Marine Administration and the USCG; "planned projects" are in pre-filing at FERC or have been announced but not been formally proposed.

alternatives is presented in section 3.2.1 for the Liquefaction Project and in section 3.2.2 for the Texas Connector Project and Louisiana Connector Project.

3.2.1 Liquefaction Project System Alternatives

For a system alternative to be viable and recommended, it must meet the purpose and need of the Liquefaction Project, be technically and economically feasible, and offer a significant environmental advantage over the project as proposed. In the case of the Liquefaction Project, it must also be compatible with PALNG's proposal to the DOE to export up to 517 bcf per year of LNG to FTA countries and up to 517 bcf per year of LNG to non-FTA countries. The system alternatives considered in this analysis are depicted on figure 3.2.1-1.

PALNG is proposing to export LNG to FTA and non-FTA countries. The volume of gas (commodity) for FTA countries has already been approved by the DOE (and therefore is determined to be in the public interest by the DOE). The DOE determination for non-FTA countries is pending. The other approved, planned, or proposed LNG export facilities have also either obtained or applied for DOE approval for the export of LNG associated with the production capacity in the respective project plans/proposals. Therefore, for PALNG's customers to obtain LNG from other facilities that have DOE approval for export, those facilities would need to construct additional liquefaction facilities to meet the export capacity proposed by PALNG, and as approved by the DOE authorizations. We recognize that liquefaction capacity may not be fully subscribed at all facilities based on contracts executed as of the writing of this EIS. However, because the DOE's export approval is a determination that the export is in the public interest, we will not speculate that any portion of other LNG terminals' liquefaction capacity is in "excess" or available as an alternative for use by PALNG to meet its project objectives.

Therefore, an expansion of existing facilities would be needed with a similar scope of pre-treatment and liquefaction facilities and possibly additional storage and marine transfer facilities, while any new facility would need a similar scope of pre-treatment, liquefaction, storage, and marine transfer facilities to accommodate the objectives of the proposed Projects. Any expansion of an existing facility could result in environmental impacts that would be similar to the environmental impacts of the proposed action (depending on the environmental resource affected) and may not provide a significant environmental advantage over the proposed project. Each of the planned, proposed, or authorized projects considered as a potential system alternative (either to expand an existing facility or new construction at a proposed terminal site to accommodate the PALNG's project objective) is listed in table 3.2.1-1. Our analysis of system alternatives listed in table 3.2.1-1 assumes and/or considers whether the project has an equal chance of being constructed; has the onsite space required for an expansion to accommodate facilities similar to those proposed for the Liquefaction Project; could be served by a pipeline system(s) for the export of 2.0 bscfd; and has a compatible in-service timeframe to meet the Liquefaction Project's objective. Meeting these criteria would qualify the system as a potential alternative. However, future Commission review and market forces will ultimately decide which and how many of these facilities are built.

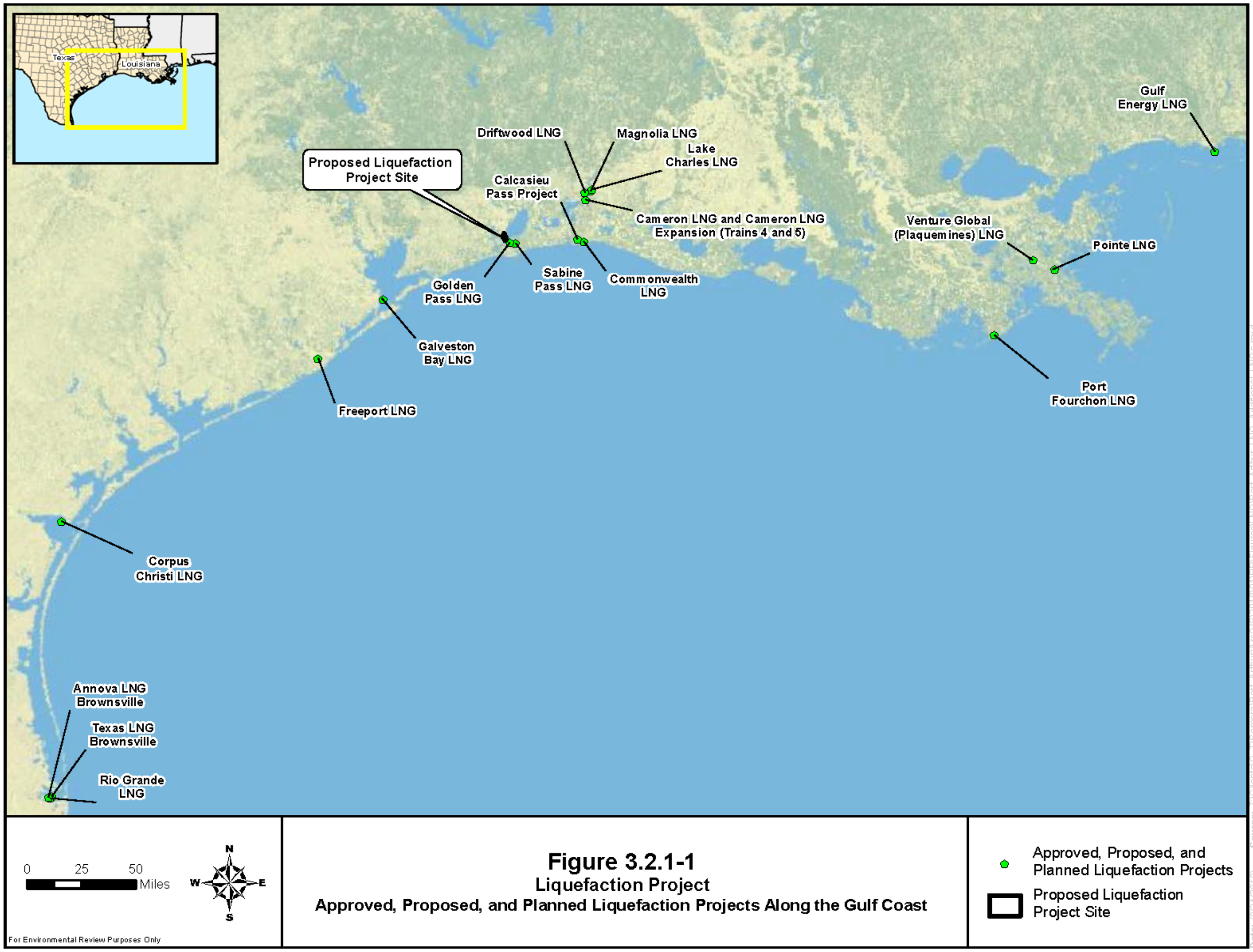

Figure 3.2.1-1
Liquefaction Project
Approved, Proposed, and Planned Liquefaction Projects Along the Gulf Coast

TABLE 3.2.1-1

Approved, Proposed, and Planned Liquefaction Projects Along the Gulf Coast – Summary Profile as System Alternatives

Project/FERC Docket No./Location	Facility Status	Existing or Proposed MTPA	FERC Status	In-Service Target Date	Could Expansion be Permitted/Completed to Meet PALNG Schedule (In-service 2023)?	Adequate Space for Expansion?
Sabine Pass LNG CP11-72-000 and CP14-12-000 *Sabine, LA*	Existing; Import/ Export	20.0	Authorized April 16, 2012 and February 20, 2014.	2016–2017	No	Possibly south of site or north of Highway 82, which forms northern border of site.
Sabine Pass LNG Expansion (Trains 5 and 6) CP13-552-000 and CP13-553-000 *Sabine, LA*	Existing; Export	9.0	Authorized April 6, 2015. As of August 2018, construction continues.	2019	No	See above.
Cameron LNG CP13-25-000, CP13-27-000, and CP13-516-000 *Hackberry, LA*	Existing; Import/ Export	14.95	Authorized June 19, 2014. As of August 2018, construction continues.	2018-2019	No	Possibly west and south of site. However, per Final EIS, higher quality wetlands; existing oil and gas production activities; and greater open water areas in these areas represent disadvantages.
Cameron LNG Expansion (Trains 4 and 5) CP15-560-000 *Hackberry, LA*	Existing; Export	9.97	Authorized May 5, 2016. As of August 2018, construction has not yet begun.	2019	No	No. See above.
Freeport LNG CP12-509-000, CP12-29-000, and CP15-518-000 *Freeport, TX*	Existing; Import/ Export	13.2	Authorized July 30, 2014 and July 7, 2016. As of August 2018, construction continues, with Commission approval requested for commissioning activities for various systems prior to the introduction of hazardous fluids.	2018–2019	No	Possibly south of site and Highway 723. However, area is occupied by residences.
Corpus Christi LNG CP12-507-000 and CP12-508-000 *Corpus Christi, TX*	New; Import/ Export	15.0	Authorized December 30, 2014. As of August 2018, construction continues, with Commission approval requested to introduce gas to Train 1.	2017–2020	No	Possibly west of site. East side of site is bound by existing industrial development.
Lake Charles LNG CP14-119-000, CP14-120-000, and CP14-122-000 *Lake Charles, LA*	Existing; Export	16.45	Authorized December 17, 2015. As of January 2017, construction had ceased.	2019-2020	No	Possibly west of site. However, per Final EIS, physical and safety restrictions due to presence of existing plant infrastructure; lack of direct road access; and LNG pipeline routing constraints in these areas represent significant disadvantages.

TABLE 3.2.1-1 (cont'd)

Approved, Proposed, and Planned Liquefaction Projects Along the Gulf Coast – Summary Profile as System Alternatives

Project/FERC Docket No./Location	Facility Status	Existing or Proposed MTPA	FERC Status	In-Service Target Date	Could Expansion be Permitted/Completed to Meet PALNG Schedule (In-service 2023)?	Adequate Space for Expansion?
Magnolia LNG CP14-347-000 *Lake Charles, LA*	New; Export	8.0	Authorized April 15, 2016. As of August 2018, construction has not yet begun.	2018–2019	No	No. Limited uplands and site is surrounded by Industrial Canal to north, existing industrial development to east and north, and saturated wetlands to south that would require fill.
Golden Pass LNG CP14-517-000 *Sabine Pass, TX*	Existing; Export	15.6	Authorized December 21, 2016. As of August 2018, construction has not yet begun.	2019–2020	No	Yes, south and southeast of site.
Gulf Energy LNG CP15-521-000 *Pascagoula, MS*	Existing; Export	10.0	Application filed June 19, 2015. As of August 2018, the NEPA process continues.	2020	No	No. Site is surrounded by existing industrial development.
Calcasieu Pass Project CP15-550-000 *Cameron Parish, LA*	New; Export	10.0	Application filed September 4, 2015. Draft EIS issued in June 2018; NEPA process continues.	2019	No	Yes, east of facility
Texas LNG Brownsville CP16-116-000 *Brownsville, TX*	New; Export	4.0	Application filed March 31, 2016. As of August 2018, the NEPA process continues.	2020	No	No. Site is surrounded by waterbodies and saturated wetlands that would require fill, and Laguna Atacosa National Wildlife Refuge.
Rio Grande LNG CP16-454-000 *Brownsville, TX*	New; Export	27.0	Application filed May 5, 2016. As of August 2018, the NEPA process continues.	2020	No	No. Limited upland area northeast of site, otherwise surrounded by waterbodies and saturated wetlands that would require fill.
Annova LNG Brownsville CP16-480-000 *Brownsville, TX*	New; Export	7.0	Application filed July 13, 2016. As of August 2018, the NEPA process continues.	2021	No	Possibly east and west of site where existing dredge disposal areas exist.
Freeport LNG Expansion (Train 4) CP17-470-000 *Freeport, TX*	Existing; Export	5.1	Application filed June 29, 2017. As of August 2018, the NEPA process continues.	2020	No	No. Site is surrounded by existing industrial development.
Venture Global (Plaquemines) LNG CP17-66-000 and CP17-67-000 *Plaquemines Parish, LA*	New; Export	20.0	Application filed March 13, 2017. As of August 2018, the NEPA process continues.	2020	No	Yes, primarily east of site.

TABLE 3.2.1-1 (cont'd)

Approved, Proposed, and Planned Liquefaction Projects Along the Gulf Coast – Summary Profile as System Alternatives

Project/FERC Docket No./Location	Facility Status	Existing or Proposed MTPA	FERC Status	In-Service Target Date	Could Expansion be Permitted/Completed to Meet PALNG Schedule (In-service 2023)?	Adequate Space for Expansion?
Driftwood LNG CP17-117-000 and CP17-118-000 *Calcasieu Parish, LA*	New; Export	26.0	Application filed April 11, 2017. As of August 2018, the NEPA process continues.	2025	Possible	No. Limited upland area north and south of site, otherwise surrounded by waterbodies and saturated wetlands that would require fill.
Corpus Christi LNG (Stage 3) CP18-512-000 and CP18-513-000 *Corpus Christi, TX*	Existing; Export	10.0	Application filed June 28, 2018. As of August 2018, the NEPA process continues.	2021	No	No. Site is surrounded by existing industrial development.
Commonwealth LNG PF17-8-000 *Cameron Parish, LA*	New; Export	9.0	Pre-filing initiated August 15, 2017. As of August 2018, the pre-filing process continues.	2022	Possible; however, project is +1 year behind PALNG in the FERC process	Possibly west of site. Existing development and highways immediately north of site.
Port Fourchon LNG PF17-9-000 *LaFourche Parish, LA*	New; Export	5.0	Pre-filing initiated August 21, 2017. As of August 2018, the pre-filing process continues.	2021-2023	Possible; however, project is +1 year behind PALNG in the FERC process	Yes, east and west of site.
Galveston Bay LNG PF18-7 *Galveston County, TX*	New; Export	16.5	Pre-filing request submitted on August 31, 2018.	2027	Possible; however, project is +1 year behind PALNG in the FERC process	No. Site is essentially located on an island in which it encompasses the entire area.
Pointe LNG PF18-8 *Plaquemines Parish, LA*	New; Export	6.0	Pre-filing request submitted on September 14, 2018	2025	Possible; however, project is +1 year behind PALNG in the FERC process	Yes, east and west of site.

As identified in table 3.2.1-1, we reviewed the liquefaction terminals that exist, have been authorized, or are proposed or planned as an alternative to PALNG's project. Our review of the proposed PALNG site in Port Arthur, Texas discussed in section 4 did not discover any significant environmental impacts from the construction of the liquefaction facilities. Additionally, we did not receive any specific comments relating to the use of a specific liquefaction terminal as a system alternative to the proposed site. We note again that the Commission does not design projects. If the Commission ultimately determines that another project would be more appropriate, it could deny a proposal, but it could not force another entity to build a project that it has not proposed. Also, if the market support is not there for a project, and export volumes proposed by one liquefaction terminal are met by another liquefaction terminal, a project may not get built. However, we cannot speculate as to the future state of export markets or any project which might ultimately meet the same market demands as PALNG.

Overall, PALNG and PAPL have designed projects that together incorporate liquefaction facilities and pipelines, respectively, to meet of the overall objectives of both projects. Any other project would also have to consider these dual objectives of not only being able to process and export the same amount of LNG as PALNG, but also being able to acquire the same volumes of natural gas by pipeline from the locations that PAPL proposes and all within a few months of the schedule proposed by PALNG and PAPL. This in and of itself could result in greater environmental impacts for those liquefaction projects located farther from PALNG's site and PAPL's receipt points, as the proposed pipelines are being constructed and operated specifically to serve the proposed liquefaction terminal. Any pipeline(s) constructed from PAPL's gas sources at the lateral and tie-in locations to these alternative liquefaction terminals could be quite extensive (e.g., to the Brownsville, Texas area). Further, the other proposed liquefaction terminals are proposed to be served by pipelines specific to the given project and in quantities needed to meet the objective of the project. These more distant projects would not provide a significant environmental advantage when considered in conjunction with the connecting gas sources. Liquefaction and export projects in proximity to PALNG's site could require less pipeline (such as Sabine Pass and Golden Pass, as those projects would require less pipeline compared to PAPL's southern pipeline), but would still require similar facilities to what PAPL requires to obtain gas from the same interconnects on its Northern Pipeline associated with the Texas Connector Project and Louisiana Connector Project, resulting in similar environmental impacts and not providing any significant environmental advantages.

As mentioned, PALNG's export of LNG (commodity) to FTA countries has already been found in the public interest by DOE. For our analysis, we are assuming that all projects, like PALNG, have contracted volumes that are not available as a direct "replacement" for the export volumes proposed by PALNG, and any other system alternative terminals would require additional volumes above and beyond what they have proposed or have been authorized to replace the liquefaction facilities of PALNG. No other entity has proposed volumes that they contend are a replacement for PALNG's exports.

If we assume that another entity could propose replacement facilities for PALNG's facilities, the applicant would need to provide exactly what the replacement facilities would entail, including their environmental impact, and conduct the corresponding safety and engineering analysis. These data are not available to PALNG, nor do we have this information. A simple one-to-one "placement" of PALNG facilities at another location may not be an accurate representation of what would be required, especially if additional ship traffic would need to be accommodated with additional berths. This analysis would be purely based on speculation and hypotheticals and would not provide the information necessary to inform us in our review or the Commission in its decision-making.

It should also be noted that unlike a pipeline under section 7 of the NGA, an authorization granted under section 3 of the NGA does not grant the applicant eminent domain and, thus, we have limited ability to ensure that a recommended alternative site would be available unless the landowner willingly makes it available for purchase or lease.

Some alternative sites may have the land/waterway available to place the exact facilities proposed by PALNG at another location. The layout of these facilities would also be subject to detailed engineering analysis, so a simple placement of the facilities to determine their comparable environmental impacts would not be an accurate representation as discussed above but could provide a general comparison. In that regard, most other locations would have very similar impacts to PALNG's proposal as they are in coastal areas, and would typically include the permanent fill of wetlands over a similarly sized footprint, and would likely involve impacts on coastal wetlands, waterways, and fisheries (possibly including EFH).

In consideration that any system alternative project sponsor would not be able to engineer, permit, and construct a project within a similar timeframe as proposed by PALNG; other liquefaction terminal export projects have applied to the DOE for export authorization to service expected contracts; no alternative project proponent has proposed a project it contends would replace PALNG's project; and all system alternatives would require additional pipelines to account for the gas sources PAPL is proposing to use to source gas to PALNG, which would result in greater or very similar environmental impacts, we find that none of the system alternatives are a viable replacement to ultimately meet PALNG's objectives.

In conclusion, no system alternative meets the criteria of being technically and economically feasible, provides a significant environmental advantage, and meets the timeframes proposed by PALNG to permit and construct a project and, therefore, we do not recommend any alternative to replace PALNG's proposed facility.

3.2.2 Pipeline Project System Alternatives

To serve as a viable pipeline system alternative to the Texas Connector or Louisiana Connector Projects, the system would need to: 1) transport all or a part of the volume of natural gas required for liquefaction associated with the Liquefaction Project; and 2) cause significantly less impact on the environment than the proposed Texas Connector or Louisiana Connector Projects. Gas provided by a system alternative must connect to the Liquefaction Project site.

Neither PAPL nor its affiliates (Sempra LNG & Midstream and PALNG) currently own or operate existing pipeline infrastructure within the Texas Connector or Louisiana Connector Projects area that, according to PAPL, could provide sufficient capacity from existing regional interstate and intrastate carriers to the Liquefaction Project site.

Based on information provided by PAPL, it met with currently existing natural gas pipeline transportation and storage companies to provide the quantities of feed gas supply required for the Liquefaction Project. The interconnect pipelines would include natural gas supplies from existing ANR, Centana, CGT, Egan, FGT, GTS/CIPCO, HPL, KMLP, NGPL, Pine Prairie, TETCO, TGT, and TGP facilities. While the existing pipelines would have the capacity to provide the required natural gas volumes for the Liquefaction Project when cumulatively combined into the proposed Texas Connector or Louisiana Connector Projects pipelines, it is speculative as to if the gas supplies from proposed interconnections would be available in the quantity needed in the future to serve the Liquefaction Project's stated purpose if provided by a single source such as one expanded pipeline system. As such, PAPL has proposed to diversify its sources of natural gas to ensure adequate volumes are available in the future for the Liquefaction Project. Further, as of the issuance of this EIS, none of these existing pipeline companies have made an announcement to expand its infrastructure to provide service to the Liquefaction Project area.

Other pipeline operators in the area are currently constructing or considering transportation service like the proposed Texas Connector and Louisiana Connector Projects. Golden Pass Pipeline and Creole Trail Pipeline, for example, are currently expanding and could potentially offer similar projects for PALNG and PAPL to consider. However, these alternative projects would likely require the same amount of facilities as PAPL to provide the same service, and these expansions are intended to serve the purpose and need of those projects, which includes proving natural gas to their associated existing LNG terminals. Even if adopted, reducing the number of interconnections would limit the diversity of supply from the interstate and intrastate natural gas markets needed to serve the Liquefaction Project. Beyond the general analysis above, we did not receive any comments requesting us to look at a specific system alternative. Therefore, we did not further consider pipeline system alternatives.

3.3 ALTERNATIVE TERMINAL SITE LOCATIONS

During initial project concept and planning, PALNG considered alternative locations for the Liquefaction Project site along the SNWW using screening criteria to narrow the list of potential terminal sites, as listed in table 3.3-1 and shown on figure 3.3-1. No other potential alternative terminal sites were identified or recommended during project scoping, and because we did not conclude any significant environmental limitations with the proposed site, our alternatives analysis in this EIS focused on the sites referenced above.[17] The alternative sites included the following:

- Alternative Site 1 - Alternative Site 1 is along the west bank of the SNWW across from Mesquite Point and southeast of and directly adjacent to the existing Golden Pass LNG facility.

- Alternative Site 2 - Alternative Site 2 is on the west bank of the SNWW about 0.9 mile north of the Gulf of Mexico.

- Alternative Site 3 - Alternative Site 3 is on the east bank of the SNWW about 0.9 mile north of the Gulf of Mexico.

We received comments from the EPA, Region 6, stating that impacts on aquatic habitats be considered in our alternatives analysis and that impacts on aquatic habitats be avoided or minimized. Consideration of impacts on aquatic habitat is provided in the narrative below.

TABLE 3.3-1

Comparison of the Proposed Liquefaction Project Site and Alternative Terminal Site Locations

Site Screening Selection Criteria	Proposed Site	Alternative 1	Alternative 2	Alternative 3
Access to a Deepwater Channel	Yes	Yes	Yes	Yes
Access to Safety and Security Infrastructure	Yes	Yes	Yes	Yes
Access to Major Roads and Barge Traffic	Yes	Yes	Yes	Yes
Sufficient Size as Currently Proposed/Land Available for Expansion	NA/Yes	NA/Yes	NA/No	NA/Yes
Utilities Available	Yes	Yes	Yes	Yes
Practicable Site	Yes	Yes	No	Yes
Aquatic Habitat Characteristics (relative to the Proposed Site)	Low to Moderate	Higher Quality	Higher Quality	Higher Quality

17 We also incorporate by reference our previous alternatives analysis for the site in FERC Docket No. CP05-83-000. See discussion in text.

0 1.5 3 Miles

N W E S

For Environmental Review Purposes Only

Figure 3.3-1
Liquefaction Project
Alternative Facility Sites

Proposed Liquefaction Project Site
Alternative Facility Sites

At Alternative Site 1, a historical dredge material deposition area occupies about 60 acres; the remainder consists of tidal coastal marsh. The wetland value of the tidal coastal marsh within Alternative Site 1 is greater than that found at the proposed site, most of which has been subjected to drainage and the deposition of dredge material. Due to the lack of sufficient upland habitat to provide suitable area for construction of the facilities, impacts on higher quality wetlands would be greater than the proposed site. Further, Alternative Site 1 lacks existing dock structures for material off-loading. As such, Alternative Site 1 would have greater impacts on aquatic resources and was removed from further consideration.

About 90 percent of the Alternative Site 2 is within the Texas Point National Wildlife Refuge (NWR), a refuge designated as a Globally Important Bird Area of the United States by the American Bird Conservancy. Because of this designation and higher quality aquatic habitat, impacts would be greater than at the proposed site. As such, Alternative Site 2 was removed from further consideration due to the lack of available land and the potential impacts on environmental resources associated with the NWR.

Alternative Site 3 predominantly consists of relatively undisturbed tidal coastal marsh. The only upland area at the site represents about 1.5 percent of the total acreage of Alternative Site 3. Vehicular access to the alternative site is currently not available. Therefore, PALNG estimates that a 2.5-mile-long access road would need to be constructed, and bridges would need to be improved or constructed to provide service for facility personnel, maintenance and supply trucks, and emergency responder vehicular traffic. Due to the proximity to the Gulf of Mexico and wetlands characterized by shallow tidal marshes, extensive salt cordgrass meadows, existing tidal channels, and the abundance of habitat preferred by migratory and pelagic bird species, the habitat value of wetlands at Alternative Site 3 are greater than the proposed site. As such, Alternative Site 3 was removed from further consideration.

In addition to the above, we conducted an analysis of the proposed Liquefaction Project site in 2006 (FERC Docket No. CP05-83-000). Although the project proposed in 2006 was to import LNG, similar siting criteria needs are also applicable to an LNG export project. Based on a regional alternatives analysis of ports in Port Arthur, Texas, and Port Plaquemines and Lake Charles, Louisiana, as well as potential sites in Florida, Mississippi, and Alabama, and along the Mississippi River; suitable port areas, including consideration of channel depth, air draft, and proximity to natural gas pipeline systems, although there were other developable sites for the import/export of LNG, none provided a significant environmental advantage over the proposed site. The 2006 site selection analysis was further refined to consider channel access (e.g., availability of a channel with enough depth, width, and air draft for the operation of a typical LNG vessel); current zoning, including compliance with DOT siting criteria (49 CFR 193); and enough area available to accommodate the proposed facilities, the safety features required by 49 CFR 193 and NFPA 59A (2001), and the berthing facilities.

As previously mentioned, the 2006 analysis concluded that the impacts associated with the proposed site were acceptable because the project would be mostly located on land that has been historically used for dredge material placement, best fulfilled the technical and economic criteria required to meet the project objectives, and had received the support of the community and elected officials. Those conditions have not changed significantly since 2006.

Alternative configurations of the Liquefaction Project's facilities were evaluated, design of the site was limited by the siting requirements of 49 CFR 193, NFPA 59A (2001), and industry and engineering standards. Regulatory requirements stipulate that potential thermal exclusion and vapor dispersion zones remain onsite; therefore, those requirements dictate the locations of specific pieces of equipment for the liquefaction facilities. Similarly, thermal radiation zones associated with flares require specific distances from other pieces of equipment and from property lines. The selected location of each of the components of the expanded terminal was based on the relevant regulations, codes, and guidelines. Finally, the marine berthing and offloading facilities are dependent on proximity and access to the Port Arthur Canal.

The proposed site consists primarily of PEM and palustrine shrub scrub wetland and vegetation types. PALNG would minimize impacts on wetlands and EFH by adopting the construction methods described in section 4.4.2.

The current facility footprint has been designed to minimize the impact on aquatic habitats, while maintaining the required regulatory siting and safety requirements. We did not identify any alternative configurations that would meet the regulations, codes, and guidelines while avoiding or reducing impacts when compared to those of the proposed site configuration. Therefore, we conclude that the proposed general configuration of the Liquefaction Project's facilities is acceptable.

3.4 ALTERNATIVE PIPELINE ROUTES

The proposed Texas Connector Project pipeline routes would be collocated with existing pipeline and other utility rights-of-way for about 43 percent of their combined lengths (see appendix L). The proposed Louisiana Connector Project pipeline route would be collocated with existing pipeline and other utility rights-of-way for about 73 percent of its length. In addition, where collocated with other pipelines owned and operated by one of its affiliates, the Louisiana Connector Project would be offset from the existing pipeline by 25 to 35 feet, where feasible. This would limit environmental impacts compared to a non-collocated route. In addition, PAPL incorporated minor route variations into the Texas Connector Project and Louisiana Connector Project routes as a result of environmental and engineering investigations, stakeholder outreach efforts, and potential issues identified by FERC staff. As a result of these routing considerations during early project design and identified during the pre-filing process, route modifications to avoid or reduce environmental impacts were eventually proposed as part of the projects in PAPL's section 7(c) applications. The associated environmental impacts are included as part of the overall analysis in section 4 of this EIS.

Generally, shorter route lengths are correlated with lower construction costs and fewer environmental impacts, although variables other than pipeline length (e.g., terrain, existing land development, sensitive natural resources) may weaken these correlations. Starting with the baseline route, PAPL implemented broad-scale adjustments to avoid or minimize crossings of wetlands, waterbodies, and forested land. Further, PAPL proposes to use the HDD method at 25 locations along the Texas Connector Project and 26 locations along the Louisiana Connector Project. As discussed throughout the EIS, use of the HDD method would avoid direct impacts on the features that exist between the entry and exit points. Compared to other pipeline projects of similar size, this is a relatively large number of HDDs that would further avoid impacts on resources.

Another consideration in selecting the pipeline routes is their location and ability to interconnect with existing natural gas systems in order to provide 2.0 bscfd of natural gas to the Liquefaction Project. For example, of the nine interconnects proposed for the Louisiana Connector Project, six are east of the compressor station at MP 96.4. Adopting a route that ends prior to or at this point would be shorter and, thus, result in few overall environmental impacts. However, it would not ensure the capacity necessary to serve the Liquefaction Project. The diversity and number of interconnect opportunities is a critical factor in serving the Projects' purposes and need.

We analyzed the regional setting of PAPL's pipeline routes and determined that different routes (which would likely be longer) between other points of interconnection would not offer any environmental advantage, irrespective of engineering feasibility or cost. We identified minimal environmental impacts associated with the construction and operation of the proposed facilities. With the exception of the alternatives along the Louisiana Connector Project discussed below, we did not identify any environmental concerns that indicate a need to identify and evaluate any additional alternative routes for the Texas

Connector and Louisiana Connector Projects, nor were any alternatives suggested during the scoping period.

3.4.1 Sabine Lake Alternative

Sabine Lake is a 90,000-acre salt water estuary on the Texas-Louisiana border that is about 14 miles long and 7 miles wide. The proposed Louisiana Connector Project's pipeline route would cross the lake for about 18 miles, with the majority of the route on the Texas side of the lake. PAPL considered an alternative early in project design to avoid crossing Sabine Lake, and considered routes located primarily on the Louisiana side of the lake versus the Texas side, as further summarized below.

Any route that avoids Sabine Lake to the west would cross urban/industrial areas in and around the City of Port Arthur and add about 30 miles of additional pipeline. The additional miles of pipeline construction would result in additional land use, wetland, waterbody, vegetation, and aquatic resource impacts, including crossing the Neches River, compared to the proposed route. Any route that avoids Sabine Lake to the east would need to cross the Sabine NWR, which borders about 10 miles of Sabine Lake. The NWR is managed to provide habitat for migratory waterfowl and other birds and to preserve and enhance coastal marshes for wildlife and fish. Also, according to the FWS, some of the largest wetland management efforts in Louisiana occur at the Sabine NWR. An easterly route would also encounter Calcasieu Lake, which is about 20 miles east of Sabine Lake and bordered on both sides by the Sabine NWR. A route alternative to avoid Sabine Lake, the Sabine NWR, and Calcasieu Lake would add about 50 miles of additional pipeline. As with a route to the west, the additional miles of pipeline construction would result in additional land use, wetland, waterbody, vegetation, and aquatic resource impacts, compared to the proposed route. As a result, routing the project to avoid Sabine Lake was eliminated from consideration.

A route that would cross Sabine Lake primarily on the Louisiana side was also considered by PAPL during early project design. This alternate route would be about 0.1 mile longer than the proposed route; however, it would be collocated with the Kinder Morgan pipeline right-of-way for about 66 percent of its length through the area and would have fewer foreign pipeline crossings. The primary disadvantage of this route is that it would cross Tier 1 Public Oyster Seed Grounds in Louisiana and, based on PAPL's consultations with the LDWF, Tier 1 level protected oyster habitat would be affected. As a result of the LDWF's concerns regarding potential impacts on oyster habitat, crossing Sabine Lake primarily on the Louisiana side was eliminated by PAPL from consideration.

We agree with these determinations and do not recommend either Sabine Lake Alternative (avoidance or the Louisiana side crossing). Further, regarding the Sabine Lake crossing, no comments were received asking us to examine any additional alternative routes and, as such, no alternative routes were considered for the Sabine Lake crossing.

3.4.2 Driftwood Route Alternative

Between approximate MPs 45.3 and 55.8 of the Louisiana Connector Project, PAPL has proposed a route that is collocated with a pipeline route proposed by Driftwood Pipeline LLC (DWPL) (FERC Docket Nos. CP17-117-000 and CP17-118-000). In some locations, the pipelines are proposed in the same workspace areas where construction right-of-way space is confined and limited such that there is not sufficient space to accommodate two new pipeline easements. As a result, and per our request, PAPL reviewed Driftwood's proposed alignment and developed an alternative route through this area in the event that the proposed Driftwood pipeline is certificated and authorized for construction. The following provides a detailed analysis of the resources that would be affected by an alternative route, referred to as the Driftwood Route Alternative, compared to the proposed route between MPs 45.3 and 55.8 (see appendix G).

The Driftwood Route Alternative begins at Louisiana Connector Project MP 45.3, diverges east and within 50 to 135 feet of the proposed route for 1.1 miles, and rejoins the proposed route at MP 46.4 until MP 46.7. The Driftwood Route Alternative then diverges east again and within 50 to 55 feet of the proposed route for about 0.3 mile until MP 47.1. At this point, the alternative follows the proposed route for 0.8 mile and includes an HDD of Walker Road before diverging east again and within 45 to 50 feet from the proposed route until MP 48.2. At MP 48.2, the Driftwood Route Alternative diverges further east of the proposed route, crossing a levee/canal and the proposed route via two HDDs, and then parallels proposed route to the west at MP 49.1. After this point, the alternative route is parallel to and about 10 to 280 feet to the west of the proposed route for 2.5 miles and includes an HDD crossing of Interstate Highway 10. At MP 51.6, the Driftwood Route Alternative crosses to the east and then west of the proposed route, within 2 to 35 feet, until rejoining the proposed route at MP 52.4. The Driftwood Route Alternative follows the proposed route for 2.4 miles, crossing the Houston River Canal via an HDD at MP 54.7, and at MP 54.81, it again diverges east and within 30 to 65 feet of the proposed route until rejoining the proposed route at MP 55.80.

Table 3.4.2-1 provides a comparison of the environmental impacts associated with both routes.

TABLE 3.4.2-1

Comparison of the Driftwood Route Alternative to the Louisiana Connector Project Route between MPs 45.3 and 55.8

Factor (Unit)	Proposed Route	Driftwood Route Alternative
Pipeline Length (miles)	10.5	10.6
Temporary Construction Workspace (acres)	160.4	163.7
Pipeline Permanent Easement (acres)	64.5	70.3
Existing Sempra Pipeline Crossings (number)	4	4
Adjacent or Collocated with Other Existing Rights-of-Way (percent)	73	68
Residences within 100 feet of Pipeline Centerline (number)	2	1
Upland Forested Impacts (acres)	25.3	30.2
Forested Wetland Impacts (acres)	43.6	51.5
Non-forested Wetland Impacts (acres)	45.5	43.2
Waterbody Crossings (number)	16 (7 via HDD)	9 (7 via HDD)
Major Waterbody ($\geq$ 100 feet) Crossings (number)	3	3

In general, and similar to the proposed route, PAPL would use a nominal 125-foot-wide construction right-of-way in upland areas, a nominal 125-foot-wide construction right-of-way in saturated wetlands, and a nominal 100-foot-wide construction right-of-way in non-saturated wetlands. PAPL has indicated that it would prefer to overlap its proposed construction workspace with Sempra's existing Cameron Interstate Pipeline easement where feasible to maximize the use of previously disturbed areas. It should be noted that PAPL is a subsidiary of Sempra and, as such, use of the existing right-of-way for the Louisiana Connector Project route through this area is acceptable to Sempra. In those areas of collocation with its affiliate, PAPL would be able to reduce the permanent right-of-way needed, thus minimizing impacts compared to having to "swing out" into adjacent areas to accommodate the alternative. PAPL would adopt five HDDs along the alternative route, including Walker Road, Interstate Highway 10, the Houston River Canal, and two HDDs across the levee/canal system near MP 48.5. In addition, PAPL would use the same construction and restoration measures for the Driftwood Route Alternative as the proposed route as described in section 2.4.2.

The Driftwood Route Alternative would be slightly longer and, as a result, would impact about 3.3 acres more land during construction and 5.8 acres more land during operation when compared to the proposed route. The proposed route would be collocated with existing rights-of-way for a greater percent of its length than the Driftwood Route Alternative, which is primarily the result of the route alternative deviating from Sempra's existing Cameron Interstate Pipeline to avoid a levee/canal. The proposed route would be within 50 feet of one additional residence than the Driftwood Route Alternative; PAPL developed a site-specific RCP for the two residences along this segment of the Louisiana Connector Project. The number of waterbody crossings identified by PAPL's field surveys would be greater along the proposed route compared to the route alternative. All waterbody crossings would be conducted in accordance with the measures outlined in PAPL's *Environmental Plan,*[18] which includes the Commission's Plan and Procedures.

With the exception of an area between approximate MPs 48.3 and 49.1, the Driftwood Route Alternative workspace would be wholly or partially located within the environmental corridor surveyed for cultural and biological resources along the Louisiana Connector Project. As such, the impacts and mitigation measures developed for sensitive features would generally be the same for both routes. According to PAPL, it consulted with the FWS regarding federally threatened and endangered species that may be affected by the Driftwood Route Alternative, and no additional federally threatened and endangered species are anticipated to be affected by the Driftwood Route Alternative. Further, no suitable habitat for the red-cockaded woodpecker was identified along the Driftwood Route Alternative. In addition, PAPL consulted with the Louisiana Office of Cultural Development and conducted cultural resource investigations along the Driftwood Route Alternative to determine if such resources are likely to be affected; no additional cultural resources are anticipated to be affected by the Driftwood Route Alternative.

While both routes would result in similar impacts on environmental resources due to their relatively close alignment and overall length, the proposed route would be shorter and result in fewer impacts on land uses including upland forest and forested and non-forested wetlands. In addition, the proposed route would have the advantage of being more closely aligned with, and even overlapping, areas previously disturbed and/or currently maintained for the Cameron Interstate Pipeline. For these reasons, we determined that the proposed Louisiana Connector Project route between MPs 45.3 and 55.8 is the preferred alternative. However, we also conclude that should PAPL's proposed right-of-way be unavailable, the Driftwood Route Alternative would meet the project objectives, and the impacts associated with the route alternative would be environmentally acceptable and appropriately mitigated for through use of PAPL's construction and restoration plans (e.g., *Environmental Plan*).

We do note that PAPL's proposed project does convey a slight environmental advantage compared to Driftwood's proposed pipeline project because of PAPL's colocation with its affiliate pipeline, which would slightly reduce the need for new permanent right-of-way for PAPL.

3.5 ALTERNATIVE ABOVEGROUND FACILITY SITES

We considered the need to evaluate potential alternative sites for aboveground facilities associated with the Texas Connector and Louisiana Connector Projects. In general, compressor station requirements are dependent on the length of the project, the pressure of the existing feed source(s), and the distance traveled to achieve the required pressure at the receipt meter station. In selecting its proposed sites, PAPL reviewed several potential compressor stations locations along the pipeline routes, looking at design and potential impacts on the surrounding public and environmental resources. We did not identify any significant environmental concerns with PAPL's proposed sites. We did not receive any comments on or

18 *Environmental Plans* for the Texas Connector Project and Louisiana Connector Project were filed on December 12, 2017 and October 16, 2017, respectively. These plans can be found on the FERC eLibrary website using Accession Numbers 20171212-5147 (Texas Connector Project) and 20171016-5210 (Louisiana Connector Project).

objections to the proposed sites, nor did we receive any suggested alternative locations. PAPL's preliminary site investigations determined that the proposed sites were well-suited with regards to engineering and hydraulic constraints, and posed minimal environmental impact. We agree, and as such did not evaluate site alternatives for the compressor stations.

All of the Texas Connector and Louisiana Connector Projects meter stations would be within existing natural gas pipeline rights-of-way and/or reflect customer and system requirements. The locations of other facilities such as MLVs and pig launchers and pig receivers are dependent on DOT regulations and are located within the permanent right-of-way and/or associated with another aboveground facility. We did not identify any significant environmental concerns with PAPL's proposed sites for the meter stations, MLVs, pig launchers, or pig receivers. We did not receive any comments on or objections to the proposed sites, nor did we receive any suggested alternative locations. PAPL's preliminary site investigations determined that the proposed sites were well-suited with regards to engineering and hydraulic constraints, and posed minimal environmental impact. We agree, and as such did not evaluate site alternatives for the meter stations, MLVs, pig launchers, or pig receivers.

4.0 ENVIRONMENTAL IMPACT ANALYSIS

This section of the draft EIS provides our analysis of impacts on the affected environment as it currently exists and the environmental consequences of construction and operation of the Projects. The section is organized by the following major resource topics: geology; soils; water resources; wetlands; vegetation; wildlife, including aquatic resources and EFH; special status species; land use, recreation, special interest areas, and visual resources; socioeconomics; cultural resources; air quality and noise; reliability and safety; and cumulative impacts.

The environmental consequences of constructing and operating the Projects would vary in duration and significance. Four levels of impact duration were considered: temporary, short term, long term, and permanent. Temporary impacts generally occur during construction with the resource returning to pre-construction condition almost immediately afterward. Short-term impacts could continue for up to 3 years following construction. Impacts were considered long term if the resource would require more than 3 years to recover. A permanent impact could occur as a result of any activity that modifies a resource to the extent that it would not return to pre-construction conditions during the life of the Projects.

We considered an impact to be significant if it would result in a substantial adverse change in the physical environment. The applicants, as part of their proposals, developed certain mitigation measures to reduce the impact of the Projects. In some cases, we determined that additional mitigation measures could further reduce the Projects' impacts. Our additional mitigation measures appear as bulleted, boldfaced paragraphs in the text of this section and are also included in section 5.2. We will recommend to the Commission that these measures be included as specific conditions in any Certificate or Authorization the Commission may issue to the applicants for these Projects.

The conclusions in the draft EIS are based on our analysis of the environmental impact and the following assumptions:

- The applicants would comply with all applicable laws and regulations.
- The proposed facilities would be constructed as described in the applicants' various application materials and filed supplements, as summarized in section 2.0 of the EIS.
- The applicants would implement the mitigation measures included in their applications and supplemental submittals to the FERC and cooperating agencies, and in other applicable permits and approvals.
- The applicants would comply with our recommended mitigation measures that become conditions in any Commission authorization.

4.1 GEOLOGY

4.1.1 Geologic Setting

The Projects are within the West Gulf Coastal Plain section of the Coastal Plain physiographic province (Fenneman, 1928) and within the Coastal Prairies subprovince, which is characterized by nearly flat geologic strata and topography with typically less than 1-foot-per-mile gradient (Bureau of Economic Geology, 1996).

Chenier plain and coastal plain sediments consisting of unconsolidated sand, silt, and clay occur at the land surface in the Projects area. The Chenier plain is characterized by two types of landforms: broad marshes containing organic clays and peat, and long, narrow relict beach features called "cheniers" that appear as ridges parallel to the coast. Chenier ridges form as a result of cyclic shoreline advance and retreat, and are mixtures of silt, sand, and shell fragments. They are slightly elevated features that attain elevations of 5 to 10 feet above sea level. These geologic materials were deposited by fluvial, tidal, littoral, and deltaic processes over the past 5,000 years (Fisher et al., 1973). The land surface near the Sabine-Naches Waterway has been modified by placement of dredge material. The topography in the Liquefaction Project area ranges between 1 and 11 feet AMSL. The topography in the Texas Connector Project area ranges between 1 and 15 feet AMSL. The topography in the Louisiana Connector Project area ranges between near mean sea level and 78 feet AMSL.

At the liquefaction site, the sedimentary units within the upper 70 to 100 feet of the surface contain normally consolidated clays, overlying slightly to generally over-consolidated soils to a depth of about 170 feet below the ground surface (Fugro, 2017a). Intermittent sand layers of varying thickness also occur within the soil stratigraphy. Shell fragments and shell hash occur throughout the sand, silt, and clay layers. Organic materials ranging from below 10 percent to 28 percent organic content also occur at various depths. Within the liquefaction site, dredged materials consisting of clay, silty clay, silts, and clayey silts overlay the natural terrain to a depth ranging from 10 to 14 feet.

Bedrock geologic units underlying the Projects are predominantly Cenozoic sedimentary rocks, including sandstone, claystone, and tuff. The depth to bedrock ranges from 200 to several thousand feet, and neither outcrops or near-surface bedrock are present in the Projects area. As such, no blasting would be necessary for construction of the Projects facilities due to the depth of bedrock.

Regarding the Liquefaction Project nonjurisdictional facilities, which includes the realignment of SH 87 and associated pipelines and utilities, the geological resources and hazards described for the Liquefaction Project are also applicable to these facilities unless discussed separately. In addition, due to their proximity to the liquefaction site and location along the Northern Pipeline corridor associated with the Texas Connector Project, the geologic resources and hazards described for the dredge disposal areas (J.D. Murphree WMA and Dredge Disposal Areas 8, 9A, and 9B) and associated temporary dredge material pipelines are also applicable to these facilities unless discussed separately.

4.1.2 Mineral Resources

Mineral resources found near the Projects in southeastern Texas and southwestern Louisiana include sand, gravel, salt, and sulfur (with associated crude oil) (USGS, 2013; 2015). Appendix H lists the mineral resources within 0.25 mile of the Projects.

No active or inactive surface sand, gravel mines, salt resources, or sulfur-from-oil extraction plants exist on the Liquefaction Project site. There are, however, four abandoned oil or gas wells on the site, and there are other oil and gas wells greater than 0.25 mile away from the site (see appendix H).

There are 356 oil and gas wells, 1 abandoned surface gravel pit, and 1 abandoned sulfur mine (Spindletop Dome Mine) within 0.25 mile of the Texas Connector Project; and 129 oil and gas wells within 0.25 mile of the Louisiana Connector Project (see appendix H). Regarding the Louisiana Connector Project, 12 oil or gas wells are within 150 feet of the proposed centerline; however, these wells are all listed as plugged and/or abandoned, or dry and plugged. Therefore, there are no wells within 150 feet of the Louisiana Connector Project centerline that could be placed back in service.

Regarding the Liquefaction Project nonjurisdictional facilities, the mineral resources identified for the Liquefaction Project are also applicable to these facilities, including two oil and gas wells in the road and utility corridor. These wells were permanently plugged and abandoned, the first in 2004 and the second in 2013.

Construction of the Projects would not affect any known mineral resources or active wells, pits, or mines. However, the Projects would affect at least four abandoned wells. Although no other abandoned wells have been identified, because of the history of the Projects area, other abandoned wells may be discovered during surveying and construction of the Projects. PALNG and PAPL have not indicated what steps they would take if construction could impact an abandoned well. Therefore, **we recommend that:**

- **<u>Prior to construction of the Projects</u>, PALNG and PAPL should file with the Secretary of the Commission (Secretary) for review and written approval by the Director of OEP a project-specific plan for construction near known abandoned wells. This plan should identify actions to be taken if any unidentified wells are discovered during construction and discuss how PALNG or PAPL would maintain the integrity of any plugged wells.**

4.1.3 Geologic Hazards

Geologic hazards are natural, physical conditions that can result in damage to land and structures, or injury to people. Potential geologic hazards in the Projects area include earthquakes, surface faults, soil liquefaction, subsidence, karst, landslides, and flooding. In general, the potential for geologic hazards to significantly affect construction or operation of the proposed Projects facilities is low.

4.1.3.1 Geotechnical Site Characterization

Liquefaction Project

Section 4.12.5.2 provides a discussion of the engineering review completed for the proposed liquefaction site, including safeguards built into the engineering design to reduce the risk of an incident occurring and impacting the public and the results of a geotechnical and structural design review. The discussion in section 4.12.5.2 focuses on the resilience of the liquefaction facilities against natural hazards, including extreme geological, meteorological, and hydrological events, such as earthquakes, tsunamis, seiche, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea level rise, landslides, wildfires, volcanic activity, and geomagnetism.

Texas Connector and Louisiana Connector Projects

The North and South Compressor Stations associated with the Texas Connector Project would be underlain by the Beaumont Formation and unnamed alluvium, respectively, which are both predominantly clay. The proposed Louisiana Connector compressor station site is underlain by alluvium and Prairie Terraces, which are both predominantly clay. PAPL stated that it would conduct geotechnical investigations of these sites to demonstrate the site preparation and foundation designs would be appropriate for the underlying soil characteristics and generally accepted good engineering practices. However, the results of these investigations were not available at the time the draft EIS was prepared. Because these investigations have not yet been provided, **we recommend that:**

- **<u>Prior to construction of the compressor stations associated with the Texas Connector and Louisiana Connector Projects</u>, PAPL should file with the Secretary the results of geotechnical studies for the compressor stations, including any recommended mitigation measures PAPL would adopt as part of the final engineering design.**

4.1.3.2 Earthquakes and Faults

Most significant earthquakes around the world are associated with tectonic subduction zones, where one crustal plate is overriding another (e.g., the Japanese islands), where tectonic plates are sliding past each other (e.g., California), or where tectonic plates are converging (e.g., the Indian Subcontinent). Unlike these highly active tectonic regions, the Gulf Coast region occurs in a relatively seismically quiet part of the North American tectonic plate. However, earthquake ground motions do occur in the Projects area, primarily caused by distance earthquake sources such as the New Madrid fault zone in southeastern Missouri. Also present in the Projects area are growth faults and faults associated with salt domes, which are not considered to be the sources of significant earthquakes (not seismogenic). Salt domes are formed when a thick bed of salt minerals intrude vertically into surrounding rock layers, due to the relative buoyancy of salt when buried beneath other sediments, which can result in radial faulting around the salt dome. Growth faults in southern Texas and Louisiana formed during periods of rapid basin subsidence as a result of accelerated deposition of sediment more than 12 kilometers thick (Crone and Wheeler, 2000). Growth faults developed parallel to the coastline in a process of gradual creep in response to dewatering and compaction of the massive thickness of sediment during the Pleistocene (Stevenson and McCulloh, 2001).

Earthquakes can result in displacement of bedrock along fault lines. For a fault to be considered active, displacement must have taken place in the past 10,000 years (USGS, 2008). Subsurface or blind faults are considered to present generally less potential for displacement of bedrock during earthquakes, in contrast to surface faults. The USGS has completed several studies to identify Quaternary (less than 2.6 million years old) faults and other tectonic structures in the eastern United States (Crone and Wheeler, 2000; Wheeler, 2005), resulting in the Quaternary Fault and Fold Database that tracks Quaternary faults, liquefaction features, and other tectonic potential tectonic features (USGS, 2006). These features are evaluated and classified into one of four categories (Crone and Wheeler, 2000):

- Class A – Features that have geologic evidence that demonstrates the existence of a Quaternary fault or tectonic origin either exposed by mapping or inferred deformational features.
- Class B – Features that have geologic evidence that is indicative of a Quaternary deformation, but the fault is not deep enough to be a potential source for earthquakes or the evidence available is too significant to assign a fault as Class B, but not enough to assign as Class A.
- Class C – Features that do not have sufficient evidence to demonstrate the existence of a tectonic fault, or Quaternary slip or deformation associated with the feature.
- Class D – Features that are defined by the USGS as not to be seismogenic.

The Projects would not intersect any known, mapped, or inferred active fault lines (USGS, 2006); however, they are within the Gulf-Margin Normal Faults region, which is identified as a Class B feature in the Quaternary Fault and Fold Database (Crone and Wheeler, 2000). The Gulf-Margin Normal Faults are present in poorly lithified rock and sediments and do not extend into crystalline basement bedrock. Therefore, they are unable to produce significant seismic ruptures that could generate damaging ground motion. Several additional studies have been identified (Bernreuter et al., 1989; Frankel et al., 2002; Hanson et al., 1999; Savy et al., 1998; Wheeler, 2005; Wheeler and Crone, 2001) that do not consider the Gulf-Margin Normal Faults to be seismogenic. Instead, they imply that these faults occur in weak sedimentary rocks that are unable to store sufficient strain energy needed to produce seismic ruptures that could generate damaging ground motion.

The nearest salt domes are about 15 miles or more from the Liquefaction Project and Texas Connector Project areas, near Port Neches, Hillebrand Bayou, and Salt Bayou (Kosters et al., 1989). Most faults in the Liquefaction Project area are active in response to oil and gas exploration and pumping; however, no detected earthquakes have been attributed to the mapped growth fault systems (Stevenson and McCulloh, 2001). Along the Louisiana Connector Project, the nearest salt dome is in Sulfur, Louisiana, 0.6 mile west of MP 53.5 (USGS, 2013).

The Gulf Coast from Florida to east Texas periodically experiences small earthquakes, but they rarely cause property damage. The area also infrequently experiences long-period low-amplitude ground motion from rare distant earthquakes along the New Madrid fault zone in southeastern Missouri (ABS Consulting Inc., 2004). The nearest earthquake to the Projects facilities in Texas was a Magnitude 3.3 earthquake in 1952 centered 9.5 miles northeast of the northern limits of the Texas Connector Project and 9 miles northwest of MP 21 along the Louisiana Connector Project. The nearest earthquake to project facilities in Louisiana was a Magnitude 3.8 earthquake in 1983 near MP 53 along the Louisiana Connector Project route (Petersen et al., 2014a). Earthquakes of Magnitude between 3.0 and 3.9 are typically felt by people indoors, especially on upper floors of buildings. Standing automobiles may rock slightly, and minimal structural damage occurs.

The shaking during an earthquake can be expressed in terms of the acceleration due to gravity (g). Seismic risk can be quantified by the motions experienced by the ground surface or structures during a given earthquake, expressed in terms of g. For reference, peak ground acceleration (PGA) of 10 percent of gravity (0.1 g) is generally considered the minimum threshold for damage to older structures or structures not made to resist earthquakes.

The USGS estimates there is a 2 percent chance for an earthquake to occur within the Projects area in the next 50 years (i.e., a recurrence interval of 2,475 years) that would result in a PGA between 0.02 g and 0.04 g (Petersen et al., 2014b). The USGS also estimates there is a 10 percent chance for an earthquake to occur within the Projects area in the next 50 years (i.e., a recurrence interval of 475 years) that would result in a PGA of between 0.01 g and 0.02 g. These estimates are for rock sites and can be amplified by a factor of 2 or more on soft soil sites such as those found in the Projects area. In addition, the USGS has assessed the potential for deep fluid injection to contribute to earthquake activity in the United States and determined there is less than a 1 percent chance in the next 50 years for a damaging earthquake with a PGA of 0.12 g to occur in the Projects area due to combined natural or induced causes within the next year (Petersen et al., 2016). The USGS intends to continue to monitor induced earthquake activity and revise its risk assessment annually. Section 4.12.5.2 provides additional discussion about the site-specific seismic conditions at the liquefaction facility site.

The Texas and Louisiana Gulf Coast is in Seismic Zone 0 of the Uniform Building Code's Seismic Risk Map (International Conference of Building Officials, 2015). Seismically engineered structures are practically nonexistent within the Gulf Coast Province. Similar to the entire Gulf Coast region, there is no record of damaging earthquakes historically affecting the areas along the pipeline routes in Texas and Louisiana.

The Texas Connector and Louisiana Connector Projects would be constructed to meet DOT's Minimum Federal Standards outlined in 49 CFR 192, further reducing the potential for seismic-related damage to occur. These are the same regulations that govern the construction and operation of natural gas pipelines throughout the country, including areas with greater seismic hazards.

Studies of earthquake performance of gas transmission pipelines in southern California indicate that modern, arc-welded, ductile steel pipelines have performed very well in earthquakes with magnitudes greater than or equal to 5.8 (O'Rourke and Palmer, 1996). These studies addressed the effects of 11 earthquakes between 1933 and 1994 with magnitudes ranging from 5.8 to 7.7.

In conclusion, due to the low level of seismic activity in the region and construction of the proposed facilities using modern materials in accordance with current industry standards and federal regulations, the potential for seismic hazards to impact the Projects facilities is low.

4.1.3.3 Soil Liquefaction

Soil liquefaction is a phenomenon that occurs when granular, saturated soils temporarily lose strength and liquefy (i.e., behave like a viscous liquid) when subject to strong and prolonged shaking as may occur during an earthquake. Areas susceptible to liquefaction may include soils that are generally sandy or silty and are generally along rivers, streams, lakes, and shorelines, or in areas with shallow groundwater (University of Washington, 2000). Structures on or within an area experiencing soil liquefaction could sustain damage due to loss of underlying soil strength.

At the Liquefaction Project site, the subsoil profiles developed from site-specific geotechnical investigations indicate the presence of layers of silty sands and sands with silt that are dense to very dense. These sand layers could be liquefiable under sufficiently strong ground motions. However, due to the low seismicity of the region, the potential for soil liquefaction to occur is low. In addition, PALNG would address possible issues relating to the potential for soil liquefaction and loss of soil strength by using piles in the foundation design.

Some sandy soils underlie portions of the Texas Connector and Louisiana Connector Project routes; however, the potential for soil liquefaction to occur is low based on the low seismicity of the region.

4.1.3.4 Subsidence

Subsidence hazards include either a sudden collapse of the ground resulting in a depression, or a slow compaction of the sediments near the earth's surface (Nelson, 2004). This can occur due to the removal of fluids present in pore space or rock fractures that are under pressure, which can be followed by a decrease in fluid pressure, resulting in a loss of support and potential collapse. Subsidence occurs throughout the Gulf Coast Region as a result of sediment compaction, oil and gas extraction, and groundwater extraction. The results of PALNG's geotechnical investigation at the Liquefaction Project site indicate that subsurface conditions are generally suitable for the proposed facilities, if adequate site preparation, foundation design, and construction methods are implemented.

Because subsidence is a recognized concern in the Liquefaction Project area, PALNG would install all key liquefaction facilities on piles, including but not limited to loading facilities and trestles, LNG storage tanks, LNG booster pumps, gas turbines, pre-treatment and liquefaction equipment, and all compressors and blowers. PALNG would monitor foundations and other critical facilities to ensure they are maintained within acceptable limits. Site preparation activities would be monitored to ensure adherence to the geotechnical design. Surface subsidence would be controlled by potential use of lime stabilization of the fill materials during placement and compaction with monitoring settlement and systematic reworking, as needed. Foundations would be constructed with pile supports to protect equipment and interconnecting piping from differential movement. Earthen containment embankments would be earth-supported and constricted with wide bases (using 2H:1V or 3H:1V slopes, depending on height) to ensure stability. Earth-supported elements, such as the storm surge barrier and plant roads, would require periodic maintenance to mitigate the long-term effects of settlements and differential movements.

Because site-specific geotechnical mitigation has been incorporated into the Liquefaction Project design (e.g., pile-supported foundations) and would include our additional recommendations as contained in section 4.12.5.2, and the facilities would be designed in accordance with NFPA 59A (2001) and, where applicable, NFPA 59A (2006), subsidence would not be a significant hazard to the Liquefaction Project facilities.

Subsidence is a likely occurrence along the Texas Connector and Louisiana Connector Projects routes and would be considered during final design. However, subsidence is generally slow and long term, and rates in the pipeline projects area are considered low (0 to 1 foot every 100 years or 0.0 to 0.12 inch per year) to intermediate (between 1.1 and 2 feet every 100 years or 0.13 to 0.24 inch per year) (USACE, 2016). Subsidence would not be likely to affect the pipeline integrity as pipelines are generally flexible structures, except at tie-in locations. PHMSA regulations requiring periodic monitoring of the pipeline right-of-way during operation would aid in identification of subsidence-related conditions that may require maintenance. As a result of compliance with 49 CFR 192.613, pipeline route inspections would be completed once per year for Class 1 and Class 2 areas and twice per year for Class 3 areas to monitor the right-of-way for subsidence. In the event of subsidence, PAPL would expose the affected pipe, reposition or replace to a stress-free condition, and properly bed and backfill to restore existing grade. As a result, the Texas Connector and Louisiana Connector Projects have a low risk of subsidence impacts.

4.1.3.5 Karst

Karst terrain and physiography result from the dissolution of soluble bedrock, such as limestone, dolomite, marble, or gypsum, through the circulation of groundwater that has become slightly acidic as a result of atmospheric CO_2 being dissolved in the water. Karst terrain is characterized by the presence of sinkholes, caverns, irregular “pinnacled” bedrock surface, and springs. Any landscape that is underlain by soluble bedrock has the potential to develop karst landforms. The geology of the Projects area lacks shallow soluble bedrock and, therefore, karst landforms have not been identified in the Projects area, nor are they anticipated.

4.1.3.6 Landslides

A landslide is defined as the movement of a mass of rock, debris, or earth, down a slope. Landslides can be initiated by heavy rainfall, earthquakes, changes in groundwater conditions, and/or slope disturbance resulting from constriction activity. Since the topography of the liquefaction and pipeline facilities sites is relatively flat with very little grade change, and the USGS has identified the region as having a low incidence and susceptibility rate (Radbruch-Hall et al., 1982), the Projects have a low risk of impact caused by landslides.

4.1.4 Other Hazards

4.1.4.1 Flooding/Storm Surge/Tsunami

Liquefaction Project

The Gulf Coast region experiences tropical cyclones and hurricanes that generate significant rainfall, flooding, storm surges, shoreline erosion, and travel interruptions. A flood occurs when the water level in a stream or river channel overflows the natural or man-made bank. Flash floods result from high intensity precipitation events in upstream areas that lead to extensive short-duration runoff into a stream channel. Based on the historical record, a 100-year flood represents a river channel water level that is likely to be equaled or exceeded once every 100 years. Storm surge is a coastal phenomenon associated with tropical cyclones, hurricanes, and intense winter storms. The surge of ocean water inland above the high tide mark is a result of low barometric pressure combined with high winds pushing on the ocean surface, causing water to "pile up" higher than ordinary sea level. The effect of a storm surge is further enhanced if it occurs at high tide (National Oceanic and Atmospheric Administration [NOAA], 2017a).

According to the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FEMA, 2013) for Jefferson County, Texas, the 100-year Base Flood Elevation for the Liquefaction Project site is 12 feet in reference to the National Geodetic Vertical Datum of 1929 and 12.04 feet in reference to the North American Vertical Datum of 1988 (NAVD88). The entire Liquefaction Project site would be enclosed for flood protection by construction of earthen levees on the channel and land sides. The channel-side earthen levee height is designed to a 500-year Still Water Elevation (SWEL) of 14.0 feet NAVD88, a 500-year wave of 5.9 feet (rounded to 6.0 feet for the purposes of levee sizing), 0.6 feet of sea level rise and subsidence, and 1.6 feet of expected settlement, yielding an initial crest height of 22.2 feet with a final post-settlement height not lower than 20.6 feet. The land-side earthen levee height is designed to a combined 100-year SWEL, 100-year wave, and sea level rise height of 17.0 feet, and 2.0 feet of expected settlement, yielding an initial crest height of 19.0 feet with a final post-settlement crest height not lower than 17.0 feet. In addition, given the uncertainty in levee settlement, PALNG would periodically monitor and maintain the crest elevation of the levee to be no less than 20.6 feet NAVD88 on the channel side and no less than 17.0 feet NAVD88 on the land side. Section 4.12.5.2 provides additional discussion of the hurricanes and possible storm surge elevations at the liquefaction site.

The basic wind speed incorporated into structural design would be a 3-second gust speed of 183 mph at an elevation of 33 feet above ground surface. This converts to a sustained wind speed of 150 mph. See section 4.12.5.2 for more details on wind speeds.

Between 1865 and August 2017, 45 hurricanes and tropical storms made landfall within 60 miles of the Liquefaction Project site (NOAA, 2017a). Three storms: Unnamed (1886), Audrey (1957), and Rita (2005), made landfall within 30 miles of Port Arthur, Texas and produced significant storm surges, with maximum heights greater than 12 feet AMSL (Needham and Keim, 2012). In addition, in 2008, Hurricane Ike made landfall east of Houston, Texas and continued northwest toward Port Arthur, resulting in water heights of 14.5 feet AMSL (NOAA, 2009; Louisiana State University, 2013). On August 30, 2017, Tropical Storm Harvey made landfall near Cameron, Louisiana. The Port Arthur area received 26 inches of rain in 24 hours, with a storm total of over 47 inches, resulting in widespread flooding, and is being considered a 500-year to 1,000-year storm event. NOAA reported that the maximum storm surge near Port Arthur was between 3 and 5 feet (NOAA, 2017b).

PALNG's commissioned Seismic Hazard Assessment (Fugro, 2017b) and Geotechnical Report (Fugro, 2017a) evaluated the potential for a tsunami or seiche (i.e., a condition in which a partially enclosed body of water is caused to oscillate, causing wave action) to affect the liquefaction facility. The Liquefaction Project would be about 7 miles north of the Gulf of Mexico shoreline. As discussed in section 4.12, the facility is designed for storm surge, which is above the maximum estimated wave height for tsunamis.

Section 4.12.5.2 further discusses liquefaction facilities safety and potential impacts on the facilities from hazards such as earthquakes, tsunamis, seiche, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea level rise, landslides, wildfires, volcanic activity, and geomagnetism.

Texas Connector and Louisiana Connector Projects

As discussed previously, storm events can lead to flooding in the Beaumont-Port Arthur, Texas area. For a Category 1 hurricane, the SLOSH model predicts a storm surge of between 3 and 6 feet along the Louisiana Connector Project in Jefferson County, Texas and Cameron Parish, Louisiana (MP 0 to MP 27) and along the Texas Connector Project's Southern Pipeline; and up to 3 feet along the Texas

Connector Project's Northern Pipeline. For a Category 2 hurricane, the model predicts a storm surge greater than 9 feet along the Louisiana Connector Project in Jefferson County, Texas, Cameron Parish, Louisiana, and the southern part of Calcasieu Parish, Louisiana, and along the Texas Connector Project's Southern Pipeline; and up to 9 feet along the Texas Connector Project's Northern Pipeline. Category 3 and stronger hurricanes would produce storm surges greater than 9 feet along these areas (NOAA, 2015a).

Buried pipelines are rarely affected by flooding; however, PAPL would implement buoyancy control measures such as concrete-coated piping, anchors, or aggregate filled saddle bags to weigh the pipe in wet areas. Concrete-coated pipe would be installed in areas that are within a wetland or waterbody, except when the pipeline is being installed using a bore or HDD, or when the pipeline is within a waterbody or wetland that is not considered wet or prone to flooding (i.e., a non-saturated wetland or an intermittent stream). In the event that the pipeline is within a waterbody or wetland, but also inside a push/pull construction area, concrete-coated pipe would not be used, but other buoyancy control measures such as anchor blocks or saddle weights may be used.

Evaluation of the potential for flooding at compressor station sites and other aboveground facilities would be conducted during the detailed engineering stage. The Texas Connector Project's North Compressor Station and the Louisiana Connector Project's Compressor Station (at MP 96) are outside of FEMA flood zones. The Texas Connector Project's South Compressor Station would be constructed within the footprint of the Liquefaction Project facility, which is within a FEMA 100-year flood zone and is discussed in previous sections. PAPL would obtain a floodplain development permit prior to construction, which would include a "no rise" certification determined by a professional engineer licensed to practice in the State of Texas. PAPL would construct aboveground facilities outside of 100-year flood zones or surround them with a storm protection levee to minimize the potential for flooding. For instance, the Texas Connector Project's North Compressor station would be built outside of the flood zone and the South Compressor Station would be within the Liquefaction Project storm protection berm. The Louisiana Connector compressor station is outside of the 100-year flood zone; however, two meter stations and four MLVs would be within the 100-year flood zone in Louisiana. PAPL would build these facilities in accordance with local parish drainage regulations. As a result, the Texas Connector and Louisiana Connector Projects facilities would not be affected by flooding or storm surge.

4.1.4.2 Erosion and Sedimentation

Shoreline erosion occurs when waves, shoreline currents, and vessel wakes disturb shoreline soils and mobilized soil is transported away from the site. Changing or irregular stream channel morphology, typically as a result of man-made structures or stream channel debris, can lead to channel scour during high water flow. Water vortices can develop in deep scour holes. The Texas and Louisiana Gulf Coast area is experiencing the highest rates of coastal erosion and wetland loss in the United States. The average coastal erosion rate was -1.2 meters per year between 2000 and 2012 along the Texas coastal shoreline, with the area between Sabine Pass and Rollover Pass experiencing a shoreline loss rate of -4.7 meters per year between 2000 and 2012 (McKenna, 2014).

Liquefaction Project

Shoreline erosion could occur at the Liquefaction Project site and along the opposite shoreline as a result of waves, currents, and vessel wakes. To prevent erosion, new revetment in the form of sheet piling riprap or other erosion prevention measures would be installed on the water side of the storm protection berm. Even though shoreline erosion is a concern at the site of the liquefaction facility, the proposed mitigation measures would minimize erosion and scour impacts.

Texas Connector and Louisiana Connector Projects

The Texas Connector Project would not be directly on the shoreline of or adjacent to a major waterbody; therefore, the facilities would not be subjected to direct effects of shoreline erosion.

The Louisiana Connector Project would be installed at the Texas shoreline at the southern end of Sabine Lake using the HDD construction method, exiting Sabine Lake via HDD at Shell Island. The HDD method is designed to avoid the disturbance of land surface and/or lake floor between the entry and exit points of the HDD. All HDDs would be drilled from the shore into the lake, minimizing the potential for shoreline erosion to occur.

4.1.5 Paleontological Resources

While fossils in the region are generally rare, there have been occasional discoveries of fossil remains of animals such as camels and mastodons. Holocene and Pleistocene marine fossil fragments are sometimes found within sedimentary units deposited in these epochs, but these fragments have little scientific value. No known paleontological resources are in the Projects area (Fossilworks, 2017). If any paleontological resources are discovered during construction, they would be treated in accordance with PALNG's and PAPL's *Unanticipated Discovery of Paleontological Resources Plan*, which is included in their *Environmental Plans*. We have reviewed PALNG's and PAPL's *Unanticipated Discovery of Paleontological Resources Plan* for the Liquefaction Project, Texas Connector Project, and Louisiana Connector Project, and find it acceptable.

4.1.6 General Impacts and Mitigation

4.1.6.1 Liquefaction Project

The primary impacts would be limited to construction activities and would include disturbance of slopes within the work areas, which would be permanent where grading and filling is required to create a safe and stable land surface to support the facilities. Based on the low probability of localized seismic ground shaking near the project, we do not anticipate any problems attributable to seismicity. According to available soils and geologic maps and the geotechnical investigations conducted by PALNG, blasting is not anticipated during construction of the liquefaction facilities.

Based on the above discussion, in consideration of PALNG's proposed mitigation and design criteria, and our recommended mitigation measures, we conclude that the Liquefaction Project would not significantly impact or be impacted by geological conditions in the area and that the overall effect of the Liquefaction Project on topography and geology would be minor.

4.1.6.2 Texas Connector and Louisiana Connector Projects

The primary impacts would be limited to construction activities and would include disturbance of slopes within the work areas. Such impacts resulting from grading and trenching operations along the pipeline rights-of-way would be temporary because PAPL would restore these areas to preconstruction contours to the maximum extent practicable. Further, based on available soils and geologic maps provided by PAPL, blasting is not anticipated during construction of the project facilities.

PAPL's parent company, Sempra Energy, has direct experience successfully completing HDDs at 15 of the 26 proposed HDDs along the Louisiana Connector Project route. PAPL conducted a qualitative analysis of geologic and soil features at the 26 proposed HDD sites and identified a consistent geologic formation of alluvium material with a high silt and clay content which rarely contained gravel. The soils are predominantly clay, mucky clay, silt loam, or sand, with little to no cobble, rock, or gravel. These formations typically create a stable HDD borehole with low occurrence of inadvertent fluid returns or borehole instability. Sempra Energy's direct experience with 15 of the 26 HDD locations indicates no issues affecting waterbodies or other resources occurred during construction, as all 15 HDDs were completed successfully; one small inadvertent return on one HDD was confined to an upland area near the entry bore hole. PAPL also consulted with HDD contractors that have completed large-diameter pipelines near the Louisiana Connector Project area, and the contractors shared similar successes as Sempra Energy's direct experience. PAPL estimates that HDD depths for the Texas Connector Project would typically be less than 50 feet below grade except for HDDs beneath the Sabine and Neches Rivers, which would be up to 100 feet below grade. Geology at these depths near the Texas Connector Project HDDs consists of clay and/or sandy clay to depths of 150 feet below grade. As noted with Sempra Energy's direct experience with other HDDs near the Louisiana Connector Project, the low permeable soils/sediment create a stable borehole with low occurrence of inadvertent fluid returns or borehole stability. Use of the HDD method would reduce impacts on existing geologic conditions between the HDD entry and exit points at the locations where this method is used. Prior to construction, and as part of its implementation Plan, PAPL has committed to provide detailed geotechnical surveys/reports for each HDD to confirm the site-specific geological conditions (as described above) which have resulted in the success of previous HDDs in the area. If any additional mitigation measures are required, PAPL has also committed to provide those measures.

Based on the low probability of localized seismic ground shaking near the projects, we do not anticipate any problems attributable to seismicity. As previously disclosed, studies of earthquake performance of gas transmission pipelines indicate that modern, arc-welded, ductile steel pipelines have performed very well in earthquakes, and the pipelines and associated aboveground facilities must be designed and installed in accordance with DOT standards, including those in 49 CFR 192, *Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards*. Each facility would be designed and constructed to provide adequate protection from washouts, floods, unstable soils, subsidence, movement due to growth faults, or other hazards that could cause it to move or sustain abnormal loads.

Based on this discussion, in consideration of PAPL's proposed mitigation and design criteria, and our recommended mitigation measures, we conclude that the Texas Connector and Louisiana Connector Projects would not significantly impact or be impacted by geological conditions in the area and that the overall effect of the Texas Connector and Louisiana Connector Projects on topography and geology would be minor.

4.2 SOILS

4.2.1 Existing Soil Resources

The soils that would be affected by construction and operation of the Projects were identified and assessed using the Soil Survey Geographic database (SSURGO). The SSURGO database is a digital version of the county-level soil surveys developed and made available by the USDA NRCS for use with geographic information systems. The soils within the proposed facility locations and routes were evaluated to identify prime farmland and major soil characteristics that could affect construction or increase the potential for adverse construction-related soil impacts. Potential impacts on soil resources that would be affected by construction and operation of the Projects may be associated with certain soil types and limitations, prime farmland, hydric soils, soil compaction, soil erosion, revegetation, and contamination. Table 4.2.1-1 summarizes the soil characteristics affected by construction of the Projects.

TABLE 4.2.1-1

Characteristics of Soils Affected by Construction of the Projects (in acres)

Facility	Project Total	Prime Farmland [a]	Hydric [b]	Compaction Potential [c]	Erosion Potential [d]	Revegetation Potential [e]
LIQUEFACTION PROJECT [f]	888.0	--	888.0	888.0	--	--
Dredge Disposal Areas						
J.D. Murphree WMA	1,910.3	--	1,910.3	--	--	--
Disposal Areas 8, 9A, 9B [g]	4,141.8	--	4,141.8	2,584.5	--	--
Subtotal	**6,940.1**	**--**	**6,940.1**	**3,472.5**	**--**	**--**
TEXAS CONNECTOR PROJECT						
Northern Pipeline	217.5	36.3	88.5	60.0	15.5	17.2
Southern Pipeline	35.3	--	26.1	4.8	2.2	2.2
FGT Lateral	11.1	11.1	--	--	--	--
GTS Lateral	3.6	1.9	0.3	1.4	--	--
HPL Lateral	8.1	4.6	1.4	2.1	--	--
KMPL Lateral	0.00	--	--	--	--	--
NGPL Lateral	1.6	--	1.6	--	--	--
TETCO Lateral	0.8	0.8	--	--	--	--
Access Roads	136.1	25.6	51.6	33.8	6.3	18.8
Aboveground Facilities	148.8	46.5	74.4	27.9	--	--
Subtotal	**562.9**	**126.9**	**243.9**	**130.0**	**24.0**	**53.2**
LOUISIANA CONNECTOR PROJECT						
Mainline	1,625.0	809.1	1,062.8	493.9	1,523.5	36.1
Centana Tie-In	0.4	--	0.4	0.4	--	--
CS Lateral	0.1	0.1	0.1	--	0.1	--
TETCO Tie-In	0.1	0.1	0.1	--	0.1	--
TGP Lateral and Tie-In	--	<0.1	<0.1	--	--	--
Egan Lateral and Tie-In	0.5	0.5	0.5	--	0.5	--
Pine Prairie Lateral and Tie-In	0.4	0.4	0.4	--	0.4	--
Texas Gas Lateral and Tie-In	0.2	0.2	0.2	--	0.2	--
ANR Lateral and Tie-In	0.3	0.3	0.3	0.3	0.3	--
CGT Tie-In	0.2	0.2	0.2	0.2	0.2	--
Access Roads	256.3	5.0	8.2	4.0	--	--
Contractor Yards	428.3	298.9	427.5	356.1	68.2	208.3
Aboveground facilities	61.2	55.2	61.2	55.2	--	11.1
Subtotal	**2,373.0**	**1,170.0**	**1,561.9**	**910.1**	**1,593.5**	**300.5**

TABLE 4.2.1-1 (cont'd)

Characteristics of Soils Affected by Construction of the Projects (in acres)

Facility	Project Total	Prime Farmland [a]	Hydric [b]	Compaction Potential [c]	Erosion Potential [d]	Revegetation Potential [e]
NONJURISDICTIONAL FACILITIES	121.0	--	121.0	121.0	--	--
Subtotal	**121.0**	**--**	**121.0**	**121.0**	**--**	**--**
Projects Total	**9,997.0**	**1,296.9**	**8,866.9**	**4,633.6**	**1,617.5**	**353.7**

[a] As designated by the NRCS. Includes soils that are considered prime if a limiting factor is mitigated (e.g., artificial drainage).

[b] Areas identified to have a hydric rating meet all the hydric criteria as determined by NRCS SSURGO.

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

[d] Includes land highly erodible water or highly erodible wind categories, which include severe to extreme erosion limitations for agricultural use and soils with an average slope >8 percent and/or soils with poor aggregation that are particularly susceptible to wind erosion.

[e] Includes coarse-textured soils (sandy loams and coarser) that are moderately well to excessively drained and soils with an average slope greater than 8 percent.

[f] Data do not include about 60 acres associated with unmapped soils and open water.

[g] Dredge disposal pipelines associated with transferring material to these locations would be placed on the ground surface or floated in water, and would not disturb soils.

4.2.1.1 Prime Farmland

The USDA categorizes prime farmland soils under its national inventory, and defines prime farmland as:

> Land that has the best combination of physical and chemical characteristics for producing food, fee, forage, fiber, and oil seed crops. It has the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods (Soil Survey Division Staff, 1993).

Prime farmland generally contains few or no rocks, is permeable to air and water, and it is not excessively erodible or saturated with water for long periods of time. Soils that do not meet the criteria and definition above may still be considered prime farmland if the limiting factor is mitigated such as with the use of artificial drainage.

Liquefaction Project

None of the soils found at the liquefaction facilities site or dredge disposal areas are classified as prime farmland soils.

Texas Connector and Louisiana Connector Projects

Construction of the Texas Connector Project would affect 126.9 acres of prime farmland soil, which comprises about one-third of the project area, and operation would affect 46.5 acres, which would be permanently impacted by aboveground facilities. Construction of the Louisiana Connector Project would affect 1,170.1 acres of prime farmland, which is less than half the project area, and operation would affect 59.2 acres which would be permanently impacted by aboveground facilities. Based on the amount of prime farmland in the counties and parishes affected by the projects, construction and operation of the Texas

Connector and Louisiana Connector Projects would result in a fraction of one percent of impact on the total prime farmland available.

Nonjurisdictional Facilities

None of the soils along the SH 87, pipelines, or utilities relocations are classified as prime farmland soils.

4.2.1.2 Hydric Soils

Hydric soils are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper soil horizon (Soil Survey Staff, 1994). These soils are generally associated with wetlands and proximity to waterbodies. Soils that are artificially drained or protected from flooding (e.g., by levees) are still considered hydric if the soil in its undisturbed state would meet the definition of a hydric soil.

Liquefaction Project

The upland portions of the liquefaction facilities site and dredge disposal areas are comprised entirely of soils categorized as hydric soils.

Texas Connector and Louisiana Connector Projects

The Texas Connector Project would affect several soil associations that contain hydric soils, including Creole mucky clay, Allemands mucky peat, Bancker mucky peat, Beaumont clay, Caplan mucky peat, Franeau clay, Ijam clay, Leton loam, Leerco muck, Orcadia-Aris, and Zummo muck. Construction of the Texas Connector Project would affect 243.9 acres of hydric soils, and operation would affect 74.4 acres of hydric soils impacted by aboveground facilities.

The Louisiana Connector Project would affect several soil associations that contain hydric soils, including Basile and Guyton silt loams, Basile and Brule, Brimstone silt loam, Clovelly muck, Prairieland silt loam, Frost silt loam, Gentilly muck, Ijam clay, Judice silty clay, and more. Construction and operation of the Louisiana Connector Project would affect 1,561.9 acres and 69.4 acres, respectively, of hydric soils.

Due to the high levels of saturation within hydric soils, compaction and rutting are primary concerns requiring avoidance and mitigation. Buoyancy hazards for the pipeline may also be encountered within hydric soil areas and high groundwater elevations.

Nonjurisdictional Facilities

Soils affected by the SH 87, pipelines, and utilities relocation are all classified as hydric soils. Construction and operation of the nonjurisdictional facilities would temporarily and permanently affect 121.0 acres of hydric soils.

4.2.1.3 Compaction Potential

Soil compaction modifies the structure and reduces the porosity and moisture-holding capacity of the soil. The degree to which soil is compacted during construction depends on moisture content and texture of the soil. Fine-textured soils with low internal drainage and high shrink-swell potential are the most susceptible to compaction. Construction equipment travel and vehicular access over wet soils may disrupt soil structure, reduce pore space, increase runoff potential, and cause rutting. Moist or saturated soils are more likely to compact or rut (Soil Survey Division Staff, 1993).

Liquefaction Project

The liquefaction facilities site and dredge disposal areas are comprised entirely of clay and peat soils prone to compaction.

Texas Connector and Louisiana Connector Projects

Construction of the Texas Connector Project would affect 130.0 acres of soils that are prone to compaction due to poor drainage qualities. About 27.9 acres of the total would be affected permanently by the operation of the Texas Connector Project's aboveground facilities. Construction of the Louisiana Connector Project would affect 910.1 acres of soils that are prone to compaction due to poor drainage qualities. About 59.2 acres of that total would be affected permanently by the operation of the Louisiana Connector Project's aboveground facilities and access roads.

Nonjurisdictional Facilities

Soils affected by the SH 87, pipelines, and utilities relocation are comprised entirely of clay and peat soils prone to compaction.

4.2.1.4 Erosion

Erosion is a continuing natural process that can be accelerated by construction and earth-disturbing activities. Factors that influence erosion potential include soil characteristics, climate, topography, vegetation cover, soil texture, surface roughness, percent slope, and length of slope. Soils most susceptible to erosion by water are typified by bare or sparse vegetation cover, non-cohesive soil particles with low infiltration rates, and moderate to steep slopes. Soils typically more resistant to erosion by water include those that occupy low relief areas, are well vegetated, and have high infiltration capacity and internal permeability. Wind erosion typically occurs in an arid climate with soils containing little vegetation growth and high wind conditions. Clearing, grading, and equipment movement could accelerate the erosion process and, without adequate protection, result in discharge of sediment into waterbodies and wetlands. Soil loss due to erosion also could reduce soil fertility and impair revegetation rates.

Liquefaction Project

No soils listed as having a severe erosion potential would be impacted by construction and operation of the liquefaction facilities site or dredge disposal areas.

Texas Connector and Louisiana Connector Projects

The Texas Connector Project would affect several soil series amounting to less than 5 percent of its total with severe erosion potential. Construction would affect about 24.0 acres of soils prone to erosion, the majority of which occur along the Northern Pipeline and are associated with access roads. Operation of the Texas Connector Project's aboveground facilities would not affect any soils with susceptibility to erosion.

The Louisiana Connector Project would affect the Gore sandy loam, Acadiana silt loam, and Caddo-Messer loam soil series, which are all susceptible to water erosion. Construction of the Louisiana Connector Project would affect 1,593.5 acres of soils with erosion susceptibility. Operation of the

Louisiana Connector Project's aboveground facilities would not affect any soils with susceptibility to erosion.

Nonjurisdictional Facilities

While no soils characterized as having severe erosion potential are found along the SH 87, pipelines, and utilities relocation area, SH 87 has experienced long-term erosion issues associated with tidal action. These issues would be alleviated for the portion of the highway relocated as part of the Liquefaction Project by moving SH 87 farther inland.

4.2.1.5 Revegetation Potential

Long-term revegetation success and restoration are essential for maintaining soil productivity and avoiding future erosion problems and associated soil loss. The revegetation potential of the Projects area soils was evaluated based on soil characteristics including texture, slope, and drainage class. Drier soils have less water to aid in the germination and eventual establishment of new vegetation. Coarser textured soils have a lower water holding capacity following precipitation, which could result in moisture deficiencies in the root zone and unfavorable growing conditions for many plants.

Liquefaction Project

None of the soils found on the liquefaction facilities site or at the dredge disposal areas are classified as having poor revegetation potential.

Texas Connector and Louisiana Connector Projects

The Texas Connector Project would affect several soil series (about 7 percent of its total) with poor revegetation potential. Construction of the Texas Connector Project would affect 53.2 acres of soils with poor revegetation potential. About 50 percent of these soils occur along the combined pipeline route itself and the other 50 percent are associated with access roads. Operation of the Texas Connector Project's aboveground facilities would not affect any soils with poor revegetation potential.

The Louisiana Connector Project would affect several soil series (about 5 percent of its total) with poor revegetation potential. Construction and operation of the Louisiana Connector Project would affect 300.5 and 20.1 acres, respectively, of soils with poor revegetation potential. All impacts on soils as a result of project operation would be associated with aboveground facilities.

Nonjurisdictional Facilities

No soils classified as having poor revegetation potential would be impacted by the relocation of SH 87, pipelines, and utilities.

4.2.1.6 Soil Contamination

Contamination from spills or leaks of fuels, lubricants, and coolant from construction equipment and facility operations could adversely affect soils. The effects of contamination would typically be minor because of the low frequency and volumes of spills and leaks.

Liquefaction Project

PALNG consulted a regulatory database search of hazardous and solid wastes in accordance with parameters set forth and recommended by the American Society for Testing and Materials (ASTM) Standard Practice 1527:97, including, but not limited to the National Priority List under the Superfund program, the Resource Conservation and Recovery Act Information Service, State Hazardous Waste list, Leaking Underground Storage Tanks database, and State Voluntary Cleanup Program. There were no listed sites found within 0.25 mile of the liquefaction facilities or the dredged material disposal areas (Environmental Data Resources, Inc., 2015).

PALNG performed a site reconnaissance of the liquefaction facilities site and found no unusual odors, waste pits, vent pipes, ground stains, or other typical indicators of potential hazardous waste or contaminated soil potential. PALNG collected sediment samples from 15 locations during its original site reconnaissance in 2004 to determine whether dredged material would be suitable for beneficial reuse. About 48 percent of the liquefaction site area was tested in association with this 2004 report. These samples were analyzed using the National Sediment Quality Survey (NSQS) and the TCEQ's Ecological Benchmark, guidelines utilized by the USACE Galveston District and TPWD, respectively. Sediments collected during the 2004 site reconnaissance were determined to be under all contamination thresholds identified under NSQS and the Ecological Benchmark. PALNG performed a Tier 1 Evaluation of Dredged Material for Beneficial Reuse, which also found composite analytical results for dredge material falls below NSQS and Ecological Benchmark.

The 2004 site assessment demonstrates sampling of about one-half of the site, and PALNG completed supplemental site assessments in 2008, 2015, and 2016 covering the remaining liquefaction site area. These site assessments make the determination that the liquefaction facilities property meets the TCEQ's Tier 1 Commercial/Industrial Protection Concentration Levels for soil and groundwater.

Based on its review of the above, the EPA recommends that all dredged material proposed to be disposed of in aquatic habitats, including material proposed to be disposed of in upland disposal facilities that discharge to an aquatic habitat and/or proposed to be used onsite, be tested in accordance with the Inland Testing Manual or Upland Testing Manual. In addition, the testing should be done using EPA-approved methods; the results should include detailed laboratory quality assurance/quality control information; and a draft sampling and analysis plan should be provided to the EPA, USACE, and TCEQ prior to sampling. Although portions of the affected area were previously tested, the EPA further recommended that the soils and sediments at the Liquefaction Project site be resampled, specifically the area within the ship canal at the marine berth, construction dock, MOF, and landward component at the MOF. The EPA also encourages PALNG to continue actively seeking other beneficial use opportunities for habitat restoration and creation when dredged material is suitable and free of toxic pollutants.

PALNG asserts that because there has been no site activity on the proposed liquefaction facilities site since the original sampling, no additional work is necessary. However, PALNG committed to resampling the area within the ship canal at the marine berth, construction dock, and MOF due to receiving new sediment loads since the original sampling analysis was conducted. PALNG also committed to resampling sediments at the landward component of the MOF as recommended by the EPA. PALNG committed to conducting this resampling in accordance with the Inland Testing Manual prior to dredging and disposal. To verify the assumption that the past soil sampling is still valid and site conditions have not changed, **we recommend that:**

- **<u>Prior to construction of the Liquefaction Project</u>, PALNG should provide the EPA, USACE, TCEQ, and Texas RRC the soil and sediment analysis conducted at the area within the ship canal at the marine berth, construction dock, MOF, and landward**

component of the MOF for review. PALNG should file the conclusions of the reviews with the Secretary along with documentation of its consultations with these agencies including any measures PALNG would need to adopt if the analysis discovers previously unknown contamination.

If, as a result of the analysis, it is determined that the dredge material is not suitable for use as proposed and the handling of dredge material must be modified (for example, a new location for dredge disposal is identified), PALNG would be required to request from FERC a variance to its project and document that it has obtained all applicable federal authorizations and permits for the modified activity(ies) prior to its use.

With respect to resampling soils and sediments previously analyzed, in its letter dated June 13, 2017, the TPWD stated that it "requires that all dredge material used in restoration be tested for contaminants and, at a minimum, meet the standards as stated in the TCEQ ecological risk assessment manual and EPA's Evaluation of Dredge Material Proposed for Discharge in Waters of the US - Testing Manual. PALNG will be required to provide documentation that all dredge material for [beneficial use] has been tested and meets these standards before proceeding with beneficial use of dredge materials activities on the WMA" (TPWD, 2017a). In addition, the need for sediment testing could be required as part of the section 401 Water Quality Certification process, which is overseen by the Texas RRC.

Texas Connector and Louisiana Connector Projects

Based on a review of potentially contaminated sites registered within 0.25 mile of the Texas Connector and Louisiana Connector Projects areas via state and federal databases (LDEQ, 2017a, 2017b, 2017c; EPA Facility Registry Service, 2017), no registered sites were identified.

Nonjurisdictional Facilities

The potential for soil contamination to be encountered during the SH 87, pipelines, and utilities relocation work was determined by the same regulatory database search and site reconnaissance detailed in section 4.2.1.6, and no registered sites were identified.

4.2.1.7 Subsurface Sediments

The following discussion applies to the Liquefaction Project only and is based on our 2006 EIS of the proposed site, as subsurface conditions have not changed since that time. However, some of PALNG's engineering design and construction commitments have altered or are currently not known. Regardless, based on the following discussion, our analysis indicates that issues of concern and potential hazards associated with soft sediments, ground subsidence, and hydric soils underlying areas that would be developed by PALNG for the Liquefaction Project would be adequately addressed with PALNG's engineering design.

The Liquefaction Project would be in an area that contains several thousand feet of deltaic and alluvial deposits consisting of interlayered clays and sands. Recent deposits located close to the Gulf Coast, including the area of the liquefaction site, consist of alluvium, deltaic, littoral, and marsh deposits. These deposits can be weak and unsuitable for supporting major structures on shallow foundations.

Significant loading on these sediments would occur during construction, hydrostatic testing, and operation of the LNG storage tanks. As a result, based upon its geotechnical evaluations of the site, PALNG may choose to use several techniques to stabilize and enhance the shear strength of the soils and sediments in various locations for the aboveground facilities. The prior studies identified the design criteria for ground improvements and foundations, which identified that the foundations for settlement-sensitive equipment and structures such as the LNG storage tanks, process equipment, and pipe racks, should be supported by piles. Foundations would be constructed on top of the piles. PALNG would install all critical process equipment and structures 9 feet above mean sea level. Vegetation clearing, grading, and over-excavation and the placement of structural fill would be conducted. Sandy clay soils free of organic or other deleterious materials would be used as structural fill and would be compacted to ASTM standards. Alternatively, PALNG may choose to use tested and approved portions of the on-site clay soils preconditioned with lime and fly-ash. Because the first layer of structural fill may be difficult to compact if the soft underlying soils are exposed or the soils become wet, geo-textile fabric may be used to reduce this difficulty and to aid in the process of structural fill placement and compaction.

Additionally, all major equipment and structures, including the LNG storage tanks, LNG process equipment, pipe racks, and the marine berth facilities would be supported on deep-driven pile foundations. Piles would be installed to a depth of about 160 feet for the LNG storage tanks and to a depth of about 70 to 80 feet for the remaining foundations. The number of piles required is not yet known but, based on the 2006 EIS, could range between 1,000 to 2,300 piles per tank. The settlement of the LNG tanks after construction could be on the order of 11 to 12 inches because of consolidation of the soils; however, differential settlement of the LNG storage tanks, as a result of the pile cap and pile stiffness, is predicted to be minimal.

4.2.2 General Impacts and Mitigation

4.2.2.1 Liquefaction Project

Construction activities such as clearing, grading, excavation, backfilling, and the movement of construction equipment may affect soil resources. Clearing removes protective vegetation cover and exposes the soil to the effects of wind and rain, which increases the potential for soil erosion and sedimentation of sensitive areas. Grading, spoil storage, and equipment traffic can compact soil, reducing porosity and increasing runoff potential.

To increase the load bearing capacity of soils along the heavy haul road, an engineered grout would be added to the subsoil that would alter the physical characteristics of the soil. The resulting substrate would have characteristics resembling soft rock (e.g., lightly cemented sandstone). Once soil alteration has taken place, it is not possible to revert to pre-existing conditions. Areas not reinforced with engineered soil surfaces would be graded, covered with a soil base and topsoil, and seeded per NRCS recommendations to prevent erosion.

To protect the liquefaction facility post-construction during its operation, PALNG would construct a storm surge barrier of improved soil and structural clay to a top elevation of 20 feet. Soils on the remainder of the liquefaction facilities site would be filled and maintained at an elevation of 6.5 feet AMSL. The total volume of soil to be cut is about 1.5 million cubic yards (yd^3). The total volume of fill required for the final elevations is about 4.4 million yd^3, including fill and stone material. The materials for and construction of the storm surge barrier would be in accordance with the recommendations set forth by a certified geotechnical engineer. In addition, PALNG would further armor the Port Arthur Canal adjacent to the site by means of riprap or other erosion prevention measures.

Localized erosion may occur during operation in the shoreline zone due to shipping vessels' bow thrusters and "prop wash." PALNG developed a Shoreline Protection Report to address potential shoreline erosion under these circumstances. LNG vessels would be assisted by tugs during vessel berthing and departure maneuvers and would minimize their own stern propeller and bow thruster use, such as in emergency maneuvering situations.

As described in detail in section 2.5.1.4, dredge material would be transported from the ship berthing area at the liquefaction site to Dredge Disposal Areas 8, 9A, and 9B using a 30-inch-diameter temporary pipeline. Based on correspondence with the SNND, the USACE has listed Dredge Disposal Areas 9A and 9B as active federal placement areas. The SNND currently owns the areas, which would be able to accommodate the proposed 4.8 million yd^3 of dredge material (SNND, 2017a). Dredge Disposal Area 8 would also receive material from the project and it is also an active federal placement area for USACE maintenance dredging (USACE, 2018).

Based on correspondence with the TPWD, a plan for beneficial use of dredge material would be required as part of a Surface Use Agreement for the project related to placement of material at the J.D. Murphree WMA (TWPD, 2017a). PALNG is currently coordinating with the J.D. Murphree WMA and TPWD in the development of its plan for the beneficial use site. PALNG met with the TPWD on November 14, 2017, to continue coordination on the placement of material within the WMA. The TPWD stated in an April 10, 2017 correspondence that beneficial use projects within the WMA were limited to 500 acres at any one time. The TPWD indicated in the November 14, 2017 meeting that it would continue to work with PALNG to ensure that the 1,900 acres of proposed dredge material could be placed on the WMA in a manner that would satisfy regulatory requirements.

To reduce the impacts of construction on soils, PALNG would implement its project-specific *Environmental Plan*, which includes measures to control erosion and sedimentation during construction and to ensure proper restoration of disturbed areas following construction. Relevant mitigation measures specified in PALNG's *Environmental Plan* include the following:

- Sediment barriers would be installed before ground-disturbing activities to prevent sediment flow from construction areas into waterbodies, wetlands, and roads.

- Temporary erosion control measures (e.g., temporary slope breakers and mulch) would be installed during construction.

- Permanent erosion control measures would be maintained following construction.

- Erosion control fabric would be placed at dike and drainage swale outlets and adjacent to roads and waterbodies as necessary.

- Dust suppression, via water application, would be used as necessary to control and minimize wind erosion.

- During periods of heavy rainfall or unusual soil saturation, rutting and compaction would be avoided to the extent practicable by utilizing low-ground weight construction equipment and/or timber mats.

- An EI would monitor field conditions daily to ensure that the erosion and sedimentation control measures are functional and adequate until the construction workspace is fully stabilized.

Most of the soils disturbed within the liquefaction facilities site (888.0 acres) would be permanently impacted by paved or gravel plant roads, occupied by aboveground facilities, or converted to open water within the recessed berthing area. PALNG would seed any remaining areas within the liquefaction facilities site with native vegetation recommended by the NRCS. Disturbed areas at the dredge disposal location sites would be seeded in accordance with the J.D. Murphree WMA recommendations as well as NRCS recommendations. Revegetated areas would be monitored following construction for the first and second growing seasons to ensure successful restoration (see section 2.5.1.9).

To prevent contamination of soils within nearby wetlands, waterbodies, and other sensitive resources during construction, PALNG developed preliminary spill prevention, control, and countermeasure plans within its *Environmental Plan*. These plans identify cleanup protocol to be implemented should fuel, lubricant, coolant, or solvent spill or leak occur thereby contaminating the project soils. Implementation of the protocols and best management practices in the spill plan would adequately minimize the potential for soil contamination. Further, should there be any unanticipated discovery of soil contamination during construction, PALNG would follow the protocols detailed in its *Unanticipated Hazardous Waste Discovery Plan* within its *Environmental Plan*. We conclude that implementation of our recommended measures (see section 4.1.2), and the measures outlined in PAPL's *Environmental Plan*, including the *Unanticipated Hazardous Waste Discovery Plan*, would help to ensure that soil contamination would not be a concern for the Liquefaction Project.

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

4.2.2.2 Texas Connector and Louisiana Connector Projects

Construction of the Texas Connector and Louisiana Connector Projects would impact 563.0 and 2,079.0 acres, respectively. About 74 percent of the soils impacted by the Texas Connector Project and 80 percent of the soils impacted by the Louisiana Connector Project would be restored to preconstruction conditions. Further, PAPL would adopt the HDD method at 25 locations along the Texas Connector Project and 26 locations along the Louisiana Connector Project, including the shorelines of Sabine Lake. As previously discussed, use of the HDD method would avoid most direct impacts, including soil disturbance between the drill entry and exit points. Cumulatively, about 26.5 miles of soil impacts would be avoided.

PAPL would conduct restoration in accordance with the landowner's request in agricultural land or using a native seed mix developed in consultation with the NRCS, thus temporarily impacted soils are anticipated to retain their former productivity. During construction, PAPL would adhere to the construction measures outlined in its project-specific *Environmental Plan*, which includes the Commission's Plan and Procedures. For example, topsoil segregation and decompaction would be implemented at all areas of temporary impact, including pipeline construction, access roads, and laydown yards. These practices would promote the maintenance of prime farmland; however, there would be a slight loss of useable prime farmland soil area associated with the locations of compressor stations, meter stations, and MLVs.

Soil grade and compaction would be monitored over time during operation after the completion of the Projects. If any noticeable expansion or subsidence is observed, remediation and mitigative action would take place as per the Commission's Plan and Procedures. Construction of the pipeline would not negate the use of the land for agriculture. The most effective best management practices for soil erosion is the preservation of existing vegetation, but where that is not feasible, silt fencing, timber mats, street sweeping, and other practices would be implemented and regularly maintained throughout construction. Additionally, PAPL would implement the spill prevention, control, and countermeasure measures in its *Environmental Plan* (which we have reviewed and found to be acceptable) to reduce potential impacts on soils from spills of hazardous materials used during construction and operation. If soil contamination is encountered, PAPL would follow the conditions of its *Unanticipated Hazardous Waste Discovery Plan* and all local, state, and federal regulations. We conclude that implementation of PAPL's *Environmental Plan*, including the *Unanticipated Hazardous Waste Discovery Plan*, would help to ensure that soil contamination would not be a concern for the Texas Connector and Louisiana Connector Projects.

Successful restoration and revegetation in areas that are not permanently developed are important to maintain ecosystem productivity and to protect the underlying soil from potential damage, such as erosion. Soils along the Texas Connector and Louisiana Connector Projects pipeline routes are currently well vegetated, and a relatively small percentage (less than 7 percent) are predicted to have a low revegetation potential following construction. PAPL would implement the measures outlined in its *Environmental Plan*, which includes the Commission's Plan, for revegetation of disturbed land areas following construction, including seeding of disturbed areas with native vegetation as recommended by soil conservation authorities and local landowners and monitoring disturbed areas for up to 3 years to ensure the success of revegetation. If upland revegetation is conducted in accordance with these measures, areas disturbed by construction would be successfully revegetated.

In addition, PAPL is coordinating with the USACE and other federal and state agencies to develop an appropriate wetland restoration plan for wetlands affected by the Texas Connector and Louisiana Connector Projects.

Operation of the Texas Connector and Louisiana Connector Projects would result in little, if any, soil disturbance. If routine or emergency repairs are required, the effects associated with the repair work will be mitigated with the same measures outlined in PAPL's *Environmental Plan*. Based on experience with herbaceous and shrub communities in the projects area, PAPL estimates that the revegetation efforts may take 1 to 5 years to reestablish.

Given the impact minimization and mitigation measures described in these plans, impacts on soils due to construction and operation of the Texas Connector and Louisiana Connector Projects would be temporary and minor, except for the soils affected by aboveground facilities and new and/or permanent access roads, which would experience permanent but still minor impacts.

4.2.2.3 Nonjurisdictional Facilities

As shown in table 4.2.1-1, construction of the nonjurisdictional facilities would impact 121.0 acres of soils, none of which are classified as prime farmland. Temporary workspaces totaling 75.7 acres would be restored to preconstruction conditions, replanted in accordance with the landowner's request in agricultural land or using a native seed mix developed in consultation with the NRCS, and are anticipated to retain their former productivity. Further, PALNG would implement the spill prevention, control, and countermeasure measures in its *Environmental Plan* to reduce potential impacts on soils from spills of hazardous materials used during construction and operation. Soil impacts during construction would be minimized through the implementation of the measures outlined in the Commission's Plan and Procedures. Given the impact minimization and mitigation measures described in these plans, we conclude that impacts on soils due to the relocation of SH 87 would be permanent and minor, and impacts on soils due to construction and operation of the non-jurisdictional pipelines and utilities would be minor. Following construction, operation of the facilities would be transferred back to the TDOT and the pipeline and utility operators.

4.3 WATER RESOURCES

4.3.1 Groundwater Resources

4.3.1.1 Aquifers

The Projects would be above the coastal lowlands aquifer system (Ryder, 1996). The coastal aquifer system extends from southern Texas to the Florida panhandle, underlying most of the Gulf Coastal Plains. The coastal lowlands aquifer system is one of the most extensively used aquifer systems in the southern United States and supplies large quantities of water for agricultural, commercial, industrial, and public/domestic uses (Renken, 1998).

The coastal lowlands aquifer system within the State of Texas is also called the Gulf Coast aquifer. The Gulf Coast aquifer consists of three individual aquifers named the Chicot, Evangeline, and Jasper aquifers, from shallowest to deepest. A fourth, deeper aquifer, named the Catahoula aquifer, is also sometimes recognized; however, the Catahoula aquifer is more often identified as a confining layer (Texas Water Development Board [TWDB], 2011). The Chicot and Evangeline aquifers underlie the proposed liquefaction and pipeline facilities with the base of the Chicot aquifer at a depth of about 800 to 1,200 feet and the base of the Evangeline aquifer at a depth of about 2,600 to 4,000 feet. The lower portion of the Chicot aquifer (700-foot sand) is the primary water source for the Projects area and underlies the Projects. The Chicot and Evangeline aquifers consist of interbedded clays, silts, sands, and gravels. Over much of the Projects area the first usable sand layer within the Chicot aquifer is overlain by a 50- to 100-foot-thick clay confining layer. Recharge to the Chicot aquifer occurs mainly in sandy outcrops northwest of the Projects area. In Louisiana, the Chicot aquifer is the most heavily used aquifer and provides over 650 million gallons per day for various uses including agriculture, public water supply, and industry (USGS, 2010). Water levels in the Chicot aquifer have declined in portions of Louisiana due to extensive pumping, which has led to concerns over the potential for saltwater intrusion (USGS, 2010).

The TWDB categorizes aquifer systems as major and minor aquifers in Texas. Major aquifers supply large quantities of water over large geographic areas, and minor aquifers supply either smaller quantities of water over large geographic areas or large quantities of water over small areas (TWDB, 2011). The Gulf Coast aquifer is designated as a major aquifer; however, for regulatory purposes, the coastal area that extends about 10 miles inland is not included in the major aquifer designation due to the presence of predominantly brackish water. Therefore, the Liquefaction Project site, portions of the Texas Connector Project (between MPs 0.0 and 3.4 along the Northern Pipeline and between MPs 0.0 and 6.3 along the Southern Pipeline), and portions of the Louisiana Connector Project (between MPs 0.0 and 17), would not be located above a major aquifer as designated by the TWDB. The rest of the Texas Connector Project route is underlined by the Chicot aquifer, which the TWDB has designated as a major aquifer. Louisiana does not have an equivalent designation of major and minor aquifers.

The Chicot aquifer has three primary water-bearing zones used for drinking water, typically referred to as the 200-, 500-, and 700-foot sands. This nomenclature is based on depth of the aquifer at specific municipalities, and the 200-foot sand in one municipality is not hydraulically connected to a 200-foot sand found in another municipality. The Chicot aquifer underlies the Texas Connector Project between MPs 6.3 and 7.6 of the Southern Pipeline and the Louisiana Connector Project between MPs 17 and 130.

The brackish to saline quality of much of the groundwater in the Jefferson County, Texas and Cameron Parish, Louisiana area limits the use of such water. The groundwater in Orange County, Texas is mostly fresh to slightly saline. Groundwater wells in Jefferson County are predominantly in the northern and western portions of the county where salinity levels are lower. Depth to surficial groundwater in Jefferson and Orange Counties, Texas and Cameron Parish, Louisiana ranges from about 3 to 50 feet below ground surface, with shallow groundwater near wetlands. Soil borings completed at the Liquefaction Project site encountered groundwater at the existing ground surface. Fresh water is obtained from surface water sources for most industrial, agricultural, and municipal use. Surface water use is discussed in section 4.3.1.

4.3.1.2 Sole Source Aquifers

The EPA defines a sole source aquifer (SSA) or principal source aquifer area as one that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer, where contamination of the aquifer could create a significant hazard to public health, and where there are no alternative water sources that could reasonably be expected to replace the water supplied by the aquifer (EPA, 2015). The EPA has designated the Chicot aquifer as an SSA in southwestern Louisiana, but this designation does not apply to the Chicot aquifer in Texas. Therefore, the Louisiana portions of the Texas Connector and Louisiana Connector Projects would overlie an EPA-designated SSA, but the other project facilities in Texas would not.

4.3.1.3 Water Supply Wells

Under the Safe Water Drinking Act (SWDA), each state is required to develop and implement a Wellhead Protection Program to identify the land and recharge areas contributing to public supply wells and prevent the contamination of drinking water supplies. The SWDA was updated in 1996 with an amendment requiring the development of a broader-based Source Water Assessment Program, which includes the assessment of potential contamination to both groundwater and surface water through a watershed approach. A wellhead protection area (WHPA) encompasses the area around a drinking water well where contaminants could enter and pollute the well.

The TCEQ Source Water Assessment and Protection Program has identified protection areas around each public water supply well or surface water source in the state. The TCEQ's method of groundwater management is through the establishment of Groundwater Conservation Districts (GCD). GCDs are locally governed districts established for the management of groundwater by supporting the conservation, preservation, protection, recharging, and prevention of waste of the groundwater resources within their jurisdiction (TCEQ, 2017a). The TCEQ, TWDB, and TPWD are authorized to identify and delineate Priority Groundwater Management Areas in Texas. The Priority Groundwater Management Area Program identifies regions of Texas that are experiencing, or are expected to experience, critical groundwater problems and encourage the formation of GCDs for those areas (TCEQ, 2017b). Jefferson and Orange Counties are not within a GCD or a Priority Groundwater Management Area (TCEQ, 2013; TCEQ, 2017c).

The State of Louisiana Wellhead Protection and Source Water Protection Program is a component of the LDEQ's Drinking Water Protection Program and is designed to protect the quality of public drinking water supplies obtained from community water wells. The LDEQ delineates a WHPA around each public water supply well or well field in the state. WHPAs typically range from a 1,000-foot radius to a 1-mile radius, depending on well screen depth, construction date, or aquifer source. A management plan is then created for each well to minimize the potential risks to public water supplies, which can include ordinances, source prohibitions, and/or education of the public.

There are no known groundwater withdrawal wells or WHPAs designated by Texas within 0.25 mile of the Liquefaction Project (TWDB, 2017). There are no drinking water wells within 150 feet of the Liquefaction Project (TWDB, 2017). The nearest registered well to the liquefaction facilities is about 1.8 miles south of the property boundary, uses the Chicot aquifer, and is classified as unused (TWDB, 2017). No springs have been identified on or within 150 feet of the Liquefaction Project site.

There are no known groundwater withdrawal wells, drinking water wells, designated WHPAs, or springs within 150 feet of the Texas Connector Project in Texas and Louisiana (LDNR, 2017a; TWDB, 2017).

There are 16 known groundwater withdrawal wells or drinking water wells within 150 feet of the Louisiana Connector Project in Louisiana and none in Texas (LDNR, 2017a; TWDB, 2017). Eight of these wells are identified as plugged and abandoned, and eight are identified as active. Active wells include six private water wells for domestic or agricultural use, one commercial well, and one monitor well. There are no designated WHPAs or springs identified within 150 feet of the Louisiana Connector Project (LDNR, 2017a; TWDB, 2017).

4.3.1.4 Groundwater Quality

The LDEQ operates an Aquifer Sampling and Assessment Program to monitor the groundwater quality in Louisiana's major freshwater aquifers. This program publishes a triennial report that presents the results of groundwater sampling of about 200 wells in 14 different aquifers. Under the SWDA, the EPA has established the primary 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 have also been established by the EPA; however, they are defined as non-enforceable guidelines for taste, odor, or appearance of water (LDEQ, 2009a; LDEQ, 2009b).

The latest available triennial report from 2009 indicates that the water from the Chicot aquifer is hard, of good quality when considering health risk guidelines, and of fair quality when considering taste, odor, and appearance. No wells from the Chicot aquifer sampled in 2008 exceeded any of the primary MCLs that are established for 90 compounds regulated by the EPA; however, several wells exceeded secondary MCLs, including 17 wells for iron, 5 wells for total dissolved solids, 4 for pH, 3 for chloride, and 3 for color. Over the past 12 years, the average concentration of six analytical parameters (pH, alkalinity, chloride, hardness, barium, and iron) have increased in the Chicot aquifer (LDEQ, 2009a; LDEQ, 2009b).

In some areas of southwest Louisiana, decreasing water levels (drawdown) and saltwater encroachment have been the result of increased groundwater withdrawals. The rate of decline is primarily due to industrial use in the Lake Charles area and rice irrigation, where water levels drop up to 2 feet per year in the 500-foot sand due to intensive groundwater withdrawal (LDNR, 2012; Louisiana Department of Transportation and Development and USGS, 2011). Chloride levels have remained relatively constant since the mid-1970s; however, in the eastern and southern Lake Charles area, elevated chloride levels greater than 100 milligrams per liter have been observed in public water supply wells, suggesting that additional saltwater intrusion and upward migration from the 500-foot sand and 700-foot sand may occur in the future (Louisiana Department of Transportation and Development and USGS, 1999; LDEQ, 2009a).

The LDNR's Office of Conservation has the authority to regulate usage of groundwater on a statewide basis through designation as an Area of Ground Water Concern or a Critical Area of Ground Water Concern. Areas of Ground Water Concern are defined as areas where the sustainability of an aquifer is not being maintained due to either movement of a salt water front, water level decline, or subsidence. A Critical Area of Groundwater Concern is defined as an Area of Ground Water Concern, where the Office of Conservation's Commissioner of Conservation finds that the sustainability of the aquifer cannot be maintained without restrictions on groundwater withdrawal. Louisiana has three designated Areas of Ground Water Concern, all of which are in northern Louisiana, within the Sparta aquifer, and over 130 miles from the Projects.

Although no portion of the Chicot aquifer has been designated as an Area of Ground Water Concern, high water use in southwest Louisiana has been identified as one of the current major issues having an impact on groundwater sustainability management (LDNR, 2012). In 2012, the LDNR and USGS entered a partnership to increase groundwater monitoring. Thus, the number of wells within Louisiana monitored for water level, chlorides, and water quality has nearly doubled. In addition, the University of Louisiana at Lafayette has initiated a 3-year study in southwest Louisiana of regional groundwater use and management (LDNR, 2014).

Texas does not currently have an equivalent program for groundwater areas of concern.

4.3.1.5 Groundwater Impacts and Mitigation

Liquefaction Project

Construction activities associated with the Liquefaction Project that could potentially affect groundwater resources include foundation excavation and installation, installation of piles for LNG vessel loading facilities and LNG tanks, and accidental release of fuels, lubricants, and/or hazardous materials during construction. New impervious surfaces created as part of construction of the Liquefaction Project could also potentially affect groundwater resources by reducing infiltration and groundwater recharge. For the evaluation of the groundwater resource, the dredge disposal areas (J.D. Murphree WMA and existing Dredge Disposal Areas 8, 9A, and 9B) and associated temporary dredge material pipelines are considered part of the Liquefaction Project. Further, other than the placement of dredge material onto the surface, no ground-disturbing activities would occur at these placement areas.

The nearest registered water supply well is 1.8 miles from the liquefaction facility site. Subsurface conditions found during geotechnical investigations at the Liquefaction Project site consist predominantly of clays with low hydraulic conductivity. There is a 25-foot-thick layer of dense to very dense silty fine sand at about 155 feet below grade. PALNG may drive pilings as deep as 160 feet but expects most piles to terminate within the clay layer. Even if a few piles terminated within the sand layer, neither the soil nor the water from the shallow depth would be carried into the sand stratum by the pile, as direct transfer is typically negligible and conduit formation potential for displacement piles is low when the ratio of pile unit volume to external surface area is high (Boutwell et al., 2000). In addition, the clay subsoil above the sand stratum is not known to contain any contaminants. The various buildings at the liquefaction facility would have shallow foundations above the local water table, the excavation and installation of which would not cause significant impacts on local groundwater. Pile driving operations are not be expected to have an adverse effect on the groundwater or the aquifers at the liquefaction site.

Accidental spills and leaks of hazardous materials associated with equipment trailers; the refueling or maintenance of vehicles; and the storage of fuel, oil, and other fluids pose the greatest risk to groundwater resources. If not cleaned up, contaminated soil could continue to leach and add pollutants to groundwater long after a spill has occurred. PALNG would adhere to the spill prevention, control, and countermeasure plans outlined in its *Environmental Plan* to minimize potential impacts on groundwater resources. The *Environmental Plan* identifies preventive measures to reduce the likelihood of a spill, including, but not limited to the following:

- Storage of fuels and lubricants, and refueling and lubrication of equipment, would be restricted to designated upland staging areas at least 100 feet away from stream channels and wetlands.

- Secondary containment for petroleum products would be constructed around aboveground storage tanks in staging areas.

- All vehicles, equipment, and staging areas would be equipped with absorbent materials and spill kits.
- Routine equipment maintenance would be performed at staging areas, and all spent oils, lubricants, filters, etc. would be collected and disposed of in accordance with federal and state regulations.
- Equipment would not be washed in streams.

The *Environmental Plan* also specifies measures to contain and clean up a spill should one occur. In addition, the plan addresses the storage and transfer of hazardous materials and petroleum products. We have reviewed the *Environmental Plan* for the Liquefaction Project and find it acceptable to minimizing impacts on groundwater resources.

PALNG does not propose to use groundwater as a water supply during construction or operation of the liquefaction facilities. Instead, water for the facility would be obtained from the local municipal water system, which has a water main pipeline on the west side of the Liquefaction Project site that would be relocated as part of the project. Since groundwater withdrawals are not anticipated, potential resultant changes in flow patterns and/or lowering of the local groundwater table because of such withdrawals would not occur.

With implementation of the measures discussed above, the activities associated with the construction and operation of the Liquefaction Project would result in negligible to minor and temporary impacts on local groundwater resources.

Texas Connector and Louisiana Connector Projects

Construction of the Texas Connector and Louisiana Connector Projects would take place mostly above the water table; however, where the water table is within the trench or grading depth, shallow groundwater resources could be temporarily affected by minor fluctuations of water level, flow characteristics, and/or increased turbidity in localized areas adjacent to the trench, which could also affect the hydrology of nearby wetland areas. New impervious surfaces caused by construction of the compressor stations for the Texas Connector and Louisiana Connector Projects could also potentially affect groundwater resources by reducing infiltration and groundwater recharge. We estimate that shallow groundwater could be encountered within the first 3 feet below grade within Jefferson and Orange Counties, Texas and in Cameron, Calcasieu, and Beauregard Parishes, Louisiana. If it becomes necessary to remove water from the pipeline trench during construction, the water would be pumped through filter bags prior to being discharged. The typical pipeline trench excavation depth would be at least 6.5 feet, which is far shallower than the depth of the Chicot aquifer in the Texas Connector and Louisiana Connector Projects area, as discussed in section 4.3.1.1. The pipeline would be installed deeper in areas where it crosses other pipelines, roads, and waterbodies. PAPL would complete pipeline construction in a given area in a short period of time and, therefore, any potential trench dewatering impacts on nearby vegetated areas would be temporary and localized. Water table elevations would return to preconstruction levels soon after the trench has been backfilled. Should the trench be continually flooded and dewatering is not feasible, PAPL would use push-pull or float techniques to place the pipe in the trench (see section 2.4.3.2 for a description of these methods). PAPL has identified several areas where the push-pull construction method would be used due to wetlands and groundwater issues (see table 2.4.3-2). Excavation could also increase turbidity within the groundwater resources adjacent to construction activities; however, there would not be a significant or adverse impact on groundwater quantity or quality as potential turbidity would be localized to the disturbance area.

The Southern Pipeline of the Texas Connector Project would cross about 0.5 mile of the Chicot aquifer in Louisiana, which is designated as an SSA. Due to saltwater intrusion in this area, the aquifer is unsuitable for domestic purposes. The Louisiana Connector Project would cross over 110 miles of the Chicot aquifer in Louisiana. Given the impermeability of the clay layer and the depth of the Chicot aquifer, construction of the Louisiana Connector Project would not adversely affect the Chicot aquifer, its groundwater quality, or the SSA in Louisiana.

Localized, near-surface soil compaction caused by heavy construction vehicles could reduce water infiltration and increase runoff and potential ponding. In areas of cleared vegetation, water infiltration would be reduced until vegetation has been restored, which could have a temporary effect on deep aquifer recharge. To minimize impacts on groundwater during construction of the Texas Connector and Louisiana Connector Projects and to restore preconstruction overland flow and recharge patterns, PAPL would adhere to the measures in its project-specific *Environmental Plan*. This includes installation of trench breakers to prevent groundwater movement or loss from nearby wetlands, restoration of topographic contours to preconstruction conditions, and restoration of vegetation to the right-of-way. Further, PAPL would use an HDD at 25 locations along the Texas Connector Project and 26 locations along the Louisiana Connector Project, including the shorelines of Sabine Lake. As previously discussed, use of the HDD method would avoid most direct impacts, including ground disturbance between the drill entry and exit points. However, a temporary, localized increase in groundwater turbidity could occur in the event of an inadvertent release of drilling fluid (also termed an “inadvertent return”) into the groundwater. Drilling fluid is composed of water and bentonite clay (a naturally occurring mineral). The EPA does not list bentonite as a hazardous substance, and no long-term adverse environmental impacts are expected should an inadvertent return occur. Similarly, while native soils may mix with the drilling fluid because of the drilling process, no adverse environmental impacts from these materials are expected should an inadvertent return occur. Cumulatively, about 26.3 miles of ground disturbance impacts would be avoided. With implementation of these measures, we conclude that impacts on groundwater would be temporary and minor.

Impacts on shallow groundwater resources could occur due to an accidental spill, leak, or other release of fuels, lubricants, or other hazardous materials during construction or operation of the Texas Connector and Louisiana Connector Projects. Potential contamination due to accidental spills or leaks of hazardous materials associated with vehicle refueling, vehicle maintenance, and storage of construction materials would present the greatest potential threat to groundwater resources during construction of the pipeline and aboveground facilities. PAPL would adhere to its project-specific *Environmental Plan*, which includes spill prevention and containment measures to minimize potential impacts on groundwater resources. We have reviewed the *Environmental Plan*’s spill prevention and containment measures for the Texas Connector and Louisiana Connector Projects and find them acceptable.

While there are no known groundwater withdrawal or drinking wells within 150 feet of the Texas Connector Project, 16 groundwater withdrawal wells or drinking water wells are known to be within 150 feet of the Louisiana Connector Project (see section 4.3.1.3). Prior to construction, PAPL would offer to the land/well owner(s) pre- and post-construction water quality well testing conducted by a qualified independent inspection service. Should construction of the projects temporarily impact a private or public well quality, PAPL would provide alternative water sources or other compensation to the land/well owner(s). Should construction impacts permanently impact a well, PAPL would repair, replace, or provide alternative sources of potable water to the land/well owner(s).

PAPL does not plan to use groundwater as a water supply during construction or operation of the pipeline. Water for hydrostatic testing would be obtained from the City of Port Arthur, the Lower Neches Valley Authority (LNVA), and/or surface water sources. Since groundwater withdrawals are not anticipated, potential resultant changes in flow patterns and/or lowering of the local groundwater table as a result of such withdrawals would not occur.

With implementation of the measures discussed above, the activities associated with the construction and operation of the Texas Connector and Louisiana Connector Projects would result in negligible to minor and temporary impacts on local groundwater resources.

4.3.1.6 Nonjurisdictional Facilities

Activities associated with the relation of SH 87, pipelines, and utilities are on the same site as the Liquefaction Project. Construction of SH 87 could increase the amount of impervious surfaces present, which could potentially affect groundwater resources by reducing infiltration and groundwater recharge. The description of the groundwater resources provided in section 4.3.1.1 and impacts discussed and mitigation measures committed to in section 4.3.1.3 are applicable to these facilities. Therefore, activities associated with the relocation of nonjurisdictional facilities would result in negligible to minor and temporary impacts on local groundwater resources.

4.3.2 Surface Water Resources

4.3.2.1 Existing Surface Water Resources

Liquefaction Project

The Liquefaction Project would be within the Sabine Lake Watershed about 11 miles north of the Gulf of Mexico on the SNWW's western shore. The Sabine Lake watershed covers an area of 1,040 square miles in southwest Texas and southeast Louisiana. Waterbodies that would be affected by the project include the Port Arthur Canal, and the Round Lake/Oilfield Road Canal. The ICWW and Port Arthur Canal would also be temporarily impacted by placement of the dredge disposal pipelines. Round Lake is surrounded by both the jurisdictional and nonjurisdictional portions of the project on the northern end of the facility, but would not be directly impacted by project activities.

The Port Arthur Canal is part of the SNWW, which is an estuarine, perennial waterbody used as a navigation channel that extends about 79 miles inland to provide access to ports at Port Arthur, Beaumont, and Orange (USACE, 2012). The SNWW is the fourth most widely used shipping channel in the United States in terms of total tonnage (USACE, 2012). The Port Arthur Canal is about 0.2 mile wide at the project site. The channel is regulated and maintained by the USACE as a Traditional Navigable Water and is considered EFH (discussed further in section 4.6.3). The Port Arthur Canal has been substantially altered by widening and dredging for navigational channel use. Dredging of the channel to about 48 feet was authorized and implemented in 2014 (SNND, 2017a). Railroad activities, pipeline installations, and discharge of fill material have also altered this waterway.

As described in section 2.1.1.1, the Liquefaction Project requires installation of a MOF, Pioneer Dock, and marine berth and turning basin in the Port Arthur Canal. This would require initial dredging of about 67,600 yd^3 for the MOF, about 508,000 yd^3 for the Pioneer Dock, about 5.3 million yd^3 for the ship slip and berthing area, and about 1.4 million yd^3 for the ship turning basin. During project operations, regular maintenance dredging is anticipated to total 287,000 yd^3 of material at the berth, turning circle, and MOF on a yearly basis. According to PALNG, the Pioneer Dock would not require maintenance dredging during operations. PALNG would use dredged material as part of its wetland mitigation plan, which is further discussed in section 4.4. Section 4.3.2.2 discusses potential dredging impacts on the Port Arthur Canal's water quality.

As described in section 2.4.1.1, PALNG would construct a heavy haul road adjacent to Round Lake to the north and west to provide a route from the MOF to the other liquefaction facilities, with an equipment bridge crossing the Round Lake/Oilfield Road Canal. A discussion of potential impacts from the installation of equipment bridges is provided in section 4.3.2.2.

The SNWW is used for commercial and recreational fishing; however, the waterbody is not considered high quality fish habitat by the state of Texas. Potential project-related impacts on recreational and commercial fishing are discussed in more detail in sections 4.8.6 and 4.9.2, respectively.

Wetland and waterbody impacts in Texas and Louisiana are regulated by the USACE under section 404 of the CWA, which establishes standards with which to regulate wetland and waterbody impacts, with the goal of no net loss of WOUS, and section 10 of the RHA (33 USC 403). Section 404(b)1 guidelines require that wetland and waterbody impacts be avoided to the extent practicable, and minimized where avoidance is not possible. The USACE Galveston District office has the authority to review and issue permits for projects that involve discharge of dredge or fill material into WOUS and work within or crossing any waters regulated under section 10 of the RHA, which includes the Port Arthur Canal.

As described in section 2.1.1.10, dredge material would be beneficially reused at the J.D. Murphree WMA and disposed of at existing Dredge Disposal Areas 8, 9A, and 9B. Dredge material would be transported to these sites via an above ground, temporary, 30-inch-diameter pipeline laid on the ground surface or, where necessary, floated in water. Figure 2.1.1-3 shows the locations of the dredge disposal areas and associated dredge pipelines, which would cross the Round Lake Canal (to reach the J.D. Murphree WMA) and ICWW and Port Arthur Canal (to reach Dredge Disposal Areas 8, 9A, and 9B).

Impaired Waters

Section 303 of the CWA, requires states, territories, and authorized tribes to develop water quality standards and prepare a list of waterbodies within their boundaries that do not meet these standards, which are referred to as “impaired waterbodies.” These lists are known as 303(d) Impaired Waters lists. Contaminants can accumulate in the sediments of contaminated waterbodies. Therefore, waters in the Liquefaction Project area where there are contaminated sediments have the potential to become contaminated if there is a resuspension of sediments. Because of the current and historical industrial use of the Port Arthur Canal the potential exists for chemical contamination. The Port Arthur Canal is not listed as an impaired water in the Texas 2014 303(d) impaired waters list.

Based on comments from the EPA and requirements from the TPWD, and as described in section 4.2.1.6, a soil and sediment analysis would be conducted according to the EPA recommendations for dredge materials relocated to the J.D. Murphree WMA.

Sensitive Waterbodies

Waterbodies may be considered sensitive for several reasons, including the presence of significant fisheries, habitat for threatened or endangered species, high-quality recreational or visual resources, historic value, or impaired water or contaminated sediments. The closest TPWD-listed “ecologically significant” waterbody, Keith Lake, is about 1.5 miles from the Liquefaction Project (TPWD, 2016). Therefore, no impacts on sensitive waterbodies as a result of the project are anticipated.

Potable Water Intakes

No sole-source drinking water supply surface waters would be affected by the Liquefaction Project and no potable water intakes are within 3 miles downstream of the Liquefaction Project (TCEQ, 2015). Therefore, no impacts on potable water intakes as a result of the project are anticipated.

Texas Connector and Louisiana Connector Projects

Texas Connector Project

The Texas Connector Project would cross five watersheds (see table 4.3.2-1).

TABLE 4.3.2-1

Watersheds Crossed by the Texas Connector Project

Watershed	Location of Watershed Within Project Area (County/Parish and State)	Project Component(s) Within the Watershed	Project Crossing (miles)
LNVA Canal – Taylor Bayou	Jefferson County, Texas	Northern Pipeline	2.0
Salt Bayou	Jefferson County, Texas	NGPL Lateral Northern Pipeline Southern Pipeline	14.7
Union Canal – Neches River	Jefferson County, Texas	Northern Pipeline GTS/CIPCO Lateral TETCO Lateral HPL Lateral FGT Lateral	2.5
Gray's Bayou – Neches River	Jefferson County, Texas	Northern Pipeline FGT Lateral	0.9
Johnson Bayou – Starks South Canal	Orange County, Texas Cameron Parish, Louisiana	Southern Pipeline KMLP Lateral	0.8

Project construction would affect 55 waterbodies, including 37 perennial, 6 intermittent, and 12 ephemeral waterbodies (see table 4.3.2-2). Appendix I lists of the waterbodies crossed along the pipelines, laterals, and access roads; milepost locations; state waterbody classifications; flow type; and proposed crossing method. The FERC classifies surface waters based on size: major waterbodies are greater than 100 feet wide, intermediate waterbodies are greater than 10 feet wide but less than or equal to 100 feet wide, and minor waterbodies are less than or equal to 10 feet wide. Fifteen major waterbodies, including the Neches River, Sabine Pass, the ICWW, Taylor Bayou, and Hillebrandt Bayou as well as 11 unnamed waterbodies, would be crossed by the Texas Connector Project pipelines. The remaining waterbodies crossed by the project are classified as intermediate or minor.

TABLE 4.3.2-2

Summary of Surface Waters Affected by the Texas Connector Project

Project Component [a]	Perennial	Intermittent	Ephemeral	Total
Northern Pipeline	27	5	10	42
Southern Pipeline	6	-	-	6
GTS/CIPCO Lateral	3	-	-	3
FGT Lateral	1	1	2	4
Project Total	**37**	**6**	**12**	**55**

[a] Waterbodies would not be affected by the KMLP, NGPL, HPL, and TETCO Laterals, or by aboveground facilities.

Waterbodies would be crossed along the Northern Pipeline, Southern Pipeline, GTS/CIPCO Lateral, and FGT Lateral. No waterbody crossings or impacts are associated with the KMLP, NGPL, HPL, and TETCO Laterals, or within proposed aboveground facilities.

Impaired Waters

In Texas, Taylor Bayou and Hillebrandt Bayou are listed on the Texas 2014 303(d) impaired waters list where crossed by the project. Taylor Bayou is listed as impaired due to presence of dioxin and polychlorinated biphenyls (PCBs), both of which are believed to be caused by Point Source Discharge from an industrial operation. Hillebrandt Bayou is listed as impaired due to bacteria, the cause for which is not listed (EPA, 2014).

In Louisiana, the waterbodies crossed by the Texas Connector Project are not listed on Louisiana's 2016 303(d) list of impaired waters. Therefore, contaminated sediments are not expected to be encountered in waterbodies along the Southern Pipeline route in Louisiana, and the project would not have significant effects on contaminated sediments.

Sensitive Waterbodies

None of the waterbodies crossed by the Texas Connector Project are listed as National Wild and Scenic Rivers, are listed as important riparian areas, or contain federally listed species. Ecologically unique river and stream segments (Texas only) are discussed in section 4.6.2. Waterbodies designated as EFH are further discussed in section 4.6.3.

Potable Water Intakes

There are no public water supply wells or surface water intakes within 150 feet of the proposed construction rights-of-way (TCEQ, 2015; LDNR, 2012). The Texas Connector Project does not cross any designated sole-source drinking water supply stream segments and is not within 3 miles of any identified stream segments in Texas (TCEQ, 2015). Also, the project is not within 3 miles of any surface water intakes in Louisiana (LDEQ, 2001).

For the Texas Connector Project, the USACE Galveston District office has the authority to review and issue permits for projects that involve discharge of dredge or fill material into WOUS, including wetlands, and work within or crossing any waters regulated under section 10 of the RHA. Sabine Pass, the ICWW, and the Neches River are waterbodies crossed by the project and regulated under section 10 of the RHA.

<u>Louisiana Connector Project</u>

The Louisiana Connector Project would cross seven watersheds as listed in table 4.3.2-3.

TABLE 4.3.2-3

Watersheds Crossed by the Louisiana Connector Project

Watershed	Location of Watershed Within Project Area (County/Parish and State)	Project Component(s) Within the Watershed	Project Crossing (miles)
Lower Sabine	Calcasieu, LA Cameron, LA	Mainline	13.1
Sabine Lake	Orange, TX Jefferson, TX Cameron, LA	Mainline Centana Meter Station PALNG Meter Station	17.5
Lower Calcasieu	Calcasieu, LA	Mainline	26.0
West Fork Calcasieu	Calcasieu, LA	Mainline	15.6

TABLE 4.3.2-3 (cont'd) **Watersheds Crossed by the Louisiana Connector Project**			
Watershed	Location of Watershed Within Project Area (County/Parish and State)	Project Component(s) Within the Watershed	Project Crossing (miles)
Upper Calcasieu	Allen, LA Beauregard, LA	Mainline Compressor Station TETCO Meter Station TGP Meter Station	26.0
Whiskey Chitto	Allen, LA	Mainline	1.5
Mermentau Headwaters	Allen, LA Evangeline, LA St. Landry LA	Mainline ANR Meter Station Egan Meter Station Texas Gas Meter Station Pine Prairie Meter Station CGT Meter Station	30.8

Project construction would affect a total of 167 waterbodies, including 60 perennial, 36 intermittent, 57 ephemeral, and 14 open water waterbodies (see appendix I). Thirty-six major waterbodies (e.g., Sabine Lake, Sabine-Neches Canal, Bayou Choupique, Whiskey Chitto Creek, Calcasieu River, Bayou Blue) would be crossed by the Louisiana Connector Project. The remaining waterbodies crossed by the project are classified as intermediate or minor.

No waterbody crossings or impacts are proposed within aboveground facilities. Temporary construction matting would be used to cross waterbodies along access roads. Appendix I lists the waterbodies crossed along the pipeline, laterals and tie-ins, and access roads; milepost locations; state waterbody classifications; flow type; and proposed crossing method.

For the Louisiana Connector Project, the USACE Galveston and New Orleans District offices have the authority to review and issue permits for projects that involve discharge of dredge or fill material into WOUS and work within or crossing any waters regulated under section 10 of the RHA. The Calcasieu River, Sabine Lake, Sabine-Neches Canal, Bayou Choupique, Bayou Nezpique, the Houston River, Little River, Hickory Branch, Beckwith Creek, and Marsh Bayou have the potential to be regulated under section 10 of the RHA. The USACE would determine the final list of waters regulated under section 10 of the RHA as part of its permitting process.

Impaired Waters

The Louisiana Connector Project would cross 14 waterbodies listed on the EPA's 303(d) list of impaired waters as shown in table 4.3.2-4.

TABLE 4.3.2-4 **Impaired Waterbodies Crossed by the Louisiana Connector Project**			
State/County or Parish	Waterbody Name	Milepost (s)	Reason for Impairment [a]
TEXAS			
Jefferson	Sabine-Neches Canal	0.2	Bacteria
Jefferson and Orange	Sabine Lake in Texas	0.7, 1.0, 3.7, 13.2	PCBs in edible tissue
LOUISIANA			
Evangeline	Bayou Des Cannes	119.1	Mercury in Fish Tissue, Nitrate/Nitrite, Dissolved Oxygen, Phosphorus (Total), Total Dissolved Solids, and Turbidity

TABLE 4.3.2-4 (cont'd)

Impaired Waterbodies Crossed by the Louisiana Connector Project

State/County or Parish	Waterbody Name	Milepost (s)	Reason for Impairment [a]
Allen and Evangeline	Bayou Nezpique	110.0	Lead, Mercury in Fish Tissue, Nitrate/Nitrite, Dissolved Oxygen, Phosphorus (Total), Turbidity, Fecal Coliform
Allen	Bayou Blue	100.9, 104.4, 104.7, 108.7	Lead, Dissolved Oxygen, and Fecal Coliform
Allen	Calcasieu River	94.6	Mercury in Fish Tissue
Allen	Barnes Creek	79.1	Dissolved Oxygen
Beauregard	Marsh Bayou	73.2	Dissolved Oxygen
Beauregard	Indian Bayou	69.8	Fecal Coliform and Dissolved Oxygen
Calcasieu	Hickory Branch	65.3	Mercury in Fish Tissue and Dissolved Oxygen
Calcasieu	Beckwith Creek	64.1	Fecal Coliform, Dissolved Oxygen, Total Dissolved Solids, and Mercury in Fish Tissue
Calcasieu	Little River	60.6	Fecal Coliform, Lead, Dissolved Oxygen, and Mercury in Fish Tissue
Calcasieu	Houston River	56.9	Chloride, Mercury in Fish Tissue, Dissolved Oxygen, Sulphates and Total Dissolved Solids
Cameron	Sabine Lake in Louisiana	13.2, 16.8	Fecal Coliform

[a] Sources: LDEQ, 2016 Louisiana Water Quality Inventory: Integrated Report (305[b]/303[d]) and TPWD, 2014 Texas Integrated Report Index of Water Quality Impairments (305[b]/303[d]).

Sensitive Waterbodies

The State of Louisiana created the Louisiana Natural and Scenic Rivers System (System Rivers) in 1970 with the purpose of preserving, protecting, developing, reclaiming, and enhancing designated free-flowing Louisiana waterbodies. These waterbodies are designated due to their unique scenic and wilderness qualities, as well as their ecological benefits. Under the Louisiana Scenic Rivers Act of 1988, the LDWF requires a Scenic River Permit for all activities on or near System Rivers that may negatively impact the waterbodies. Four waterbodies crossed by the pipeline route are designated as System Rivers: Beckwith Creek, Hickory Branch, Barnes Creek, and Whiskey Chitto Creek (LDWF, 2017a).

None of the waterbodies crossed by the Louisiana Connector Project are listed as National Wild and Scenic Rivers, or are listed as important riparian areas. There are no public water supply intakes within 150 feet of the construction right-of-way. Ecologically unique river and stream segments (Texas only) are discussed in section 4.6.2. Potential impacts on protected species associated with sensitive waterbodies are discussed further in section 4.6.

Potable Water Intakes

The TCEQ identifies protection zones for areas surrounding sole-source surface drinking water supplies, including 3 miles upstream from the water supply intake. The project does not cross any designated sole-source drinking water supply stream segments and is not within 3 miles of any identified stream segments in Texas (TCEQ, 2015). In Louisiana, one surface water intake for a public water supply is approximately 1.2 miles east of the Sabine River Diversion Canal crossing (Louisiana Geographic Information Center, 1999).

Nonjurisdictional Facilities

The existing environment for the relocation of 3.3 miles of SH 87, pipelines, and utilities is consistent with the description provided for the Liquefaction Project. The new road right-of-way would cross the Round Lake Canal, which is a dual channel canal connecting Round Lake to Lost Lake, and is not connected to the Port Arthur Canal.

4.3.2.2 Surface Water Impacts and Mitigation

Direct impacts on surface water resources are defined as those project-related impacts that occur to waterbodies in the construction workspace that are temporarily or permanently disturbed and for which the acreage of impacts is quantifiable. Direct impacts may include increased sedimentation and turbidity associated with construction activities and alterations to the depth of the waterbody (e.g., filling or dredging). Indirect impacts on surface water resources would occur outside of the construction workspace and may include potential changes in flow regime or water quality, temperature profiles, and sedimentation.

Liquefaction Project

<u>Dredging and Dredge Material Placement</u>

The primary impacts associated with the Liquefaction Project within the Port Arthur Canal would result from dredging associated with construction of the marine berths, MOF, and Pioneer Dock, which is described above.

Dredging for construction and maintenance dredging during operation are anticipated to result in temporarily increased turbidity levels, decreased dissolved oxygen levels, and resuspension of nutrients or chemicals into the Port Arthur Canal water column. Increased turbidity levels have the potential to negatively impact aquatic plants and phytoplankton in the immediate area of dredging activities, while decreased dissolved oxygen concentrations may negatively impact benthic organisms.

Sedimentation and turbidity associated with marine berth, MOF, and Pioneer Dock construction would be minimized by using dry excavation methods to the extent practicable. Where hydraulic dredging is required, pumps used to convey material from the hydraulic cutter heads would capture most of the siltation for transport to the dredge material disposal area, thus minimizing increased turbidity. The ambient turbidity levels in the Port Arthur Canal are high due to regular activities such as ship traffic, flows, and waves, thereby reducing the relative impact of the increased turbidity produced by project-related dredging. Based on an analysis of turbidity near the Liquefaction Project conducted in 2005, and considering the flow velocity and average depth of the Port Arthur Canal at the project site, total suspended solids (TSS) resulting from construction and maintenance dredging would drop to less than 10 mg/l after 200 to 300 yards (PI Engineering, 2005). Considering the average background TSS of the Port Arthur Canal is about 40 mg/l, it is anticipated that construction and maintenance dredging associated with the PALNG facilities would have an incremental, but minor effect on the existing TSS levels within the Port Arthur Canal. Turbidity impacts related to dredging are expected to be short term and to have minimal adverse effects on water quality and aquatic life due to existing activities in Port Arthur Canal, which already contribute to high levels of background turbidity.

PALNG would comply with all conditions of permits required to construct the marine facilities and perform maintenance dredging, including USACE section 10 and section 401 permits, and a Coastal Zone Consistency Determination. Dredged material would be placed within the J.D. Murphree WMA if authorized by the USACE, as well as SNND Dredge Disposal Areas 8, 9A, and 9B, which are currently authorized to receive dredge material by the USACE (see section 4.4.4.1). Dredge material would be transported to the WMA and SNND Dredge Disposal areas 8, 9A, and 9b using an above ground 30-inch-diameter pipeline that would be temporarily placed across the surface of the lands and canals between the liquefaction site and the WMA. PALNG stated it would use board mats as necessary to accommodate the dredge pipelines to minimize surface impacts along the Northern Pipeline right-of-way. PALNG also stated that it is likely the dredge pipeline would be placed and managed similar to what is currently done by the USACE and SNND when maintenance dredging is performed within the ICWW and Port Arthur Canal, which may consist of installing a floating pipe that can be disconnected and moved out of a vessel's path, placed under the ICWW channel, or placed along the bottom of the channel. PALNG has committed to ensure that navigational traffic in waterways is not interrupted and would complete a final design of this temporary pipeline at the ICWW and Port Arthur Canal crossing locations prior to construction.

<u>LNG Loading and Ship Berthing Facilities</u>

Construction of the LNG loading and ship berthing facilities would also require over-water and land-based equipment installation (e.g., LNG loading platform, breasting dolphins, personal access bridges). A combination of conventional in-water marine construction equipment (e.g., barges, cranes, pile driving equipment) and shore-based construction equipment (e.g., backhoes, bulldozers) would be used to install the necessary structures.

Impacts on water quality resulting from construction of the LNG loading and ship berthing facilities, which would involve dredging, resulting in temporary increases in suspended sediment and turbidity levels. The USACE conducts period maintenance dredging of the Port Arthur Canal in the vicinity of the proposed liquefaction site. This routine dredging, combined with existing vessel traffic associated with operation of existing facilities, causes sustained high and variable turbidity levels within the Port Arthur Canal. The project-related dredging impacts would vary depending on the methods and equipment used. For example, 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. Mechanical dredging may also cause localized increases in suspended sediments; however, based on similar projects, it is anticipated 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).

PALNG 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 under section 401 of the CWA, and a Coastal Use Permit.

While the creation of additional surface water area would be a permanent impact, increases in suspected sediments and turbidity associated with dredging for the LNG loading and ship berthing area would be temporary (i.e., confined primarily to the period of in-water activity and shortly thereafter) and limited to the area within and immediately adjacent to the LNG loading and ship berthing facilities. As such, no significant or adverse water quality impacts are anticipated from LNG loading and ship berthing facilities.

<u>Vessel Traffic</u>

Shoreline Erosion and Resuspension of Sediments

Throughout construction of the project, barges and support vessels would deliver large equipment and materials to the MOF and Pioneer Dock. The Port Arthur Canal was specifically created to provide deepwater access for maritime commerce and is maintained by regular dredging (SNND, 2017b). 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. PALNG anticipates that construction barge traffic would peak at about 175 barges per month in the early stages of construction. Increased barge traffic also has the potential to negatively impact shoreline erosion and cause resuspension of bottom sediments, resulting in temporary increases in turbidity within the Port Arthur Canal. As described in section 4.2.2.1, PALNG developed a Shoreline Protection Report to address potential shoreline erosion under these circumstances. LNG vessels would be assisted by tugs during vessel berthing and departure maneuvers and would minimize their own stern propeller and bow thruster use, such as in emergency maneuvering situations. Also, PALNG would protect the shoreline within the project area through the installation of riprap or other erosion prevention measures, which has been successfully implemented for other facilities along the Port Arthur Canal. Given the fact that the Port Arthur Canal was created to accommodate vessel traffic and PALNG's mitigation measures described above, impacts on waterbody shorelines due to construction and operation of the Liquefaction Project would be permanent, but minor.

Ballast Water Discharge

During operation of the Liquefaction Project, up to 180 LNG vessels would call on the liquefaction facility per year, each of which could discharge between 12 to 18 million gallons of ballast water (depending on LNG vessel size) into the Port Arthur Canal during 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. Exclusive Economic Zone (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 vessels would discharge all ballast water under federal oversight and in accordance with federal regulations. The International Maritime Organization (IMO) has adopted this regulation, which requires each vessel to install and operate a ballast water management system. Therefore, ballast water discharged into the Port Arthur Canal would be composed of open ocean water, and potential impacts on water quality may include changes in temperature, pH, dissolved oxygen, and salinity levels.

The volume of water required for ballast varies depending on the size and type of vessel. Depending on hydrologic conditions at the time of discharge, the composition of ballast water may be very similar to or different from the ambient water within the Port Arthur Canal. The primary potential impact on water quality associated with ballast water discharge would be a temporary increase in salinity level. Because the Port Arthur Canal is about 11 miles north of the Gulf of Mexico, these differences may not be measurable under normal tidal cycles. Furthermore, the amount of ballast water discharged into the Port Arthur Canal during each LNG vessel visit to the liquefaction facility would represent 0.03 percent of the water within a 500-meter stretch of the Port Arthur Canal, which would present a minor influence on the overall system.

Another water quality parameter that may be influenced by ballast water discharge is dissolved oxygen levels. Ballast water would be discharged near the bottom of the marine berth and may contain lower levels of dissolved oxygen than the surrounding water. This could impact aquatic life, but based on the volume of ballast water compared to the 500-meter stretch of the Port Arthur Canal, these lower levels would be expected to come relatively quickly into equilibrium with surrounding dissolved oxygen levels, resulting in a temporary, minor impact.

Ballast water discharge has the potential to introduce aquatic invasive species. PALNG would not be operating the LNG vessels, but anticipates that the vessels would comply with all international and national requirements for ballast water management to avoid these potential issues such as Ballast Water Management for Control of Nonindigenous Species in WOUS CFR Title 33, Chapter I, Subchapter O, Part 151, Subpart D. This requires that ballast water be obtained from a public water system that meets the requirements under 40 CFR 141 and 143 as ballast water, that a record be kept of which public water system the water was obtained from, and that complete ballast water exchange must take place 200 nautical miles from any shore. If ballast water must be discharged into WOUS, a Ballast Water Management System must be developed and approved by the USGS.

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, PALNG 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, significant impacts on surface waters would not result from ballast water discharge.

Cooling Water Discharge

During operation, LNG vessels and barges require water for cooling of the main engine/condenser, diesel generators, and equipment associated with fire and hotel services (Hunt, 2003). The volume of water required for cooling varies depending on what mode of operation the vessel is in (i.e., transit, maneuvering, in-port). While at the liquefaction facility (in-port mode), LNG vessels would need cooling water for the auxiliary diesel engines that are used to generate electrical power for onboard systems while loading.

Water required for engine cooling would vary greatly based on the type of vessel calling on the liquefaction facility. Cooling water needs may range from 530,000 to 660,000 gallons per hour depending upon type and size of the LNG vessel (CH2M Hill, 2013). Steam-powered LNG vessels that have a capacity of 138,000 m^3 would have the highest cooling water requirements, while LNG vessels with dual fuel/diesel electric engines (maximum LNG capacity of 218,000 m^3) would require a smaller volume of cooling water. LNG vessels with a maximum LNG capacity of 15,000 m^3 would require the least cooling water due to their smaller size, increased maneuverability, and reduced time spent at the liquefaction facility. At the high end of this range, a complete discharge of cooling water would represent less than 0.01 percent of the water in the Port Arthur Canal in the project area.

Impacts on surface waters from cooling water intake and discharge would be primarily limited to an increase in water temperature near the LNG vessel. Cooling water return temperatures vary widely depending on the type of LNG vessel and mode of operation. Based on a review of available information, we anticipate that cooling water discharged at the liquefaction facility could range between 2.7 ˚F and 7.2 °F warmer than ambient water temperatures (Caterpillar, 2012). Section 4.6.2 describes further impacts on aquatic resources from temperature changes.

Due to the limited temperature differences, and relatively small volume of discharge compared to the total water within the Port Arthur Canal, we anticipate that the increased water temperature levels would diminish shortly after discharge and, therefore, would have temporary and minor impacts on water quality.

While in transit through the Gulf of Mexico, the temperature of water used for engine cooling could increase by as much as 9.5 ˚F. Due to the volume of water within the Gulf of Mexico and the use of established shipping lanes where frequent vessel traffic would increase the speed at which the warmer water would be diluted to ambient temperatures, increased water temperatures would have a negligible impact on water quality within the Gulf of Mexico.

Site Modification and Stormwater Runoff

Ground disturbance during construction of the liquefaction facilities would increase stormwater discharges, resulting in a temporary increase in suspended sediment levels. As described in section 4.3.1.1, there are no known contaminated soils within the liquefaction site, including the portion of the site within the Port Arthur Canal. Therefore, increased stormwater runoff is not expected to contribute significant amounts of contaminated sediments to the Port Arthur Canal.

Construction of the liquefaction facility would permanently reduce the amount of existing pervious surfaces, thereby increasing the potential frequency and volume of stormwater runoff into the Port Arthur Canal. Stormwater runoff may pick up debris, chemicals, dirt, and other pollutants before entering directly into a waterbody (EPA, 2013). Construction of the marine berth, Pioneer Dock, and MOF also would require dredging of about 7.7 million yd^3 from the Port Arthur Canal, which may cause temporary increases in erosion and sedimentation in the immediate vicinity of construction.

In accordance with section 402(l)(2) of the CWA, the NPDES Construction Stormwater General Permit does not apply to the project because it is considered an oil and gas production facility, and as such, non-contact stormwater runoff from these facilities are exempted. However, during construction, impacts on downgradient surface water resources would be minimized through the implementation of PALNG's *Stormwater Pollution Prevention Plan* (SWPPP). This includes installation and maintenance of erosion and sedimentation control structures to reduce impacts on the Port Arthur Canal and nearby surface waters. Following construction, the shoreline would be stabilized with an armored shoreline protection system to prevent post-construction erosion.

With implementation of these measures and the design of the project, erosion and stormwater runoff from construction and operation would be minimized, and impacts on the Port Arthur Canal would not be adverse or significant.

Waterbody Crossings

A heavy haul road would be constructed around Round Lake Canal as described in section 2.1.1. As with the other project facilities, construction would be conducted in accordance with PALNG's *Environmental Plan* (which includes the Commission's Plan and Procedures), including the installation and maintenance of erosion and sedimentation control structures, and all Texas permitting requirements. As such, impacts on Round Lake Canal resulting from use of the heavy haul road would not be adverse or significant.

Hydrostatic Testing

PALNG would hydrostatically test the piping and storage tanks to verify the integrity of these facilities prior to placing them in service. Water also would be used to flush pipes to remove any solids that may be present inside of them. Water used for hydrostatic testing as well as pipe flushing would be obtained the LNVA or the City of Port Arthur municipal water source. If water is obtained via surface water appropriation from the LNVA, water intake hoses with mesh strainers would be used to avoid impacts on aquatic organisms. The mesh would have 0.25-inch spacing, and the speed of intake would be kept low enough to minimize the entrapment of aquatic organisms. No additives, such as a biocide or oxygen scavenger, would be used during hydrostatic testing or pipe flushing activities.

About 87 million gallons of test water would be required for hydrostatic testing of the LNG tanks. After completion of hydrostatic testing, PALNG would discharge the hydrostatic test water to the Port Arthur Canal in accordance with its Texas RRC discharge permit and PALNG's *Environmental Plan* to minimize impacts on surface water. Hydrostatic testing of the liquefaction facility piping and tanks would result in a temporary, localized, and minor impact on surface waters.

Firewater and LNG Storage Tank Deluge System

PALNG would construct firewater and deluge supply and distribution systems for extinguishing fires, cooling structures and equipment exposed to thermal radiation, and dispersing flammable vapors at the liquefaction facility. The primary source of water supply for the firewater and deluge systems would be from the same municipal source used for potable water at the liquefaction facility, and backup water pumps would be installed to withdraw water from the Port Arthur Canal.

The firewater and deluge systems would be used on an intermittent, as-needed basis during emergency situations. Potable water would be obtained via a municipal source. Any discharge would be similar to that of stormwater runoff. As discussed previously regarding stormwater runoff, PALNG would implement measures, including installation and maintenance of all necessary erosion and sedimentation control structures, to avoid impacts on the Port Arthur Canal and nearby surface waters as detailed in PALNG's *Environmental Plan*. With implementation of these measures and the design of the project, erosion and runoff from usage of the firewater and deluge systems would be minimized.

Inadvertent Releases

Water quality of the Port Arthur Canal, Round Lake Canal, Round Lake, and Oil Field Road Canal could be adversely affected by a spill, leak, or other release of hazardous materials during construction. Transport of released hazardous materials into these waterbodies by stormwater runoff may degrade water quality and could affect aquatic organisms. To minimize the potential for a release of hazardous materials and to avoid or minimize the impacts of a release if one were to occur, PALNG would adhere to the measures outlined in its *Environmental Plan*. Spill prevention measures that PALNG would implement include but are not limited to the following:

- Store fuels and lubricants only at designated staging areas and at least 100 feet away from the water's edge.

- Maintain a supply of sorbent and barrier materials sufficient to allow the rapid containment and recovery of any spill at the construction staging areas.

- Restrict refueling and lubrication of equipment to upland areas at least 100 feet away from stream channels and wetlands.

With the implementation of these measures, impacts on water quality in the event of a spill or leak are expected to be minor and temporary.

Miscellaneous Water Uses

Water may be necessary to aid in dust control and equipment or vehicle washing to control the spread of noxious weeds during construction. However, due to the average annual precipitation greater than 60 inches per year, dust suppression is not likely necessary (U.S. Climate Data, 2016). Also, equipment or vehicle washing to prevent the spread of noxious weeds has not been recommended or required by any agency. In the event water use for these purposes is required, PALNG has committed to obtaining any permits necessary to collect, use, and dispose of this water.

Through implementation of PALNG's *Environmental Plan* (which includes the Commission's Plan and Procedures), SPCC Plan, potential construction and operation impacts resulting from miscellaneous water use for dust control and/or vehicle washing would be temporary and minor.

Texas Connector and Louisiana Connector Projects

Construction and operation of the Texas Connector and Louisiana Connector Projects would be conducted using similar, industry-recognized methods and mitigation measures. As such, the following discussions apply to both pipeline projects. Differences in methods or mitigation measures are described separately as appropriate by project.

<u>Pipeline Installation Methods</u>

The open-cut method of construction involves clearing and grading of stream banks, in-water trenching, trench dewatering, and backfilling. These activities may increase sedimentation, turbidity, and water temperature; decrease dissolved oxygen levels; and re-suspend chemical or nutrient pollutants that may be contained in sediments. The primary impact on water quality due to in-stream trenching and backfilling would be sediment suspension. The extent of the impact would depend on sediment loads and stream velocity at the time of construction, as well as sediment particle size. These factors would determine the density, downstream extent, and persistence of the sediment plume.

Through the transport of sediment and movement of aquatic biota from upstream sources, these resources would be expected to return to preconstruction conditions soon after the completion of instream work, backfilling, and restoration, including the adjacent uplands. To minimize surface water impacts, PAPL would implement the construction and mitigation measures described in PAPL's *Environmental Plan*, which includes the Commission's Procedures. Open-trench construction measures that PAPL would implement include but are not limited to the following:

- Limit the use of equipment operating in waterbodies to that needed to construct each crossing.
- Install and maintain sediment barriers around spoil piles to prevent the flow of spoil into the waterbody.
- Do not begin in-stream activity until the in-stream pipe section is complete and ready to be installed in the waterbody.

Adherence to these measures would minimize impacts associated with open trench waterbody crossings.

The HDD construction method (see section 2.4.3.1) involves the circulation of drilling mud to remove cuttings, stabilize the borehole, and cool and lubricate the drill bit. Drilling mud is composed primarily of freshwater, bentonite clay, and a small amount of other additives. The use of the HDD method would eliminate or significantly reduce the potential for construction-related impacts on water quality because it avoids disturbance of stream beds and banks, and associated riparian vegetation. However, there is the potential during drilling for an inadvertent release of drilling mud through sand or gravel, or through fractured rock formations. Because drilling mud is composed of primarily freshwater and bentonite, a small release would likely dissipate, and impacts on water quality beyond a temporary increase in turbidity would not be anticipated. In larger quantities, the release of drilling mud could negatively affect fisheries and/or vegetation, although impacts would generally be less than those associated with an open-cut crossing. To minimize potential impacts on water quality in the event of an inadvertent release of drilling mud, PAPL would implement its HDD Plan (included within PAPL's *Environmental Plan*). Measures to prevent or control an inadvertent release of drilling mud include installing perimeter controls to contain any inadvertent release of drilling mud.

Texas Connector Project

The surface waters that would be impacted during construction and operation of the Texas Connector Project are summarized in table 4.3.2-2 and listed in appendix I. No surface water impacts related to aboveground facilities, ATWS, access roads, or construction yards are anticipated from pipeline construction and operation. Therefore, they are not discussed further in this section.

PAPL proposes to conduct 34 HDD operations as part of the Texas Connector Project. As some of the HDDs would encompass more than one waterbody, a total of 53 waterbodies would be crossed using the HDD or bore method. Of these, 27 crossings are associated with construction of the Northern Pipeline, 4 crossings are associated with construction of the Southern Pipeline, 2 crossings are associated with construction of the GTS/CIPCO Lateral, and 1 crossing is associated with construction of the FGT Lateral.

PAPL provided preliminary profile drawings showing the proposed HDD crossings (see appendix J). In accordance with the Commission's Procedures, PAPL would provide detailed plans for each HDD crossing for FERC review and approval prior to construction. The HDD crossing plans would consist of site-specific diagrams showing the location of mud pits, pipe assembly areas, and areas to be disturbed; and would identify any aboveground disturbances or clearing between the HDD entry and exit workspaces.

As previously discussed, the use of the HDD method would eliminate or significantly reduce the potential for construction-related impacts on water quality because the HDD crossings avoid disturbance of the stream beds, banks, and associated riparian vegetation. There is the potential during drilling for drilling mud to enter waterbodies that, when in larger quantities, could negatively affect fisheries and/or vegetation. Based on previous PAPL's experience in the project area and the existing geologic and soil conditions, the proposed HDD crossings are anticipated to be successful. In accordance with the Commission's Procedures, PAPL is required to provide a contingency plan for each crossing in the event the HDD is unsuccessful and how the abandoned drill hotel would be sealed, if necessary. PAPL prepared a preliminary HDD Contingency Plan that describes measures PAPL would implement in the event the HDD is unsuccessful. PAPL stated that it would finalize the HDD Contingency Plan with the selected contractor, and the final plan would be incorporated into construction compliance documents.

Tidal movement has the potential to impact construction by causing flooding of the right-of-way and increasing the possibility for increased erosion and turbidity. PAPL identified portions of the construction right-of-way with the highest potential to be impacted by tidal movement as between MPs 0.0 and 12.0 on the Northern Pipeline, and between MPs 1.0 and 7.6 on the Southern Pipeline. PAPL would monitor these areas during construction and, as necessary, implement the following mitigation measures:

- Temporarily build up the right-of way with sand.
- Use amphibious excavators.
- Install soil and sediment containment measures.

Louisiana Connector Project

The surface waters that would be impacted during construction and operation of the Louisiana Connector Project are summarized in table 4.3.2-9 and listed in appendix I. Potential impacts on these surface waters during construction and operation of the project are described in the following sections. No surface water impacts from ATWS, access roads, or construction yards are anticipated during pipeline construction and operation. Therefore, they are not discussed further in this section.

PAPL would use the open-cut method at 91 waterbody crossings, the HDD method at 26 crossings, the bore method at 7 crossings, the barge lay method at 3 crossings, and the push-pull method at 23 crossings along the Louisiana Connector Project.

Similar to the Texas Connector Project, PAPL provided preliminary profile drawings showing the proposed HDD crossings (see appendix J). In accordance with the Commission's Procedures, PAPL would provide detailed plans for each HDD crossing prior to construction, which would be reviewed and approved by FERC. The HDD crossing plans would consist of site-specific diagrams showing the location of mud pits, pipe assembly areas, and areas to be disturbed, and identification of aboveground disturbances or clearing between the HDD entry and exit workspaces. In addition, and as discussed in section 4.1.7.2, PAPL provided supporting information for 22 of the crossings that demonstrated, based on previous experience in the project area and the existing geologic and soil conditions, the proposed HDD crossings are anticipated to be successful. In accordance with the Commission's Procedures, PAPL is required to provide a contingency plan for each crossing in the event the HDD is unsuccessful and how the abandoned drill hotel would be sealed, if necessary. PAPL prepared a preliminary HDD Contingency Plan that describes measures PAPL would implement in the event of the HDD is unsuccessful. PAPL stated that it would finalize the HDD Contingency Plan with the selected contractor, and the final plan would be incorporated into construction compliance documents.

One waterbody is listed as being near the proposed compressor station. PAPL proposes to avoid impacts on this waterbody through station siting, and best management practices such as silt fencing or an equivalent measure.

PAPL would cross the Sabine River Diversion Canal, which is identified as a surface water intake used for public water supplies, using the HDD method. Therefore, impacts on this surface water intake are not anticipated.

<u>Sabine Lake Crossing</u>

Approximately 18 miles of the Louisiana Connector Project would be installed in Sabine Lake using a combination of the HDD method and open-cut construction from lay barges. An HDD would be used to install the pipeline at the shoreline approaches of Sabine Lake between MPs 0.0 and 1.0, and MPs 17.5 and 18.2. Open-cut construction across the lake bottom would connect the two HDD exit points.

PAPL has stated that its current plan is to conduct both HDD entry and exit into Sabine Lake with the HDD entry point on land and the exit point in the lake. Depending on if a closed pumping and return system is used, drilling mud could be more difficult to control if not contained within a closed system. Therefore, the greatest potential for drilling mud to be released into the lake would be at the HDD entry and exit points.

Temporary siltation and sedimentation could occur at the HDD entry and exit points in Sabine Lake, primarily from the drilling mud associated with the initial drilling of the pilot hole, the subsequent reaming, and the pulling of the pipeline through the hole. Drilling mud is non-toxic and would not chemically affect organisms in the lake; however, sessile organisms near the release could be smothered and killed.

Open-cut construction would be used for the remainder of the Sabine Lake crossing. As described in section 2.4.3.1, PAPL proposes to use a 300-foot-wide construction right-of-way to allow for dredging of both the pipeline trench and the floatation channels that would be required for operation of the lay barges.

Pipeline construction across Sabine Lake would require the dredging and excavation to allow a 4-foot minimum depth from lake bottom to top of pipe. Sediments excavated to install the pipeline would be temporarily stored in the lake adjacent to the pipeline ditches. After the pipeline installation is complete, the pipe trench would be backfilled and the lake bottom contours returned to preconstruction conditions to the maximum extent practicable.

PAPL selected its proposed construction methods after analyzing several alternative methods for constructing through Sabine Lake. Construction methods considered included the use of a standard shallow water lay barge, simultaneous dual lay operation from a single barge, push/pull, and jet trenching. PAPL's analysis considered seasonal timing and duration of construction activities in the lake, total extent of physical disturbance in the lake, and constructability under specific lake conditions. These timing and duration parameters were identified in consideration of economic impacts on the lake users, impacts on fishery resources, public perception, and impacts on the lake.

The primary impacts on water quality associated with open-cut construction in the lake would be the resuspension of sediment into the water column. Dredging and excavation operations necessary to install the pipeline through Sabine Lake would suspend sediment and affect water quality and aquatic resources. Sediments may be resuspended during trench excavation and from spoil pile erosion due to wind and wave forces. These lake processes could result in additional impacts on water quality and aquatic resources. The suspended solids and turbidity levels would decline to ambient levels following completion of construction.

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

PAPL's affiliate, Sempra, proposed to cross Sabine Lake as part of the Port Arthur LNG Project approved by the Commission in 2006. That project, which was for the import of LNG, was never constructed; however, the current proposal for the Louisiana Connector Project would cross Sabine Lake in generally the same location as the project approved by the Commission in 2006. As part of originally proposed project, Sempra conducted a turbidity analysis for the Sabine Lake crossing. As described in our EIS for the Port Arthur LNG Project (2006) and based on Sempra's turbidity analysis from 2005, the proposed dredging activities in all but the lowest reaches of Sabine Lake would have the potential to generate turbidity levels above background concentrations. However, the ambient turbidity levels in the water (as generated by flows, waves, and ship traffic in the ICWW) create a high background level of turbidity, thereby reducing the potential relative impact of dredging-related turbidity. Further, the 2006 EIS also stated that, based on correspondence from the TPWD, Sabine Lake is chronically turbid, and aquatic species mortality due to excess turbidity has not been documented.

PAPL asserts that the analysis and turbidity impacts described in the 2005 turbidity analysis reflect the current proposed project conditions. However, to verify if the conditions described in the 2005 turbidity analysis are still applicable today, PAPL consulted with the TPWD, Sabine Lake Ecosystem Leader. A response from the agency has not yet been received.

In accordance with the Commission's Procedures, PAPL is required to provide a site-specific crossing plan for each major waterbody and HDD crossing, which includes Sabine Lake. As such, PAPL would file detailed information, including site-specific plans, for the Sabine Lake crossing prior to construction.

As discussed above, we expect that construction activities near waterbodies would not significantly affect water quality in Sabine Lake or cause contaminant limits to be exceeded. Only localized and short-term increased turbidity events are anticipated during construction.

Miscellaneous Water Uses

Water may be necessary to aid in dust control and equipment or vehicle washing to control the spread of noxious weeds during construction. However, due to the average annual precipitation greater than 60 inches per year in the project area, dust suppression is not likely necessary (U.S. Climate Data, 2016). Also, equipment or vehicle washing to prevent the spread of noxious weeds has not been recommended or required by any agency. In the event water use for these purposes is required, PAPL has committed to obtaining any permits necessary to collect, use, and dispose of this water.

The volume and source of water to be used for dust control and site preparation would not be known until prior to construction. Therefore, **we recommend that**:

- **Prior to construction of the Texas Connector and Louisiana Connector Projects, PAPL should file with the Secretary for review and approval by the Director of OEP the anticipated volume and source of water to be used for dust control.**

HDD Water Use

The HDD construction method involves the circulation of a drilling mud to remove cuttings, stabilize the borehole, and cool and lubricate the drill bit. Drilling mud is composed primarily of freshwater and bentonite clay. PAPL proposes to use both municipal and surface water sources for HDD operations. Volume requirements by HDD feature crossing and intake locations are described in table 4.3.2-5.

TABLE 4.3.2-5

Surface Water Appropriation for Horizontal Directional Drill Water Use

Project/Facilities Tested	Feature Crossing	Drilling Mud Volume (approximate gallons)
TEXAS CONNECTOR PROJECT		
Southern Pipeline	Canals	300,652
Southern Pipeline	Inlet to Keith Lake, Wetland, Boat Ramp	1,006,204
Southern Pipeline	Foreign Pipeline Easement, Hwy 87	1,055,643
Southern Pipeline	Sabine Pass	1,206,684
Southern Pipeline	Foreign Pipeline Easement/ Road	404,756
Northern Pipeline	Intercoastal Waterway/ Taylor Bayou	1,256,405
Northern Pipeline	JD Murphree WMA	1,285,710
Northern Pipeline	JD Murphree WMA	1,164,516
Northern Pipeline	HWY 73/ Pond	760,563
Northern Pipeline	Taylor Bayou	1,023,023
Northern Pipeline	Hillebrandt Bayou, HWY 365	764,575
Northern Pipeline	Canals	271,015
Northern Pipeline	Canal	248,368

TABLE 4.3.2-5 (cont'd)		
Surface Water Appropriation for Horizontal Directional Drill Water Use		
Project/Facilities Tested	Feature Crossing	Drilling Mud Volume (approximate gallons)
Northern Pipeline	Foreign Pipeline Easement, W. Port Arthur Road	637,164
Northern Pipeline	Foreign Pipeline Easement	384.237
Northern Pipeline	Foreign Pipeline Easement	417,869
Northern Pipeline	Foreign Pipeline Easement/Canal	705,022
Northern Pipeline	HWY 69, HWY 347, Foreign Pipeline Easement, Railroad	607,342
Northern Pipeline	Neches River	620,076
Northern Pipeline	Wetland/ Floodplain	837,743
Northern Pipeline	Forested Wetland, Foreign Pipeline Easement	743,396
Northern Pipeline	Foreign Pipeline Easement	242,352
GTS Lateral	Foreign Pipeline Easement	910,000
FGT Lateral	Wetland	351,006
	Project Subtotal	**16,820,468**
LOUISIANA CONNECTOR PROJECT		
Pipeline	State Hwy 87 / Port Arthur Canal / State Hwy 82 / S Levee Rd	308,344
Pipeline	(Foreign Pipelines)	199,985
Pipeline	Sabine Lake	241,275
Pipeline	East Pass	393,867
Pipeline	(Foreign Pipelines)	258,006
Pipeline	ICWW	332,974
Pipeline	Vinton Drainage Canal	87,606
Pipeline	Unnamed Waterbody	179,520
Pipeline	Waterbody / Canal / Unnamed Rd	129,254
Pipeline	Bayou Choupique	189,573
Pipeline	Walker Rd	145,698
Pipeline	Foreign Pipeline	103,619
Pipeline	Interstate Hwy 10	112,092
Pipeline	Houston River Canal	93,350
Pipeline	Houston River	236,248
Pipeline	State Route 27 / Bankens Rd / Kansas City Southern RR	204,940
Pipeline	Little River	96,941
Pipeline	Beckwith Creek	164,369
Pipeline	Hickory Branch	163,507
Pipeline	Barnes Creek	253,482
Pipeline	Whiskey Chitto Creek	57,446
Pipeline	Pipeline	86,313
Pipeline	Pipeline	103,188
Pipeline	Nezpique Bayou	78,558
Pipeline	Pond	114,103
Pipeline	Des Cannes Bayou	71,808
	Project Subtotal	**4,406,066**

While specific locations of hydrostatic test water discharge are unknown at this time, it is anticipated that water used to test the HDD segments would be discharged to a vegetated upland or Sabine Lake following the completion of hydrotesting. Also, PAPL has committed to comply with the Commission's Procedures, which requires that before construction, PAPL file with the Secretary a list identifying the location of all waterbodies proposed for use as a hydrostatic test water source or discharge location. With the implementation of these measures, impacts on water quality due to hydrostatic testing of the HDD segments would be temporary and minor.

Hydrostatic Testing

Before being placed into service, the pipeline and lateral pipeline segments would be hydrostatically tested. Pipeline segments installed using HDD would also be hydrostatically tested prior to installation (known as an HDD pre-test) to ensure structural integrity per DOT standards in 49 CFR 192. PAPL proposes to use both municipal sources and surface waters for hydrostatic testing of the pipeline facilities. Surface water requirements as well as proposed intake and discharge locations are described in table 4.3.2-6.

TABLE 4.3.2-6

Surface Water Appropriation and Discharge for Hydrostatic Testing of the Texas Connector and Louisiana Connector Projects

Project/Facilities Tested	Intake Water Source	Intake Milepost	Discharge Source	Discharge Milepost	Volume Required (gallons)
TEXAS CONNECTOR PROJECT					
Northern Pipeline (MP 0 – 10.2), Southern Pipeline (MP 0 – 7.6), and KMLP and NGPL laterals	Taylor Bayou	10.2 on the Northern Pipeline	Sabine Pass	MP 7.6 on the Southern Pipeline	7,000,000
South Compressor Station and KMLP and NGPL meter stations	Municipal Source	N/A (Municipal Source)	Upland	South Compressor Station and KMLP and NGPL meter stations	300,000
Northern Pipeline (MP 10.2 – MP 26.6) and GTS/CIPCO, HPL, TETCO, and FGT laterals	Hillebrandt Bayou	11.7 on the Northern Pipeline	Upland	11.7 on the Northern Pipeline	7,000,000
North Compressor Station and GTS/CIPCO, HPL, TETCO, FGT meter stations	Municipal Source	N/A (Municipal Source)	Upland	Northern Compressor Station	300,000
LOUISIANA CONNECTOR PROJECT					
Mainline	Municipal Source	N/A (Municipal Source)	Upland	Unknown	49,500,000

Withdrawals of hydrostatic test water would be from impaired waterbodies and municipal water sources. The discharge water would be tested in accordance with Texas RRC and LDNR permits.

After the hydrostatic test is successfully completed, each pipeline segment would be de-watered by pushing the water out with compressed air. PAPL would not add any chemicals to the hydrostatic test water, and the discharged water would be tested in accordance with permitting requirements. In addition, PAPL would implement the measures outlined in its Procedures (included within PAPL's *Environmental Plan*), which include notifying state agencies prior to testing; screening intakes to avoid entrainment of fish; maintaining adequate stream flow rates to protect aquatic life and to provide for all waterbody uses and downstream withdrawals of water by existing users; siting hydrostatic test manifolds outside of wetlands and riparian areas to the maximum extent practicable; regulating discharge rates; using energy dissipation devices; and installing sediment barriers as necessary to prevent erosion, streambed scour, suspension of sediments, or excessive streamflow.

PAPL has requested comment from the Texas RRC regarding appropriation of hydrostatic test water from impaired waterbodies.

Surface water appropriation and discharge for hydrostatic testing is still pending for the Louisiana Connector Project. PAPL has committed to compliance with the Commission's Procedures (including the measures discussed above), which require that before construction PAPL file with the Secretary a list identifying the location of all waterbodies proposed for use as a hydrostatic test water source or discharge location. With the implementation of these measures, impacts on water quality due to hydrostatic testing would be temporary and minor.

Operation

Impacts on surface waters are not expected during operation of the Texas Connector and Louisiana Connector Projects because no further in-stream activities would be expected. Because the pipelines would be installed at a sufficient depth below the beds of waterbodies, exposure of the pipe is not anticipated. If a pipeline anomaly (i.e., corrosion, dent, rupture) is detected during routine inspections that could require pipeline excavation or replacement within a waterbody, impacts would be similar to those described above for construction, but typically the same or shorter in duration.

Nonjurisdictional Facilities

Construction of relocated SH 87 would include culvert installation into Round Lake Canal for the road crossing, and open-cut installation of all underground utility facilities. Impacts from open-cut installation would be similar to those described above for pipeline installation. Impacted waterbodies would be restored to their previous contours, with the exception of culvert installation into Round Lake Canal, and allowed to revert to their previous flow regime. Construction requirements, erosion and sediment control, and inadvertent releases would be managed in accordance with PALNG's *Environmental Plan*. Further, PALNG would comply with all conditions of applicable permits. Conditions may include the maintenance of specific flow rates or special measures to limit impacts on aquatic species. Any maintenance required during operation of the roadway and collocated utility facilities would be managed by the owner of each facility.

4.3.2.3 Alternative Measures to the Commission's Procedures

Liquefaction Project

Section V.B.1 of the Commission's Procedures states that in-stream work, except that which is required to install or remove bridges, should occur between June 1 and November 30 for warmwater fisheries. As described previously, construction and operation of the liquefaction facility would involve year-round activity within the Port Arthur Canal, which is currently utilized for both commercial and recreational fishing activities. Use of the Port Arthur Canal year-round for construction and operation would shorten the duration of construction activities, and allow for maintenance dredging of the marine berth and MOF. PALNG would comply with the required federal and state permits and their conditions. As such, we find year-round use of the Port Arthur Canal to be consistent with federal and state water quality permitting.

Section V.C. of the Commission's Procedures states that all waterbody banks should be returned to pre-construction contours or to a suitable angle of repose, as approved by the EI. PALNG proposes to place rock armoring along the shoreline for the entire length of the project at the Port Arthur Canal. This rock armoring is proposed to reduce the potential for erosion caused by increased wave action associated with barge traffic. As such, we find installation of rock armoring along the shoreline to be reasonable and adequately justified provided that PALNG complies with the conditions of its USACE permit.

Section V.B.2 of the Commission's Procedures states that all extra work areas should be at least 50 feet from the water's edge, except where adjacent upland consists of cultivated cropland or other disturbed land. ATWS associated with construction of the liquefaction facility would be within 50 feet of the Port Arthur Canal. There are insufficient upland areas within the project area to provide the extra workspace necessary for construction, and workspace is required to conduct the necessary construction work within the Port Arthur Canal for the marine berth, MOF, and Pioneer Dock. As such, we find locating ATWS within 50 feet of the shoreline to be reasonable and adequately justified.

Texas Connector Project

Section V.B.2 of the Commission's Procedures states that all extra work areas should be at least 50 feet from the water's edge, except where adjacent upland consists of cultivated cropland or other disturbed land. PAPL proposes to site ATWS within 50 feet of the water's edge at several locations due to the need to tie-in to the pipeline at a point of intersection after completion of HDD waterbody crossings. Appendix D lists the locations of ATWS areas in which this modification applies, and our conclusion.

Sections V.B.3 and V.B.4 of the Commission's Procedures also state the following:

- Section V.B.3.b: Construct crossings as close to perpendicular to the axis of the waterbody channel as engineering and routing conditions permit.
- Section V.B.3.c: Where pipelines parallel a waterbody, maintain at least 15 feet of undisturbed vegetation between the waterbody and the construction right-of-way.
- Section V.B.4.a: All spoil from minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings, must be placed in the construction right-of-way at least 10 feet from the water's edge.

PAPL is proposing to work within waterbodies between MPs 13.2 and 14.2 and between MPs 14.5 and 14.7. PAPL has identified these as existing agricultural canals. PAPL proposes to work within these canals and the adjacent field road to avoid additional impacts on adjacent cultivated areas and avoid working over an existing pipeline in the area. As such, PAPL is requesting alternative measures to the Procedures measures listed above to allow for work in the waterbody. Based on the site-specific conditions, we find that the modifications to place the pipeline in the canals and clearing vegetation, place spoil less than 10 feet from the agricultural canals, and locate ATWS within 50 feet of the shoreline to be reasonable and adequately justified.

Louisiana Connector Project

Section V.B.2 of the Commission's Procedures states that all extra work areas should be at least 50 feet from the water's edge, except where adjacent upland consists of cultivated cropland or other disturbed land. PAPL proposes to locate ATWS within 50 feet of the water's edge at several locations. ATWS at these locations are proposed due to the need to tie-in to the pipeline at a point of intersection after completion of HDD waterbody crossings. Appendix D lists the locations of ATWS areas in which this modification applies and our conclusion. Although adequate justification has been provided for these alternative measures, PALNG and PAPL would be required to comply with other requirements of the Commission's Procedures. Erosion and sedimentation control devices should be monitored and maintained in these areas more frequently than the minimum time intervals required by the Commission's Procedures until final grading and revegetation have been completed.

4.4 WETLANDS

Wetlands are defined by the USACE and EPA as areas that are inundated or saturated by surface water 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 (Environmental Laboratory, 1987). The Liquefaction Project and portions of the Texas Connector Project are in an extensive coastal wetland complex.

Wetland and waterbody impacts in Texas and Louisiana are regulated by the USACE under section 404 of the CWA, which establishes standards to regulate wetland impacts with the goal of no net loss of WOUS. Section 404(b)1 guidelines require that wetland impacts be avoided to the extent practicable and minimized where avoidance is not possible. For the Liquefaction Project and Texas Connector Project, the USACE Galveston District has the authority to review projects and issue permits for projects that involve discharge of dredge or fill material into WOUS, including wetlands. For the Louisiana Connector Project, this authority is provided to the USACE Galveston and New Orleans Districts.

As a cooperating agency, the USACE identified that the wetland data provided in its permit applications from PALNG and PAPL for the Projects differ from those filed with the FERC. Because the USACE is a cooperating agency and intends to use the EIS in determining whether to issue permits to PALNG and PAPL, the impacts on wetlands resulting from the Projects should correspond between the USACE permit applications and the EIS. Therefore, **we recommend that:**

- **<u>Prior to the close of the draft EIS comment period</u>, PALNG and PAPL should file with the Secretary updated wetland impact data for the Projects to ensure accuracy, as well as consistency with the wetland data provided to the USACE as part of PALNG's and PAPL's permit applications. The updated data should be filed with the FERC using the same format and wetland classification system/definitions as submitted to the USACE.**

Texas and Louisiana do not have their own wetland protection laws or programs; instead, they are required to conduct a section 401 certification review of USACE section 404 permit applications to determine whether a project would comply with their respective state's water quality standards. Water quality certification under section 401 of the CWA has been delegated to the state agencies (TCEQ and LDEQ), with review by the EPA.

In addition to being regulated by the USACE, wetlands within Texas and Louisiana coastal zones are regulated by the TGLO's Texas Coastal Management Program (TCMP) and the LDNR Coastal Management Program, respectively (TGLO, 2017; LDNR, 2017b). The Projects area within Jefferson and Orange Counties are entirely within the Texas Coastal Zone (TGLO, 2017). Under section 307 of the CZMA, the TGLO would coordinate with the Texas RRC to develop a consistency determination for the Projects. The Projects would also affect wetlands in Louisiana's coastal zone in Cameron Parish and southern Calcasieu Parish (USACE, 2016). PALNG and PAPL must comply with all conditions of applicable permits issued by the USACE, the TGLO, and the LDEQ, including the provisions of section 307 of the CZMA and required compensatory wetland mitigation. Section 4.8 provides more discussion of project-related impacts within designated coastal zones.

4.4.1 Existing Environment

Field delineations, where access was allowed, were used to identify wetlands present on the liquefaction site and crossed by the proposed pipelines and their associated facilities (e.g., access roads). PALNG conducted wetland delineations at the liquefaction site in 2004 and again in 2014; PAPL conducted wetland delineations for the Texas Connector Project facilities in August 2014 and the Louisiana Connector Project facilities in March through July 2017. Wetland delineations were performed in accordance with the USACE's Wetlands Delineation Manual and the Atlantic and Gulf Coastal Plain regional supplement, which require the identification of wetlands based on the presence of three parameters: hydrophytic vegetation, hydric soils, and wetland hydrology (Environmental Laboratory, 1987). In addition, PALNG and PAPL conducted qualitative assessments for each identified wetland based on the USACE's five ecological parameters: quality of wetland vegetation, soils, hydrology, presence of plant and animal species of concern, and degree of disturbance within wetlands and adjacent areas. Where survey access permission was not granted by the landowner, FWS NWI maps were used to supplement field delineations. The wetland delineations for the Projects have not yet been verified by the USACE; therefore, the wetlands acreage impacted could change upon USACE verification. PALNG and PAPL would be required to complete wetland surveys and obtain necessary authorizations for all project areas prior to construction.

Six types of wetlands were identified within the Projects area, including the nonjurisdictional facilities. Table 4.4.1-1 lists the Cowardin classification for wetlands within the Projects area and includes a description of each. In general, the Cowardin classification system is based on the hydrology and dominant vegetation present in the wetland, and further classifies wetland types according to the flooding regime, which ranges from temporarily or irregularly flooded to seasonally flooded or permanently flooded (Cowardin et al., 1979).

TABLE 4.4.1-1

Wetland Classification Types in the Projects Area

Wetland Type	Wetland Description
Palustrine Emergent	Vegetation standing in up to 3 feet of water; dominated by erect, rooted herbaceous freshwater hydrophytic vegetation
Palustrine Scrub-Shrub	Areas dominated by woody vegetation less than 20 feet (6 meters) tall; woody shrub component consisting of shrubs and small trees
Estuarine Scrub-Shrub	Wetlands adjacent to the subtidal area that are exposed and flooded by tides periodically; dominated by woody vegetation less than 20 feet (6 meters) tall; woody shrub component consisting of shrubs and small trees
Estuarine Emergent Wetland	Wetlands adjacent to the subtidal area that are exposed and flooded by tides periodically; includes wetlands not normally flooded associated with the splash zone
Palustrine Forested	Areas dominated by woody vegetation that is 20 feet (6 meters) tall or taller
Palustrine Unconsolidated Bottom	All wetland and deepwater habitats with at least 25 percent cover of particles smaller than stones, and a vegetation cover less than 30 percent

Source: Cowardin et al., 1979

4.4.1.1 Liquefaction Project

PEM wetlands are the dominant wetland type at the Liquefaction Project site. The site was historically an extensive marsh complex characterized by vegetation suited to brackish water conditions. The site has been used previously as a disposal site for dredged material by the USACE and Jefferson County and Beaumont navigation districts, which has resulted in pockets of upland and a system of levees. Dominant PEM plant species found at the site include common reed (*Phragmites australis*), California club rush (*Schoenoplectus californicus*), salt meadow cord grass (*Spartina patens*), brown seed paspalum (*Paspalum plicatulum*), and seaside tansy (*Borricha frutescens*) (T. Baker Smith, LLC, 2015).[19]

19 Chinese tallow is a non-native species that occupies most of the liquefaction site; however, this plant is not indicative of a wetland. Chinese tallow is discussed in sections 4.5.1.1 and 4.5.3.1.

EEM wetlands are located on the southern end of the Liquefaction Project site and are classified as high-quality wetlands as they are in an area that was not previously used for disposal of dredged material or levee creation (T. Baker Smith, LLC, 2015). The estuarine wetlands in the project area have been manipulated via installation of a bulkhead, which has limited access to fish species and excluded it from consideration as EFH. Dominant EEM plant species found at the site included salt meadow cord grass, coastal salt grass (*Distichlis spicata*), seaside club rush (*Schoenoplectus robustus*), and California club rush.

PSS wetlands are in the southern half and along the northern edge of the Liquefaction Project site. These wetlands have been affected by the dredge material disposal and levee construction, negatively impacting wetland quality, and are comprised of cottonwood-hackberry-salt cedar brush. Dominant PSS plant species found at the site included Jesuit's bark (*Iva frutescens*) and groundsel tree (*Baccharis halemifolia*).

4.4.1.2 Texas Connector and Louisiana Connector Projects

Texas Connector Project

PAPL used a combination of field survey and NWI data to identify six types of wetlands within the Texas Connector Project area: PEM, EEM, PSS, estuarine scrub-shrub (ESS), palustrine unconsolidated bottom (PUB), and palustrine forested (PFO) (see table 4.4.1-1). Based on PAPL's wetland delineation surveys, 156 wetland crossings are associated with the Texas Connector Project. In some cases, the project would include multiple crossings of the same wetland. PAPL would conduct 51 crossings using the open-cut method, 81 crossings using HDD or bore methods, and 20 crossings using the push-pull method. These crossing methods are described in section 2.4.3. Appendix K provides additional information on proposed wetland crossings, including wetland identification numbers, crossing locations by milepost, temporary and permanent impacts (acres), and the proposed crossing methods. There are no wetlands at the proposed pipe storage and contractor yards; therefore, they are not discussed further in this section.

PEM wetlands are the dominant wetland type in the Texas Connector Project area. Dominant PEM plant species include green flatsedge (*Cyperus virens*), common rush (*Juncus effusus*), California bulrush (*Schoenoplectus californicus*), and shortbristle horned beaksedge (*Rhynchospora corniculata*). EEM wetlands identified in the Texas Connector Project area range from brackish mashes to mangrove swamps and coastal rivers. Dominant EEM plant species include coastal salt grass, green bulrush (*Scirpus atrovirens*), and several varieties of cordgrass (*Spartina*). PSS wetlands identified in the Texas Connector Project area contain plant species such as Chinese tallow (*Triadica sebifera*), Black willow (*Salix nigra*), and buttonbush (*Cephalanthus occidentalis*) in the northern project area; common reed (*Phragmites australis*), grassleaf rush (*Juncus marginatus*), and Eastern baccharis (*Baccharis halimifolia*) are dominant in the southern project area. ESS wetlands were identified in the northern project area, consisting primarily of common reed, eastern baccharis, and seacoast marsh elder (*Iva imbricate*). Dominant PUB plant species include knotweed (*Fallopia japonica*) and bald cypress (*Taxodium distichum*) in the northern project area; broadleaf cattail (*Typha latifolia*) and common rush are dominant in the southern project area. PFO wetlands in the Texas Connector Project area are dominated by Chinese tallow and bald cypress in the northern project area, and Chinese tallow and American sweetgum (*Liquidambar styraciflua*) in the southern project area.

Louisiana Connector Project

PAPL used a combination of field survey and NWI data to identify four types of wetlands within the Louisiana Connector Project area: PEM, EEM, PSS, and PFO (see table 4.4.1-1). Based on these surveys, 594 wetland crossings are associated with the Louisiana Connector Project. In some cases, the project would include multiple crossings of the same wetland. PAPL would conduct 436 crossings using the open-cut method, 109 crossings using HDD or bore methods, and 49 crossings using the push-pull method. These crossing methods are described in section 2.4.3. Appendix K provides additional information on the proposed wetland crossings, including wetland IDs, crossing locations by milepost, and temporary and permanent impacts (acres). The proposed crossing methods for each wetland are shown on PAPL's alignment sheets for the Louisiana Connector Project.[20]

Emergent wetland types are common along the proposed right-of-way due to the collocation of the route with other utility rights-of-way. The dominant vegetation species are consistent with those found in the Texas Connector Project area and described above.

4.4.1.3 Nonjurisdictional Facilities

Wetlands impacted by nonjurisdictional facilities are adjacent to, and consistent with, those identified for the Liquefaction Project. PEM wetlands are the dominant wetland type in the nonjurisdictional facilities area, with EEM and PSS wetlands making up a portion of the project area as well. The USACE may require a section 10 and/or a section 404 permit for these facilities, if they involve regulated activities in areas subject to USACE jurisdiction.

4.4.2 Wetland Impacts and Mitigation

4.4.2.1 Liquefaction Project

Construction of the Liquefaction Project facilities would permanently convert 725.7 acres of wetlands, including 303.7 acres of PEM wetland, 21.2 acres of EEM wetland, and 400.8 acres of PSS wetland (see table 4.4.2-1). Permanently impacted wetlands would be converted to upland industrial or open land within the liquefaction site, or open water within the marine berth, Pioneer Dock, and MOF. Operation and maintenance of the proposed facilities is not expected to result in additional wetland impacts.

PALNG proposes to discharge 2.4 million yd^3 of dredge material from the ship berthing area and Pioneer Dock for beneficial reuse into the J.D. Murphree WMA. Based on consultations with the TPWD and WMA staff, PALNG has identified an area in Salt Bayou Unit 16, known as Pintail Flats, as a location where deposition of dredge material would be beneficial. The WMA has been impacted by increased salt water inflow and sediment loss, partially due to maintenance dredging of the ICWW and SNWW. This has caused areas of the marsh to convert to shallow open water areas.

Locations of dredge material placement would be coordinated with WMA staff, and determined by conducting geotechnical analyses to determine settling and compaction. Elevation targets would be determined, not to exceed mean higher high water, and visually marked in the field. Dredge material would be transported via a temporary discharge pipe placed in the Round Lake Canal, and mechanized equipment may be used to achieve appropriate elevations once dredge material is placed.

Containment dikes would be used as necessary to ensure that dredge material is not deposited outside of the approved beneficial reuse area. Placement of dredge material is anticipated to result in the creation of about 1,268.8 acres of coastal marsh wetland. Revegetation would be monitored over a minimum of 5 years to ensure achievement of 80 percent native vegetation cover.

20 PAPL's alignment sheets for the Louisiana Connector Project can be found under Accession No. 20171016-5210; under the Files, select the files titled "2017-10-16 RR1 - Part 2 of 2 - Public.PDF." The alignment sheets are included as Appendix 1.F.

TABLE 4.4.2-1

Wetlands Affected by the Projects

Project	Wetland Type												Impacts (acres)	
	PEM		PSS		PFO		EEM		ESS		PUB			
	Cons. [a]	Oper.[a]	Cons.	Oper.	Cons.	Oper.	Cons.	Oper.	Cons.	Oper.	Cons.	Oper.	Cons.	Oper.
LIQUEFACTION PROJECT	317.0	303.7	420.2	400.8	0.0	0.0	21.2	21.2	0.0	0.0	0.0	0.0	758.4	725.7
Dredge Disposal Areas														
J.D. Murphree WMA	0.0	0.0	0.0	0.0	0.0	0.0	903.0	0.0	0.0	0.0	0.0	0.0	903.0	0.0
Disposal Areas 8, 9A, 9B	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
Dredge Disposal Pipelines														
J.D. Murphree WMA	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
Disposal Areas 8, 9A, 9B	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.5	0.0
Subtotal	**317.4**	**303.7**	**420.2**	**400.8**	**0.0**	**0.0**	**924.3**	**21.2**	**0.0**	**0.0**	**0.0**	**0.0**	**1,661.9**	**725.7**
TEXAS CONNECTOR PROJECT														
Northern Pipeline	107.9	0.0	11.9	0.0	19.3	4.5	4.6	0.0	5.2	0.0	1.8	0.0	150.7	4.5
Southern Pipeline	9.9	0.0	0.0	0.0	0.0	0.0	35.2	0.0	4.5	0.0	0.0	0.0	49.6	0.0
FGT Lateral	0.3	0.0	0.0	0.0	3.4	0.9	0.0	0.0	0.0	0.0	0.1	0.0	3.8	0.9
GTS Lateral	0.2	0.0	0.1	0.0	4.7	1.6	0.0	0.0	0.0	0.0	0.0	0.0	5.0	1.6
KMLP Lateral	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.2	0.0	0.0	0.0	0.6	0.0
NGPL Lateral	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.1	0.0	0.0	0.0	1.6	0.0
HPL Lateral	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
TETCO Lateral	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
GTS/CIPCO Lateral	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
Aboveground Facilities [b]	0.0	0.0	0.0	0.0	0.0	0.0	6.0	3.0	6.0	3.0	0.0	0.0	12.0	6.0
Access Roads	10.9	0.0	1.5	0.0	10.4	4.1	3.4	0.0	0.8	0.0	0.2	0.0	27.3	4.1
ATWS	28.7	0.0	6	0.0	7.5	0.0	9.9	0.0	0.0	0.0	0.0	0.0	52.1	0.0
Subtotal	**157.9**	**0.0**	**19.5**	**0.0**	**45.3**	**11.1**	**61.1**	**3.0**	**16.8**	**3.0**	**2.1**	**0.0**	**302.4**	**17.2**
LOUISIANA CONNECTOR PROJECT														
Mainline	265.7	100.3	35.7	14.8	171.8	68.0	138.5	49.1	0.0	0.0	0.0	0.0	611.7	232.2
TETCO Lateral	0.37	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0
CS Lateral	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
TGP Lateral	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
Egan Lateral	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
Pine Prairie	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
Texas Gas Lateral	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
ANR Lateral	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE 4.4.2-1 (cont'd)

Wetlands Affected by the Projects

	Wetland Type													
	PEM		PSS		PFO		EEM		ESS		PUB		Impacts (acres)	
Project	Cons. [a]	Oper.[a]	Cons.	Oper.	Cons.	Oper.	Cons.	Oper.	Cons.	Oper.	Cons.	Oper.	Cons.	Oper.
CGT Lateral	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
Aboveground Facilities	0.2	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.4	0.2
Laydown Yard	2.9	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0
Access Roads	14.9	9.8	0.3	<0.1	0.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	16	10.4
ATWS	28.1	0.0	2.2	0.0	25.9	0.0	15.1	0.0	0.0	0.0	0.0	0.0	71.3	0.0
Subtotal	**312.2**	**110.2**	**38.5**	**14.8**	**201.0**	**68.6**	**153.7**	**49.2**	**0.0**	**0.0**	**0.0**	**0.0**	**705.4**	**242.8**
Nonjurisdictional Facilities	90.5	28.4	50.3	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	140.8	45.1
Projects Total	**878.0**	**442.3**	**528.5**	**432.3**	**246.3**	**79.7**	**236.1**	**73.4**	**16.8**	**3.0**	**2.1**	**0**	**2,810.9**	**1,030.7**

[a] Construction and operation impacts are based on the typical construction and permanent rights-of-way widths (125 feet, 110 feet, 50 feet, etc.) and workspace areas as discussed in section 2.2. The HDD method would be used to avoid direct impacts on wetlands at various locations, as listed in table 2.4.3-1. Most wetland types would be allowed to revert to pre-construction conditions, and limited vegetation maintenance would be allowed in wetlands during project operations.

[b] The South Compressor Station and Centana and PALNG laterals would be within the liquefaction site boundaries and, therefore, their impacts on wetlands are included as part of the impacts for the Liquefaction Project.

Placement of dredge material and incorporation of design features described above is intended to provide, maintain, or enhance the following: shoreline protection, sediment deposition, nutrient and organic carbon exchange, wildlife habitat, native plant community, and plant biomass production. Achievement of these functions would provide adequate restoration of natural marsh function.

The placement of dredge material within the J.D. Murphree WMA and resulting re-creation of historic emergent wetlands would result in the Liquefaction Project contributing a net benefit to wetlands within the Sabine Lake Watershed. We anticipate that, if the USACE issues a section 404/section 10 permit for the Liquefaction Project, it would be conditional upon project-related adverse impacts on WOUS being effectively offset by the beneficial use of dredge material.

Dredge material would be transported to the WMA using a 2.7-mile-long, 30-inch-diameter pipeline that would be temporarily placed across the surface of the lands and canals between the liquefaction site and the WMA. The dredge disposal pipeline to the J.D. Murphree WMA would temporarily impact 16.6 acres of open water (discussed in section 4.3.2). The USACE will assess the impacts on wetlands and WOUS associated with the placement of this temporary pipeline, including activities such as matting, grading, or vegetation removal. If the USACE Galveston District determines that these activities constitute a dredge and fill activity, they will be subject to USACE authorization.

The remaining 4.9 million yd^3 of dredged material would be placed in established Dredge Disposal Areas 8, 9A, and 9B under the permits obtained for this use by the SNND. PALNG communicated with SNND staff on September 2016 to confirm that capacity for this volume of dredge material is available at Dredge Disposal Areas 9A and 9B and covered under SNND's existing permits (Fountain, 2016). While similar correspondence with the SNND for Dredge Disposal Area 8 is not available, the site is significantly larger than areas 9A and 9B combined and likely able to accommodate dredge material from the Liquefaction Project. Dredge material would be transported to these disposal areas using a 2,031-foot-long, 30-inch-diameter pipeline that would be temporarily placed across the surface along the Texas Connector Project's proposed North Pipeline right-of-way and within the ICWW between the liquefaction site and the disposal areas. PALNG has not completed final design of the temporary pipeline at the ICWW crossing location. However, the USACE and SNND conduct similar activities during maintenance dredging within the ICWW. This may involve installing a floating pipe that can be disconnected and moved out of a vessel's path, placed under the ICWW channel, or along the bottom of the channel. PALNG stated it would use board mats where necessary to minimize surface impacts along the Texas Connector Project's North Pipeline right-of-way for the dredge disposal pipeline to Dredge Disposal Areas 8, 9A, and 9B. The dredge disposal pipeline to Dredge Disposal Areas 8, 9A, and 9B would temporarily impact 0.4 acre of PEM wetland, 0.1 acre of EEM wetland, and 1.8 acres of open water (discussed in section 4.3.2). As stated above, the USACE Galveston District will determine if these activities constitute a dredge and fill activity, subject to USACE authorization.

In addition to the mitigation measures required by the Commission's Procedures (which is part of PALNG's *Environmental Plan*), PALNG would be required to comply with the permit conditions attached to the USACE's section 10 and 404 permits, the Texas RRC's section 401 permit, and the TGLO's Coastal Zone Management Consistency Determination.

The USACE, under section 404(b)1 guidelines, employs a method referred to as "sequencing," which requires that wetland project siting and alternatives be approached first with an attempt at avoidance, followed by minimization, and finally mitigation. PALNG is required to avoid wetland impacts to the extent practicable, and all unavoidable impacts must be minimized to the extent possible. The guidelines also restrict the discharge of dredge or fill material where a less environmentally damaging alternative is feasible. Additionally, the USACE requires compensatory mitigation for all permanent wetland loss. The USACE has a goal of "no net loss" of wetlands in the United States. This means that unavoidable wetland impacts must be offset by the creation, restoration, enhancement, or preservation of at least an equal amount of wetlands, which is referred to as compensatory mitigation.

As required by 33 CFR 332.3, PALNG is required to propose compensatory mitigation that is commensurate with the amount and type of impact resulting from construction and operation of the Liquefaction Project. There are three mechanisms for providing compensatory mitigation: permittee-responsible compensatory mitigation, mitigation banks, and in-lieu fee mitigation. PALNG developed a mitigation plan that would include credit purchases from USACE-approved mitigation banks and permittee-responsible compensatory mitigation, with the amount of compensatory mitigation determined based on the USACE's preliminary jurisdictional determinations. The plan is subject to review and approval by the USACE Galveston District as part of the section 404/10 permit process. PALNG has filed its section 404 permit application with the USACE, Galveston District, and provided a draft Compensatory Mitigation Plan. Compensatory mitigation would be initiated at the time of the first USACE-jurisdictional impact occurs and based on a timeline established by the USACE. The USACE may recommend additional conditions to address components of the Compensatory Mitigation Plan or project authorization.

During operation, vessel traffic along the Port Arthur Canal and within the berthing area could result in increased shoreline erosion, potentially impacting wetland fringe along the canal due to increased wave activity. PALNG would install rock armoring to provide scour protection from propeller wash along the entire shoreline within the project area. In addition to providing scour protection, the rock armoring would prevent erosion of the adjacent unprotected shoreline resulting from wave activity produced by vessels maneuvering within the recessed berthing area. With the implementation of PALNG's proposed rock armor, and considering the anticipated vessel speed and the fact that the Port Arthur Canal is an existing ship channel regularly subject to commercial marine traffic, we have determined the increase in vessel traffic within the Port Arthur Canal and recessed berthing area would cause a negligible increase in erosion of the adjacent wetland fringe.

Based on the mitigation measures that PALNG would implement, including adopting the measures identified in its *Environmental Plan* and USACE permit, the low quality of the wetlands identified and that the site is dominated by the non-native Chinese tallow; and the compensatory wetland mitigation PALNG would adopt, including the beneficial reuse of dredge material to create about 1,268.8 acres of coastal marsh wetland, impacts on wetlands resulting from construction and operation of the liquefaction facilities would be permanent but minor.

4.4.2.2 Texas Connector and Louisiana Connector Projects

Construction and operation of the Texas Connector and Louisiana Connector Projects would be conducted using similar, industry-recognized methods and mitigation measures. As such, the following discussions apply to both pipeline projects. Differences in methods or mitigation measures are described separately as appropriate by project.

Ground-disturbing activities associated with construction of the Texas Connector and Louisiana Connector Projects, including clearing and grading of temporary work areas, could temporarily affect the rate and direction of water movement within wetlands. Temporary wetland impacts resulting from construction may vary based on construction timing and construction techniques, and may include temporary ground disturbance, removal of wetland vegetation, temporary storage of dredged and/or excavated material, and rutting or compaction. 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, accidental spills, and discharge of hydrostatic test water could also negatively affect wetland regeneration.

The effects of construction would be greatest during and immediately following construction. Generally, once the 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 (EEM, PEM) and PUB 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 (PSS) 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 (PFO), the impact of construction would be long term due to the long regeneration period of these vegetation types (30 years or more).

During construction and operation of the facilities, PAPL would adhere to the measures outlined in its project-specific *Environmental Plan*, which includes the Commission's Procedures, to minimize wetland impacts. The measures include the following requirements:

- Wetland crossings would be installed using standard cross-country construction methods, push-pull methods, or HDD.
- When possible, extra workspace would be located at least 50 feet outside of wetlands.
- Existing roadways through wetlands may be used as access roads only if they can be used without modification and do not impact adjacent wetlands.
- Dewatering would be conducted such to prevent sediment discharge into wetland areas.
- The right-of-way would be returned, as closely as possible, to preconstruction contours following construction.
- When possible, push-pull methods of pipe laying would be used in which an open trench is dug, and the pipe is pushed down the trench segment by segment as it is fabricated and welded in an adjacent upland area or a central location within a large wetland complex.

PAPL would minimize wetland impacts by collocating the Texas Connector Project pipelines with existing rights-of-way for 43 percent of its pipeline routes, and the Louisiana Connector Project pipeline with existing rights-of-way for 73 percent of its route (see appendix L). Section 2.2.2 provides additional details and typical drawings of right-of-way cross-sections in both collocated and non-collocated areas. Additionally, several wetlands would be avoided using the HDD method. Apart from a minor cut line path that may be required along the HDD guide wire path, no clearing is proposed between the entry and exit points of the HDDs. Section 2.4.3 describes the specialized construction techniques that PAPL would implement for construction through wetlands.

Our Procedures require that an applicant identify those provisions of the Commission's Procedures that may be technically infeasible or unsuitable due to site conditions. The applicant must provide site-specific justification why those provisions are not applicable and/or provide alternative measures that would ensure an equal or greater level of protection. PAPL would typically construct the pipelines using a 100- to 125-foot-wide construction right-of-way in wetlands. This construction right-of-way is greater than that provided for in the Commission's Procedures, which requires no greater than a 75-foot-wide construction right-of-way in wetlands. Because this represents a difference to the Commission's Procedures, PAPL requested approval to its proposed alternative construction rights-of-way in wetlands, which is discussed in more detail in section 4.4.3. PAPL has identified provisions where it proposes alternative measures, as discussed in section 4.4.3.

Upon completion of construction, all temporarily impacted wetlands would be restored to preconstruction contours and allowed to revegetate in accordance with PAPL's *Environmental Plan*. Per the Commission's Procedures, which is included as part of PAPL's *Environmental Plan*, PAPL is required to consult with federal and state agencies to develop a project-specific restoration plan and would monitor and maintain the site until revegetation has been successful. In accordance with the Commission's Procedures, wetland revegetation is determined to be successful when the affected wetland satisfies the current federal definition of a wetland; the vegetation is at least 80 percent of either the cover documented for the wetland prior to construction, or at least 80 percent of the cover in adjacent areas not disturbed by construction; the plant species composition is consistent with wetland plant communities in the area if natural revegetation measures are used; and invasive species and noxious weeds are absent, unless present in adjacent areas undisturbed by project construction activities.

As stated above, all workspaces outside the 50-foot-wide permanent right-of-way would be allowed to revegetate to preconstruction conditions in accordance with PAPL's *Environmental Plan*. Within the 50-foot-wide permanent right-of-way; however, PAPL would maintain up to a 10-foot-wide corridor centered over each pipeline in an herbaceous state during operation to facilitate pipeline inspections and maintenance. In addition, in accordance with the Commission's Procedures, PAPL may selectively remove trees within a 30-foot-wide corridor centered over each pipeline with roots that could compromise the integrity of the pipeline coating. The remaining 20 feet within the permanent easement would be allowed to revegetate naturally. As a result, a 10-foot-wide corridor through both PSS and PFO wetlands would be permanently converted to emergent wetland. An additional 20-foot-wide corridor (extending 10 feet on either side of the 10-foot-wide corridor centered over each pipeline) through PFO wetlands would be permanently converted to PSS wetland.

Within the permanent easement, existing PFO wetlands would be converted to EEM, PEM, and PSS wetlands. While the conversion would not constitute a wetland loss, it would represent a potential permanent change in wetland function. The function and value of PFO wetlands within the maintained right-of-way would be altered as they would be converted to EEM, PEM, and PSS wetlands. It is expected that converted wetlands would continue to provide important ecological functions such as sediment/toxicant retention, nutrient removal and transformation, flood attenuation, and groundwater recharge/discharge. If a pipeline anomaly (i.e., corrosion, dent, rupture) is detected during routine inspections that could require pipeline excavation or replacement within a wetland, impacts would be similar to those described above for construction.

In addition to the mitigation measures required by the Commission's Procedures (which is part of PAPL's *Environmental Plan*), PAPL would be required to comply with the permit conditions attached to the USACE's section 404 permit, the Texas RRC's and LDEQ's section 401 permits, the TGLO's Coastal Zone Management Consistency Determination, and LDNR's Coastal Use Permit.

Similar to the Liquefaction Project discussed above (see section 4.4.2.1), PAPL is required to avoid wetland impacts to the extent practicable, and all unavoidable impacts must be minimized to the extent possible. Additionally, unavoidable wetland impacts must be offset by the creation, restoration, enhancement, or preservation of at least an equal amount of wetlands, which is referred to as compensatory mitigation by the USACE.

PAPL has indicated its intent to use credit purchase from USACE-approved mitigation banks and agency in-lieu fee programs to provide compensatory mitigation for both the Louisiana Connector and Texas Connector Projects. PAPL has provided applications to the USACE for both projects; however, the finalized Compensatory Mitigation Plans have not been provided.

With the implementation of the above measures, construction and operation of the proposed pipeline facilities would have short-term to permanent, but minor impacts on wetlands.

Texas Connector Project

Construction of the Texas Connector Project would affect 217.9 acres of PEM and EEM wetlands, 19.5 acres of PSS wetland, 45.3 acres of PFO wetland, and 2.1 acres of PUB wetland (see table 4.4.2-1). Most of the wetland impacts resulting from construction and operation of the proposed project would be temporary, as the marsh and emergent vegetation would recover over time. However, operation of the project would result in the conversion of 7.0 acres (4.5 acres along the Northern Pipeline, 0.9 acre along the FGT Lateral, and 1.6 acres along the GTS Lateral) of PFO wetland to PEM or PSS wetland, as well a permanent loss of 6.0 acres at aboveground facilities and 4.1 acres at permanently maintained access roads.

About 149.6 acres of wetlands would be affected by construction of the Northern Pipeline and about 49.6 acres of wetlands would be affected by construction of the Southern Pipeline (see table 4.4.2-1). About 11.0 acres of wetlands would be affected by construction of pipeline laterals, including 5.0 acres for the GTS Lateral, 3.8 acres for the FGT Lateral, 0.6 acre for the KMPL Lateral, and 1.6 acres for the NGPL Lateral. Temporary workspace within wetlands also totals 7.8 acres along the Northern Pipeline, 0.5 acre along the FGT lateral, and 1.7 acres along the GTS Lateral.

ATWS areas would affect 52.1 acres of wetlands (see table 4.4.2-1). Of these acreages, about 7.5 acres would be located within PFO wetlands. Although PFO wetlands would take longer to revegetate, all 52.1 acres of ATWS located in wetlands along the pipeline routes would be allowed to return to pre-existing conditions following restoration.

Construction and operation of the aboveground facilities associated with the Texas Connector Project would permanently convert 6.0 acres of wetlands to upland industrial use (see table 4.4.2-1), including less than 0.1 acre each of PEM and PUB wetlands at the North Compressor Station, 3.0 acres of ESS wetland at the KMLP Meter Station, and 3.0 acres of EEM wetland at the NGPL Meter Station (see section 4.4.3.2). Aboveground facilities were sited to be near proposed interconnects and on previously impacted lands. Due to the need to site these facilities in proximity to necessary interconnects, PAPL has indicated that wetland impacts are not avoidable at these locations.

Construction of access roads associated with the Texas Connector Project would impact about 23.1 acres of wetland, including 6.3 acres of PFO wetland. About 4.1 acres of these impacts would be permanent and PFO wetland would be converted to PSS and PEM wetland types.

Pipeline facilities would cross two wetlands enrolled in the Texas Prairie Wetland Program at MP 10.7 along the Northern Pipeline. To avoid impacts on Texas Prairie Wetland Program-enrolled wetlands, PAPL would cross these wetlands using the HDD method.

Louisiana Connector Project

Construction of the Louisiana Connector Project would affect 636.2 acres of wetlands, including 427.4 acres of marsh (PEM and EEM wetlands), 36.3 acres of PSS wetland, and 172.5 acres of PFO wetland (see table 4.4.2-1). Similar to the discussion for the Texas Connector Project, most of the wetland impacts resulting from construction and operation of the proposed project would be temporary, as the marsh and emergent vegetation would recover over time. However, operation of the project would result in the conversion of 68.6 acres of PFO wetland to EEM, PEM, or PSS wetland along the pipeline right-of-way. About 6.0 acres of these would be affected by construction of laterals, including 2.4 acres for the TETCO Lateral, 2.0 acres for the Centana Lateral, and 1.6 acres for the PAPLNG Lateral. In addition, about 11.7 acres would be affected by permanently maintained access roads.

ATWS areas would affect 71.4 acres of wetlands (see table 4.4.2-1). Of this acreage, about 26.0 acres would be within PFO wetlands. Although PFO wetlands would take longer to revegetate, all ATWS located in wetlands along the pipeline routes would be allowed to return to pre-existing conditions following restoration.

Construction and operation of the compressor station would temporarily impact less than 0.1 acre of wetlands, of which a small amount is forested and actively disturbed by silviculture activities. Construction and operation of MLVs would result in 0.2 acre of permanent wetland loss. Construction of access roads for the Louisiana Connector Project facilities would impact about 21.1 acres of wetland, including 0.8 acre of PFO wetlands. About 11.7 acres of these impacts would be permanent; 0.6 acre of forested wetland would be converted to PSS, PEM, or EEM wetlands. Aboveground facilities were sited to be near to proposed interconnects and on previously impacted lands. Due to the need to site these facilities in proximity to necessary interconnects, PAPL has indicated that wetland impacts are not avoidable at these locations.

4.4.2.3 Nonjurisdictional Facilities

The relocation project was selected to accommodate space requirements of the liquefaction site, to comply with TDOT design requirements, to remain within property owned by PALNG, and to avoid wetlands, such as those that are present adjacent to Round Lake and the J.D. Murphree WMA. Relocation of SH 87 would result in the permanent loss of 16.6 acres of wetlands associated with the roadway and shoulders, and conversion of 7.1 acres of PFO for the roadway and maintained utility right-of-way. All areas outside the new roadway and maintained right-of-way would be allowed to revert to preconstruction conditions. PFO wetlands within the maintained utility right-of-way would revegetate to PEM or PSS wetlands. Wetland impacts associated with relocation of electrical transmission lines would be limited to the areas surrounding the structures.

4.4.3 Alternative Measures to the Commission's Procedures

4.4.3.1 Liquefaction Project

Section VI.A.6 of the Commission's Procedures states that aboveground facilities should be located outside of wetlands except where the location of such facilities outside of wetlands would prohibit compliance with DOT regulations. As described previously, PALNG proposes to construct the new liquefaction facility within a site that contains 725.7 acres of wetlands. Section 3.0 of this EIS provides an analysis of alternative liquefaction facility sites and concludes that, when multiple factors are considered, the proposed site is the environmentally preferable site. Further, the site was previously approved for use in 2006 (FERC Docket No. CP05-83-000). As such, we find that the placement of the liquefaction facility within wetlands is reasonable and adequately justified. In addition, PALNG would be required to comply with the conditions of its USACE permit, including the implementation of compensatory mitigation.

4.4.3.2 Texas Connector and Louisiana Connector Projects

Texas Connector Project

Additional Temporary Workspace

PAPL identified numerous locations where ATWS would be located partially or completely within wetlands. Per the Commission's Procedures (section VI.B.1), all extra workspace areas should be at least 50 feet away from wetland boundaries (expect where the adjacent upland consists of cultivated or rotated cropland or other disturbed land). If this is not feasible, the project sponsor should file a site-specific justification for each extra work area, including a discussion as to why the site-specific conditions do not permit a 50-foot setback and measures to ensure the wetland would be adequately protected.

PAPL's justification for each requested ATWS in a wetland is presented in appendix M. We have reviewed these requests and believe that, due to the presence of extensive wetlands along the pipeline routes, there is no other reasonable or practical location for them except in wetlands and that these ATWS are necessary for installation of the pipeline.

Expanded Construction Corridor in Wetlands

Section VI.A.3 of the Commission's Procedures state that the construction right-of-way in wetlands be limited to 75 feet or less. If this is not feasible, the project sponsor must receive FERC approval where topographic conditions or soils limitations require that the construction right-of-way width in federally delineated wetlands be greater than 75 feet.

PAPL identified several areas where additional width would be needed in wetland areas; these are listed in appendix M. PAPL justifies its requests for additional width by citing previous experience with soils in the project area, which present additional challenges in establishing slope stability and containing spoil material along the temporary right-of-way due to saturated soil conditions. Additional space has been requested to allow for additional slope stability, and space for storage. Saturated soil conditions in wetlands, classified by the OSHA as Type C soils, are less cohesive than unsaturated soils, and require longer trench slopes to prevent safety concerns due to soil sloughing off the trench walls. This type of soil is also difficult to contain and requires additional measures to keep it from flowing off the right-of-way. Additionally, the need to operate excavators on semi-submersible mats or employ amphibious excavators in saturated environments may require additional space due to the size of the equipment. The proposed construction corridor as proposed would be 100 to 125 feet wide in wetlands.

Given the soil conditions along the route as described above and the size of the pipelines, we believe that it may not be feasible to maintain construction disturbance within a 75-foot-wide right-of-way. Therefore, in wetland areas where conventional construction methods would be used, we have no objection to the proposed construction right-of-way width (up to 125 feet).

Aboveground Facilities

Section VI.A.6 of the Commission's Procedures states that aboveground facilities should be sited outside of wetlands, except where such siting would prohibit compliance with DOT regulations. PAPL identified 12 acres of wetlands impacted construction by aboveground facilities associated with the Texas Connector Project, 6 of these acres being permanently converted to upland industrial use. PAPL justifies its request stating that aboveground facilities were sited based on project engineering requirements, DOT regulations, and minimization of wetland impacts to the extent practicable. Due to extensive wetlands in the project area, wetland avoidance was not feasible while complying with other regulatory and engineering requirements (e.g., tie-ins to existing pipelines). Based on these justifications, we have determined that the proposed deviations from the Commission's Procedures are reasonable and adequately justified.

Louisiana Connector Project

Additional Temporary Workspace

PAPL identified numerous locations where ATWS would be used partially or completely within wetlands. Our Procedures do not allow extra work space in wetlands without written approval for a variance. PAPL's justification for each requested ATWS in a wetland is presented in appendix M and include reasons for the ATWS such as soil stability or road crossing locations. We have reviewed these requests and believe that, due to the presence of extensive wetlands along the pipeline routes, there is no other reasonable or practical location for them except in wetlands and that these ATWS are necessary for installation of the pipeline.

Expanded Construction Corridor in Wetlands

Our Procedures do not allow for construction corridor in wetlands to exceed 75 feet in width without receiving written approval for a variance. PAPL has identified several areas where additional width would be needed in wetland areas, which are listed in appendix M. Similar to the Texas Connector Project, PAPL cites previous experience with soils in the project area (saturated soil conditions, classified by OSHA as Type C soils). The proposed construction corridor as proposed would be 100 to 125 feet wide.

Given the soil conditions along the route as described above and the size of the pipelines, we believe that it may not be feasible to maintain construction disturbance within a 75-foot-wide right-of-way. Therefore, in wetland areas where conventional construction methods would be used, we have no objection to the proposed construction right-of-way width (up to 125 feet).

Aboveground Facilities

Section VI.A.6 of the Commission's Procedures states that aboveground facilities should be sited outside of wetlands, except where such siting would prohibit compliance with DOT regulations. PAPL identified 0.4 acre of wetlands that would be impacted construction of aboveground facilities associated with the Louisiana Connector Project, 0.1 acre of which would be impacts on PFO wetlands. PAPL justifies its request stating that aboveground facilities were sited based on project engineering requirements, DOT regulations, and minimization of wetland impacts to the extent possible. PFO wetlands at the aboveground facility are associated with active silviculture and do not represent a high-quality wetland habitat. Due to extensive wetlands in the project area, wetland avoidance was not practicable while complying with other regulatory and engineering requirements. Based on these justifications, we have determined that the proposed deviations from the Commission's Procedures are reasonable and adequately justified.

4.5 VEGETATION

4.5.1 Existing Vegetation Resources

4.5.1.1 Liquefaction Project

The Liquefaction Project would be within the Western Gulf Coastal Plain level III ecoregion, which is a relatively flat area adjacent to the Gulf of Mexico. The dominant natural vegetation is grassland and land uses include cropland, developed land, and oil and gas production (Griffith et al., 2007). The project is in the Texas-Louisiana Coastal Marshes level IV ecoregion, which extends east from Galveston Bay along the coast of Texas and Louisiana to the Marsh Island area, and is characterized by lakes, rivers, bayous, tidal channels, and canals. The estuarine and marsh complex supports numerous grass species, waterfowl, small mammals, alligators, shrimp, oysters, and sport fishery species (USGS, 2017).

The TPWD has further subdivided the Texas ecoregions into three sub-regions (TPWD, 2012), of which the Liquefaction Project falls within the upper sub-region, which includes areas adjacent to Sabine Lake and Galveston Bay.

The Liquefaction Project would be on a previously disturbed parcel that is atypical of the coastal marsh area due to alteration of hydrology by leveeing and placement of fill. The site was selected based on avoiding, to the extent practical, unique vegetation communities, while still providing sufficient area and the required orientation for the slip relative to the Port Arthur Ship Canal. Thus, the parcel meets the requirements for spacing between the liquefaction-related facilities and the relocation of SH 87 in compliance with TDOT requirements. Exotic invasive plant species have established dominance over large portions of the proposed liquefaction site, which has altered the vegetation complex such that native plant species are completely absent in many locations on the property. A limited amount of forested cover is found on the site, primarily along previous dredge material deposit levee edges. These forested areas are highly invaded by Chinese tallow.

PALNG's field surveys identified four vegetation cover types at the liquefaction site: PEM wetlands, EEM wetlands, PSS wetlands, and open upland. Most of the vegetated land that would be affected by the project is open wetland (758.3 acres) followed by open land uplands (87.0 acres). Due to the installation of Jefferson County's new boat ramp and bulkhead at Keith Lake, some of the EEM wetlands in the project area are separated from tidal flow and are converting to brackish or PEM wetlands. Wetland vegetation types, acres impacted by wetland vegetation type, measures to minimize impacts, and compensatory mitigation for unavoidable impacts are discussed in detail in section 4.4.1.1. Thus, our evaluation of impacts in this section focuses on the upland vegetation at the liquefaction site.

4.5.1.2 Pipeline Projects

Texas Connector Project

The Texas Connector Project is within the Western Gulf Coastal Plain level III ecoregion. Within this, the south segment of the Texas Connector Project is in the Texas-Louisiana Coastal Marshes level IV ecoregion. The north segment would pass through approximately 17 miles of this ecoregion as well as 9 miles of the Northern Humid Gulf Coastal Prairies level IV ecoregion. This coastal plain traditionally supported mostly grassland species with clusters of oaks or maritime woodlands, but has mostly been converted to cropland, rangeland, pasture, or urban land uses and has been heavily invaded by non-native species such as Chinese tallow (USGS, 2014).

Coastal prairies native to the Northern Humid Gulf Prairies and Texas-Louisiana Coastal Marshes ecoregions in the project area have largely been converted to rangeland, cropland, pasture, and developed land uses. The Texas Connector Project falls within the TPWD-defined upper sub-region, which includes areas adjacent to Sabine Lake and Galveston Bay.

The Texas Connector Project area is comprised of forested uplands; upland open lands, scrub-shrub uplands, agricultural lands (including pasture lands), and PFO, PSS, PUB, PEM, and EEM wetlands. Forested uplands in the Texas Connector Project area are dominated by species in the tree stratum, including loblolly pine, (*Pinus taeda*), American sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), sugar-berry (*Celitus laevigata*), water oak (*Quercus nigra*), and the invasive Chinese tallow (*Triadica sebifera*). Upland open lands are characterized by herbaceous vegetation such as Bermuda grass (*Cynodon dactylon*), golden crown grass (*Paspalum dilatatum*), annual ragweed (*Ambrosia artemisiifolia*), southern dewberry (*Rubus trivialis*), perennial rye grass (*Lilium perenne*), brown-seed crown grass (*Paspalum plicatulum*), and Bahia grass (*Paspalum notatum*). Scrub-shrub uplands typically consist of low woody vegetation such as yaupon (*Ilex vomitoria*), southern bayberry (*Morella cerifera*), groundsel tree (*Baccharis halimifolia*), fringed greenbriar (*Smilax bonanox*), and southern dewberry (*Rubus trivialis*). Agricultural lands in the project area are used for pasture and include vegetation such as golden crown grass, Bermuda grass, brown-seed crown grass, Bahia grass, red clover (*Trifolium pretense*), and white clover (*Trifolium repens*). Wetland vegetation types, acres impacted by wetland vegetation type, measures to minimize impacts, and compensatory mitigation for unavoidable impacts are discussed in detail in section 4.4.1.2.

Louisiana Connector Project

The Louisiana Connector Pipeline Project is within both the Western Gulf Coastal Plain and South Central Plains Level III ecoregions. The Western Gulf Coastal Plain is discussed above, while the South Central Plains ecoregion is characterized by rolling plains typically used for timber production, livestock grazing, and oil and gas production (USGS, 2014). Within this larger ecoregion, the Louisiana Connector Project crosses four level IV ecoregions: the Texas-Louisiana Costal Marshes, Northern Humid Gulf Coastal Prairies, Flatwoods, and Lafayette Loess Plains. The Texas-Louisiana Costal Marshes and Northern Humid Gulf Coastal Prairies are discussed in section 4.5.1.1 and the Texas Connector Project section, respectively, above. The Flatwoods ecoregion tends to be flat to gently sloping and was once dominated by longleaf pine flatwoods and savannas. The Lafayette Loess Plains originally supported prairie species such as big bluestem, little bluestem, yellow Indiangrass, and switchgrass. However, it has largely been converted to agricultural land use (USGS, 2014). The Texas portion of the Louisiana Connector Project falls within the TPWD-defined upper sub-region, which includes areas adjacent to Sabine Lake and Galveston Bay. The State of Louisiana does not further divide level IV ecoregions.

The Louisiana Connector Project area consists of upland open lands, agricultural lands, forested uplands (including pine plantations), scrub-shrub uplands, and PEM, EEM, PFO, and PSS wetlands. Upland open lands are characterized by herbaceous vegetation as described in the Texas Connector Project discussion above. Wetland vegetation types, acres impacted by wetland vegetation type, measures to minimize impacts, and compensatory mitigation for unavoidable impacts are discussed in detail in section 4.4.1.2.

Agricultural lands in the project area are used for cultivated or rotated cropland, orchards, vineyards, and hay fields. Typical crops include rice, soybeans, corn, and sugarcane (USGS, 2014). Forested uplands in the project area are dominated by species in the tree stratum, including southern live oak (*Quercus virginiana*), post oak (*Quercus stellata*) slash pine (*Pinus elliotti*), loblolly pine, (*Pinus taeda*), American sweetgum, southern magnolia (*Magnolia grandiflora*), and greenbriar. Pine plantation species are typically monocultures of slash or loblolly pine.

Open water crossed by the project includes Sabine Lake (MP 0.8 to MP 17.6) as well as the waterbody flows to Black Bayou (MP 22.9 to MP 24.5). The Sabine Lake crossing entrance and exits would be constructed using the HDD method, resurfacing about 500 feet from the shoreline, reducing impacts on the shoreline and associated vegetation habitats. Seagrasses have been extirpated from Sabine Lake and as such, no impacts on seagrasses are anticipated (NOAA, 2004). The waterbody flows to Black Bayou would be crossed using the push/pull method described in section 2.2.4.3.1.

4.5.1.3 Nonjurisdictional Facilities

Nonjurisdictional facilities associated with the Liquefaction Project include the relocation of SH 87 and existing pipelines and utilities to accommodate the proposed marine facilities. The relocation of the highway, pipelines, and utilities would require a new 295-foot-wide temporary right-of-way adjacent to an existing transmission corridor. The existing vegetation along the nonjurisdictional corridor is predominantly PEM and PSS wetland, with a small amount of forested upland and open water habitat. The vegetation at this site is the same as described above for the Liquefaction Project.

4.5.2 Construction and Operation Impacts and Mitigation

Table 4.5-1 provides acreages of vegetation cover types that would be affected by construction and operation of the Projects. Project-specific discussions follow the table. Wetland impacts are discussed in greater detail in section 4.4.

TABLE 4.5-1

Vegetation Impacts from Construction and Operation of the Projects

	Forested [a]				Open Land [b]					
	Upland		Wetland		Upland		Wetland		Totals	
Project, State, Facility	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
LIQUEFACTION PROJECT										
Texas										
Jurisdictional Facilities	-	-	-	-	87.0	82.3	758.3	725.7	845.3	808.0
Dredge Disposal Areas [c]										
J.D. Murphree WMA	-	-	-	-	-	-	903.0	903.0	903.0	903.0
Sabine Neches Areas 9A and 9B	-	-	-	-	-	-	481.0	481.0	481.0	481.0
Sabine Neches Area 8	93.6	93.6	14.3	14.3	3.1	3.1	2,839.8	2,839.8	2,950.8	2,950.8
Nonjurisdictional Facilities	-	-	-	-	2.6	1.1	112.5	42.4	115.1	43.5
Liquefaction Project Total	**93.6**	**93.6**	**14.3**	**14.3**	**92.7**	**86.5**	**5,094.6**	**4,991.9**	**5,295.2**	**5,186.3**
TEXAS CONNECTOR PROJECT										
Louisiana										
Pipeline Right-of-Way and ATWS										
PAPL South	-	-	-	-	0.5	0.1	2.5	0.7	3.0	0.8
KMPL Lateral	-	-	-	-	-	-	1.8	0.5	1.8	0.5
KMPL Meter Station	-	-	-	-	-	-	3.0	3.0	3.0	3.0
Access Roads	-	-	-	-	0.2	0.2	1.1	0.4	1.3	0.6
Texas										
Pipeline Right-of-Way and ATWS										
PAPL South	0.2	0.1	-	-	4.6	1.0	34.6	12.7	39.4	13.8
PAPL North	1.8	0.0	20.3	4.3	137.8	43.1	141.7	41.3	301.6	88.7
NGPL Lateral	-	-	-	-	-	-	4.0	1.3	4.0	1.3
HPL Lateral	-	-	-	-	0.7	0.5	-	-	0.7	0.5
TETCO Lateral	-	-	-	-	1.9	0.7	-	-	1.9	0.7
FGT Lateral	-	-	2.5	0.8	18.3	5.9	0.4	0.1	21.2	6.8
GTS Lateral	0.4	-	-	1.5	5.5	1.2	0.2	-	6.1	2.7
NGPL Lateral to Meter Station	-	-	-	-	0.0	0.0	0.5	0.2	0.6	0.2

TABLE 4.5-1 (cont'd)

Vegetation Impacts from Construction and Operation of the Projects

	Forested [a]				Open Land [b]					
	Upland		Wetland		Upland		Wetland		Totals	
Project, State, Facility	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
Aboveground Facilities										
North Compressor Station	-	-	-	-	40.3	40.3	-	-	40.3	40.3
South Compressor Station	-	-	-	-	-	-	-	-	-	-
NGPL Meter Station	-	-	-	-	-	-	-	-	-	-
HPL Meter Station	-	-	-	-	3.0	3.0	-	-	3.0	3.0
TETCO Meter Station	-	-	-	-	2.8	2.8	-	-	2.8	2.8
FGT Meter Station	-	-	-	-	3.0	3.0	-	-	3.0	3.0
GTS Meter Station	-	-	-	-	-	-	-	-	-	-
Tie-in to GTS Lateral	-	-	-	-	0.2	0.2	-	-	0.2	0.2
MLV	-	-	-	-	0.1	0.1	-	-	0.1	0.1
Pipe/Contractor Yards	-	-	-	-	19.8	-	-	-	19.8	-
Access Roads	-	-	2.2	-	14.2	0.5	18.7	0.1	35.1	0.6
Texas Connector Project Total	**2.4**	**0.1**	**25.0**	**6.6**	**252.9**	**102.6**	**208.5**	**60.3**	**482.8**	**169.6**
LOUISIANA CONNECTOR PROJECT										
Texas										
Pipeline Right-of-Way and ATWS										
Mainline	-	-	-	-	-	-	0.1	-	0.1	-
Aboveground Facilities	-	-	-	-	-	-	-	-	-	-
PALNG Meter Station [d]	-	-	-	-	-	-	-	-	-	-
Centana Meter Station [d]	-	-	-	-	-	-	-	-	-	-
Pipe/Contractor Yards	-	-	-	-	-	-	-	-	-	-
Access Roads	-	-	-	-	-	-	-	-	-	-
Louisiana										
Pipeline Right-of-Way and ATWS										
Mainline	411.0	134.9	171.8	68.0	539.0	203.2	439.9	164.3	1561.7	570.5
Compressor Station Lateral #1 and #2	-	-	-	-	0.1	0.1	-	-	0.1	0.1
TGP Lateral	-	-	-	-	-	-	-	-	-	-
EGAN Lateral	-	-	-	-	0.8	0.3	-	-	0.8	0.3
Pine Prairie Lateral	-	-	-	-	-	-	-	-	-	-
Texas Gas Lateral	-	-	-	-	-	-	-	-	-	-
ANR Lateral	-	-	-	-	2.1	0.9	-	-	2.1	0.9
Aboveground Facilities										
Holbrook Launcher and Receiver	0.1	0.1	-	-	0.3	0.3	-	-	0.4	0.4
Compressor Station	53.0	45.0	-	-	0.8	0.1	-	-	53.8	45.1
MLV #1	-	-	-	-	-	-	0.1	0.1	0.1	0.1
MLV #2	-	-	-	-	-	-	0.1	0.1	0.1	0.1
MLV #3	-	-	-	-	-	-	0.1	0.1	0.1	0.1
MLV #4	-	-	-	-	-	-	-	-	0.1	0.1
MLV #5	-	-	-	-	0.1	0.1	-	-	0.1	0.1
MLV #6	-	-	-	-	-	-	0.1	0.1	0.1	0.1
MLV #7	0.1	0.1	-	-	-	-	-	-	0.1	0.1
MLV #8	0.1	0.1	-	-	-	-	-	-	0.1	0.1
MLV #9	-	-	-	-	-	-	-	-	-	-
TETCO Meter Station	3.0	3.0	-	-	0.2	0.1	-	-	3.2	3.1
TGP Meter Station	-	-	-	-	3.3	3.1	-	-	3.3	3.1
EGAN Meter Station	-	-	-	-	3.4	3.1	-	-	3.4	3.1

TABLE 4.5-1 (cont'd)										
Vegetation Impacts from Construction and Operation of the Projects										
	Forested [a]				Open Land [b]					
	Upland		Wetland		Upland		Wetland		Totals	
Project, State, Facility	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
Pine Prairie Meter Station	-	-	-	-	3.8	3.3	-	-	3.8	3.3
Texas Gas Meter Station	-	-	-	-	2.9	2.7	-	-	2.9	2.7
ANR Meter Station	-	-	-	-	3.5	3.2	-	-	3.5	3.2
CGT Meter Station	-	-	-	-	3.3	3.1	-	-	3.3	3.1
Pipe/Contractor Yards	61.5	-	-	-	205.6	-	3.2	-	270.3	-
Access Roads	17.7	1.2	0.8	0.4	91.7	2.0	20.3	4.0	130.5	7.5
Louisiana Connector Project Total	**546.4**	**184.3**	**172.5**	**68.4**	**860.9**	**225.4**	**463.8**	**168.5**	**2,044.1**	**647.2**
Texas Total	**96**	**93.7**	**39.3**	**20.9**	**344.9**	**188.8**	**5,294.8**	**5,047.6**	**5,775.2**	**5,351**
Louisiana Total	**546.5**	**184.4**	**172.6**	**68.4**	**861.6**	**225.9**	**472.2**	**173.3**	**2,053.0**	**652.1**
PROJECTS TOTAL	**642.5**	**278.1**	**211.9**	**89.3**	**1,206.5**	**414.7**	**5,767.0**	**5,220.9**	**7,828.1**	**6,003.1**

a Includes PFO under the wetland heading.
b Open uplands include open lands and agricultural lands. Open wetlands include PEM, EEM, PSS, and ESS wetlands, discussed further in table 4.4.2-1. Residential lands, developed lands, and open water land uses (per tables in section 4.8) are excluded as they are not typically considered vegetated lands.
c Dredge disposal pipelines associated with transferring material to these locations would be placed on the surface and not require the removal of vegetation.
d Facilities would be constructed within the liquefaction facility property boundaries; therefore, these impacts are not included in the table.
Notes: Table does not include impacts on open water or developed land.
Addends may not sum due to rounding.

4.5.2.1 Liquefaction Project

Table 4.5-1 provides acreages of vegetation cover types that would be affected by construction and operation of the Liquefaction Project. Upland vegetation is primarily open land at the terminal site. No silvicultural or agricultural lands would be affected.

Of the 845.3 acres of vegetated land (which excludes open water and developed lands) affected by the project, 808.0 acres would be converted to industrial use by being permanently filled with gravel or other material (e.g., asphalt), and 151.0 acres of open water would be created for project operations. Vegetation would be removed at the ground surface using mechanical or manual methods, or a combination of the two (vegetation would not be burned). Following construction, temporarily impacted areas would be restored to their original contours and revegetated per landowner or NRCS recommendations in accordance with the Commission's Plan and Procedures, which are part of PALNG's *Environmental Plan*.[21] Additional details of construction procedures are provided in section 2.0.

Dredge materials removed by construction of the Liquefaction Facility would be deposited in four areas: the J.D. Murphree WMA, and the existing SNND Dredge Disposal Areas 8, 9A, and 9B. The J.D. Murphree WMA borders the Liquefaction Project to the west and is managed by the TPWD. The WMA is classified as estuarine wetland marsh and open water. Field surveys conducted in May 2016 determined that the dominant species is marsh hay cord grass (*Spartina patens*). Other species present include leafy three-square (*Schoenoplectus robustus*), saltgrass (*Distichlis spicata*), and smooth cordgrass (*Spartina alterniflora*). Marsh area is being lost at a rapid rate due to subsidence, erosion, and saltwater intrusion

21 The *Environmental Plan* for the Liquefaction Project was filed on November 29, 2016 and can be found on the FERC eLibrary website using Accession Number 20161129-5254.

(TPWD, 2017). The beneficial use of dredge material would assist in restoring elevation to the WMA. Dredge Disposal Areas 9A and 9B are classified as PEM wetland and encompass about 481 acres. Dredge Disposal Area 8 is classified as PEM and EEM wetlands (forested and marshes), grassland uplands, and open water and encompasses about 3,565 acres. No additional restoration activities are proposed as the sites are existing permitted dredge disposal locations operated by the SNND and permitted as such by the USACE. Vegetation clearing would not be required for these dredge disposal pipelines and, therefore, impacts on vegetation would not occur.

Transport of the dredge material would be conducted by the use of temporary, above ground 30-inch-diameter pipelines to their respective sites where the dredge material would be placed on the surface. Project-related dredge material placement at the J.D. Murphree WMA would affect 903.0 acres of EEM wetlands. Once dredge materials are placed on the site, TPWD would require that revegetation consist of planting bare-root stems or potted plants to promote the re-establishment of vegetative cover within two to three growing seasons. As such, no permanent impacts in the form of lost vegetation are anticipated.

Although impacts on vegetation would be permanent, the severity of impacts would be decreased when considering the disturbed condition of the area, including its past function as a dredge disposal area and its tidal isolation; the established presence of the invasive exotic Chinese tallow; and the proposed beneficial use of dredge material to re-create EEM wetlands on the J.D. Murphree WMA. PALNG's implementation of its project-specific *Environmental Plan*, which require the use of temporary and permanent erosion control measures, revegetation procedures, and post-construction monitoring, would further minimize impacts on vegetation communities within and adjacent to the liquefaction facility. Due to the limited vegetation diversity caused by previous use as a dredge disposal site and the proposed beneficial use of dredge material to re-create EEM wetlands, impacts on vegetation from construction and operation of the liquefaction facility would be permanent, but minor.

4.5.2.2 Texas Connector and Louisiana Connector Projects

Construction and operation of the Texas Connector and Louisiana Connector Projects would be conducted using similar, industry-recognized methods and mitigation measures. As such, the following discussions apply to both pipeline projects. Differences in methods or mitigation measures are described separately as appropriate by project.

Construction of the Texas Connector Project would disturb a total of 482.8 acres of vegetated land, and construction of the Louisiana Connector Project would disturb a total of 2,044.1 acres of vegetated land. Table 4.5-1 provides acreages of vegetation cover types that would be affected by construction and operation of the projects.

The duration and magnitude of impacts on vegetation would depend on the type and amount of vegetation affected, the rate at which vegetation regenerates after construction, and the frequency of vegetation maintenance conducted on the right-of-way during pipeline operation. In addition, right-of-way revegetation would depend on factors such as soil types, right-of-way maintenance practices, and land use. The Texas Connector and Louisiana Connector Projects would cause minor and generally short-term changes on agricultural land, herbaceous wetlands, and upland open land because these areas would revegetate within 1 to 4 years. Impacts on upland forested areas that are not located in areas of regular mowing would be longer term, though species common to southern pine forests (such as loblolly pine) tend to grow quickly, adding up to 2 feet of height growth per year (Texas Forest Service, Texas A&M University System, 2010). Deciduous hardwood species such as the sweet gum and red maple also tend to grow at a medium to fast rate (Arbor Day Foundation, 2017).

Impacts on vegetation associated with installation of the pipeline primarily would be caused by vegetation clearing within the construction right-of-way and associated ATWS. Except for areas that would be crossed by HDD, vegetation would be cleared from the entire working right-of-way. Vegetation would be removed at the ground surface using mechanical or manual methods. Following vegetation removal, the construction right-of-way would be graded to allow for safe, level working conditions. Once the pipeline is installed, the trench would be backfilled, and the temporary right-of-way would be revegetated according to PAPL's *Environmental Plan*.[22]

Following construction, the permanent right-of-way generally would be 50 feet wide. In wetlands, a 10-foot-wide corridor centered over the centerline would be regularly mowed and maintained in an herbaceous state to facilitate periodic pipeline corrosion/leak surveys. Typically, PAPL would not reseed actively cultivated crop lands unless requested by the landowner. Within forested areas, landowners would be allowed to replant temporary work areas; however, the 50-foot-wide permanent easements would be maintained in an herbaceous state. PAPL would monitor disturbed areas until restoration and revegetation are successful. At a minimum, on the ground inspections would be performed for 3 years following construction. Impacts associated with ATWS would be temporary as these areas would be allowed to return to preconstruction conditions following construction.

Upland forested areas within the permanent easement would be permanently converted to herbaceous cover. Of the 548.8 acres of upland forest that would be cleared during construction of the project, PAPL would permanently maintain 184.4 acres in an herbaceous state. Within wetlands, PAPL would maintain a 10-foot-wide strip over the pipeline in an herbaceous state, and would selectively remove trees located within 15 feet of the pipeline that have roots that could compromise the integrity of the pipeline coating. Of the 197.5 acres of forested wetland that PAPL would clear during construction, about 75.0 acres would be permanently converted to herbaceous or scrub-shrub wetland within this 30-foot-wide permanently maintained corridor. In temporary work areas (temporary rights-of-way and ATWS) where upland forest and forested wetland would be allowed to regrow, impacts would be long term because re-establishment to preconstruction conditions could take 10 to 30 years, depending on the species type.

PAPL would minimize impacts on vegetation communities affected by pipeline construction by collocating the Texas Connector Project with existing pipelines and utilities for 43 percent of the routes and the Louisiana Connector Project for 73 percent of its route. Additionally, PAPL proposes to install the pipelines using the HDD method at 25 locations along the Texas Connector Project and at 26 locations along the Louisiana Connector Project (see table 2.4.3-1), which would avoid or minimize impacts on riparian vegetation and wetland communities, including forested wetlands. Vegetation clearing would be minimal between HDD entry and exit locations during construction and operation of the project, apart from a minor hand-cut line path, which may be necessary to allow for the placement of a tracing wire to ensure HDD accuracy. Approximately 3 acres would be affected by clearing and construction mat placement between HDD entry and exit points on the Texas Connector Project. Approximately 410.0 acres of vegetation impacts would be avoided by use of the HDD method.

The J.D. Murphree WMA would be crossed by the Northern Pipeline between approximate MPs 4 and 6 and MPs 10 and 12, and by the South Pipeline between approximate MPs 0 and 2. Use of the HDD crossing method at these locations would reduce direct impacts on the WMA.

PAPL's implementation of the Commission's Plan and Procedures (included as part of the *Environmental Plan*), which require the use of temporary and permanent erosion control measures, topsoil segregation in select areas, testing and mitigation for soil compaction, post-construction monitoring, and

22 *Environmental Plans* for the Texas Connector Project and Louisiana Connector Project were filed on December 12, 2017 and October 16, 2017, respectively. These plans can be found on the FERC eLibrary website using Accession Numbers 20171212-5147 (Texas Connector Project) and 20171016-5210 (Louisiana Connector Project).

limited routine vegetation maintenance would further minimize impacts on vegetation. All disturbed areas would be routinely monitored until restoration and revegetation are successful. Impacts on wetlands would be addressed through the implementation of PAPL's compensatory mitigation plan (see section 4.4.4.2).

Construction and operation of the compressor stations, meter stations, MLVs, and pig launchers and receivers associated with the Texas Connector Project would affect 49.4 acres of vegetated land (see table 4.5-1). Construction of the compressor stations, meter stations, MLVs, and pig launchers and receivers associated with the Louisiana Connector Project would affect 78.0 acres of vegetated land (see table 4.5-1). Of these impacts, all of those associated with the Texas Connector Project and 67.4 acres associated with the Louisiana Connector Project would be permanently impacted by project operations at aboveground facilities.

In addition, a total of 49.4 acres of vegetated land would be affected by pipe storage/contractor yards and access roads associated with the Texas Connector Project during construction, of which 0.6 acre would be used in operations. A total of 400.8 acres of vegetated land would be affected by pipe storage/contractor yards and access roads associated with the Louisiana Connector Project during construction, of which 7.5 acres would be used during operations. Project construction would require vegetation clearing and grubbing within the construction workspace, surface grading, and placement of permanent fill for facility operations. PAPL would grade and re-gravel the sites as necessary. Following construction, PAPL would restore the sites to pre-construction conditions in adherence to its *Environmental Plan* and/or the areas would be allowed to revegetate naturally.

Specific to the Louisiana Connector Project, 170.3 acres of open water would be affected by use of the barge lay method of construction in Sabine Lake and 40.2 acres would be affected during operations. Submerged aquatic vegetation may be present, though no surveys have been done to confirm presence. The barge lay construction method is discussed in detail in section 2.4.3.1.

Based on the amounts and types of vegetation impacted along the pipeline routes, the temporary nature of the impacts, and PAPL's proposed impact minimization measures, construction and operation of the Texas Connector and Louisiana Connector Projects would not have a significant impact on vegetation communities in the project areas.

4.5.2.3 Nonjurisdictional Facilities

Construction of the nonjurisdictional facilities associated with the Liquefaction Project would temporarily affect a total of 115.1 acres of vegetation, including 112.5 acres of open wetlands, and 2.6 acres of open uplands. A total of 71.6 acres would be revegetated in accordance with PALNG's *Environmental Plan*, which includes the Commission's Plan and Procedures, using seed mixes following landowner or NRCS recommendations. The remaining 43.5 acres would be permanently converted to developed land associated with the paved road surface.

4.5.3 Exotic or Invasive Plant Communities and Noxious Weeds

Exotic plant communities, invasive species, and noxious weeds can out-compete and displace native plant species, thereby negatively altering the appearance, composition, and habitat value of affected areas. In accordance with the Plant Protection Act of 2000 (7 USC 7701), 13 plants have been federally designated as noxious weeds that could occur in Louisiana (NRCS, 2010), and the State of Louisiana has designated one plant as a noxious weed, Chinese tallow (Louisiana Revised Statutes Title 3 Part 1791). The Texas Department of Agriculture defines a noxious and invasive plant as any plant species that has a serious potential to cause economical or ecological harm to the agriculture, horticulture, native plants, ecology and waterways of Texas (Texas Department of Agriculture, 2016). A total of 26 noxious plants are listed with four of those also listed as invasive, including the Chinese tallow tree. The state of Texas has created noxious weed control districts to assist in the reclamation of land from noxious weeds in the interest of conservation and development of natural resources in the state (Texas Agriculture Code, Title 5, Subtitle B, Chapter 78).

4.5.3.1 Liquefaction Project

Field surveys identified that Chinese tallow, Japanese honeysuckle, and Chinaberry tree fern were present at the liquefaction site. Because the site would be cleared of vegetation and maintained in such state, no invasive species controls are anticipated. Invasive species present at the nonjurisdictional facilities would be periodically mowed by TDOT or controlled by the owner of each of the other nonjurisdictional facilities, in accordance with their requirements.

4.5.3.2 Texas Connector and Louisiana Connector Projects

Vegetation communities are more susceptible to infestations of invasive or noxious weed species following soil disturbances. Vegetation removal and soil disturbance during construction of the Texas Connector Project could create optimal conditions for the establishment or spread of undesirable species. Invasive or noxious plants could negatively affect habitat by competing for resources such as water and light, changing the community composition, eliminating or reducing native plants, or changing the vegetation structure. The changes in community composition or vegetation structure could reduce native plant populations and can also negatively affect wildlife habitat.

Chinese tallow and alligator weed (both on the Texas noxious plant list) were identified in the Texas Connector Project area. PAPL proposes to control Chinese tallow and alligator weed through routine mowing of the right-of-way. The presence of invasive species along the Louisiana Connector Project was observed during wetland delineations. Chinese tallow was identified in upland areas and alligator weed and water hyacinth were observed in canals and drainage ditches.

PAPL proposes to control Chinese tallow through a management approach of leaf spraying per consultation with the NRCS. PAPL's *Environmental Plan* details measure that would be implemented to minimize the spread of aquatic invasive species, including equipment inspection and invasive species removal before equipment arrives on site, during in-stream work, and before equipment leaves the worksite.

PAPL also would implement the measures in the Commission's Plan and Procedures, which require post-construction monitoring for the first and second growing seasons in uplands, and for 3 years in wetlands, to evaluate the success of revegetation. As part of this monitoring program, PAPL would be required to examine the project areas for the presence of invasive species. In non-agricultural upland areas, revegetation would be considered successful if the density and cover of non-nuisance species within the areas disturbed during construction are similar to the density and cover in adjacent undisturbed areas. Wetland revegetation would be considered successful if all the following criteria are satisfied:

- The affected wetland satisfies the current federal definition for a wetland (i.e., soils, hydrology, and vegetation).
- Vegetation is at least 80 percent of either the cover documented for the wetland prior to construction, or at least 80 percent of the cover in adjacent wetland areas that were not disturbed by construction.
- If natural rather than active revegetation was used, the plant species composition is consistent with early successional wetland plant communities in the affected ecoregion.

- Invasive species and noxious weeds are absent, unless they are abundant in adjacent areas that were not disturbed by construction.

PAPL and PALNG have committed to incorporating the measure in the Commission's Plan requiring them to develop 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. These measures would adequately minimize the colonization and/or spread of noxious and invasive species in areas disturbed by the Projects.

4.5.4 Vegetation Communities of Special Concern

4.5.4.1 Liquefaction Project

Vegetation communities of special concern may include ecologically important natural communities, threatened or endangered plant species, or other rare or imperiled plants in need of special protection or minimal disturbance. No critical habitat or vegetation communities of special concern have been identified in the project area, including both jurisdictional and nonjurisdictional facilities. Protected state plant species potentially occurring within the project area are discussed in section 4.7.

4.5.4.2 Texas Connector and Louisiana Connector Projects

Federally listed plant species are discussed in section 4.7.3 and state-listed plant species are discussed in section 4.7.4. The FWS indicated concern regarding regrowth of marsh grasses due to compaction from heavy construction equipment. PAPL has committed to monitoring the pipeline rights-of-way according to regulatory permit conditions and would coordinate with regulatory agencies to address regrowth issues if identified. In accordance with the Commission's Plan, restoration of disturbed areas would be considered successful if the right-of-way surface condition is similar to adjacent undisturbed lands and revegetation efforts would continue until revegetation is successful. In accordance with the Commission's Procedures, wetland revegetation would be considered successful if vegetation is at least 80 percent of either the cover documented for the wetland prior to construction, or at least 80 percent of the cover in adjacent wetland areas not disturbed by construction.

The LNHP identified two unique vegetation communities affected by the Louisiana Connector Project. The project would cross the Coastal Prairie community between MPs 34.5 and 38.5. This community is considered S1 (critically imperiled) in Louisiana. This community type is typically dominated by grass species such as brownseed paspalum (*Paspalum plicatulum*), little bluestem (*Schizachyrium scoparium*), slender bluestem (*Schizachyrium tenerum*), big bluestem (*Andropogon gerardii*), panic grasses (*Panicum spp*.), dropseeds (*Sporobolus spp*.), wire grass (*Spartina patens*), sedges (*Carex spp*.), beaked sedges (*Rhynchospora spp*.), paspy grasses (*Paspalum spp*.), three-awn grasses (*Aristida spp*.), broomsedges (*Andropogon spp*.), switch grass (*Panicum virgatum*), love grasses (*Eragrostis spp*.), Indian grass (*Sorghastrum nutans*), purple-top (*Tridens spp*.), umbrella sedges (*Cyperus spp*.), and nut-rushes (*Scleria spp*.). Grazing, invasive species, fire suppression, development, and saltwater intrusion are the primary threats to this community. The project would cross this area where it is actively grazed by livestock, which can remove the native and perennial grasses, leaving areas exposed and increase the risk of subsequent dominance of invasive species. PAPL would implement its *Environmental Plan* to restore this open upland area and, as such, permanent impacts in the form of loss of sensitive vegetation are not anticipated.

The Louisiana Connector Project would also cross a stand of Western Acidic Longleaf Pine Savannah/Flatwoods between MPs 65.5 and 67.23. The Western Acidic Longleaf Pine Savannah community is ranked S1S2 (imperiled). The upper vegetation stratum of this community is typically characterized by longleaf pine (*Pinus palustris*), sweet bay (*Magnolia virginiana*), black gum (*Nyssa sylvatica*), live oak (*Quercus virginiana*), blackjack oak (*Q. marilandica*), laurel oak (*Q. laurifolia*), swamp cyrilla (*Cyrilla racemiflora*), wax myrtles (*Morella spp.),* St. John's worts (*Hypericum spp*.), and littleleaf snowbell (*Styrax Americana*).

The herbaceous vegetation stratum of the western acidic longleaf pine savannah/flatwoods is typically very diverse and dominated by graminoids. The community at the crossing location is managed for active silviculture production. Existing management activities include clear cutting, thinning, stand rotation, and equipment access/operation. Construction and operation of the Louisiana Connector Project would result in conversion of forested vegetation to herbaceous right-of-way. However, due to existing silviculture management at the crossing location, the area is already disturbed. In addition, proposed access road AR-CAL-59 is an existing logging road through this vegetation community; impacts associated with project use of the road would be temporary (see appendix E).

Based on the disturbed nature of both unique vegetation communities affected by the Louisiana Connector Project and PAPL's implementation of the measures in its *Environmental Plan* to restore the areas disturbed by construction, no significant impact on the vegetation communities are anticipated.

4.6 WILDLIFE AND AQUATIC RESOURCES

4.6.1 Wildlife Resources

Wildlife species in the Projects area were identified through literature review, interpretation of aerial photography of various vegetation habitats, and field surveys. Detailed information on vegetation types present within the Projects area is included in section 4.5. Protected wildlife species affected by the Projects are discussed in section 4.7. Typical wildlife species occurring within the various habitat types of the Projects area are listed in table 4.6.1-1.

TABLE 4.6.1-1

Wildlife Species in the Projects Area by Associated Habitat

Species	PEM Wetlands	PSS wetlands	PFO Wetlands	EEM Wetlands	Forested Uplands	Open Uplands	Open Water
Mammals							
Common muskrat (*Ondatra zibethicus*)	X	X	X	X			X
Coyote (*Canis lutrans*)		X				X	
Eastern cottontail rabbit (*Sylvilagus floridanus*)					X	X	
Gray squirrel (*Sciurus carolinensis*)					X		
Marsh rice rat (*Oryzomys palustris*)	X	X					X
Nine-banded armadillo (*Dasypus novemcinctus*)					X	X	
North American mink (*Neovison vison*)	X	X	X	X			X
Plains spotted skunk (*Spilogale putorius interrupta)*					X	X	
Raccoon (*Procyon lotor*)		X			X	X	
Red fox (*Vulpes vulpes*)					X	X	
Seminole bat (*Lasiurus seminolus*)					X		
Southeastern myotis (*Myotis austroriparius*)					X		
Swamp rabbit (*Sylvilagus aquaticus*)	X	X	X	X			X
Tree squirrels (*Sciuridae spp*.)			X		X	X	
Virginia opossum (*Didelphis virginiana*)					X		
White-tailed deer (*Odocoileus virginianus*)					X	X	
Wild hog (*Sus scrofa*)		X				X	
Birds							
American bittern (*Botaurus lentiginosus*)	X	X		X			
American coot (*Fulica Americanaamericana*)	X	X		X			
American peregrine falcon (*Falco peregrinus anatum*)		X					
American white ibis (*Eudocimus albus*)	X						X
American widgeon (*Anas Americanaamericana*)	X	X	X	X			
Bald eagle (*Haliaeetus leucocephalus*)					X		
Barred owl (*Strix varia*)					X	X	
Black-crowned night–heron (*Nycticorax nycticorax*)	X						
Black–neck stilt (*Himantopus mexicanus*)	X						
Blue jay (*Cyanocitta cristata*)					X	X	

TABLE 4.6.1-1 (cont'd)

Typical Wildlife Species in the Projects Area by Associated Habitat

Species	PEM Wetlands	PSS wetlands	PFO Wetlands	EEM Wetlands	Forested Uplands	Open Uplands	Open Water
Brown thrasher (*Toxostoma rufum*)					X	X	
Canvasback (*Aythya valisineria*)		X		X			X
Cattle egret (*Bubulcus ibis*)	X						
Carolia chickadees (*Peocile carolinensis*)					X	X	
Cedar waxwing (*Bombycilla cedrorum*)					X	X	
Clapper rail (*Rallus longirostris*)	X						
Common snipe (*Capella gallinago*)	X						
Cooper's hawk (*Accipiter cooperi*)					X	X	
Downy woodpecker (*Picoides pubescens*)					X	X	
Great blue heron (*Ardea Protonataria citrea*)	X			X			
Great horned owl (*Bubo virginianus*)					X	X	
Greater white-fronted goose (*Anser albifrons*)		X		X			X
Green heron (*Butorides virescens*)	X	X	X				
Green-winged teal (*Anas carolinensis*)		X		X			X
Hairy woodpecker (*Picoides villosus*)					X	X	
Hermit thrush (*Catharus guttata*)					X	X	
Mallard (*Anas platyrhynchos*)		X		X			X
Mottled duck (*Anas fulvigula*)		X		X			X
Northern cardinal (*Cardinalis cardinalis*)					X	X	
Northern flicker (*Colaptes auratus*)					X	X	
Ovenbird (*Seiurus aurocapilla*)					X	X	
Pileated woodpecker (*Dryocopus pileatus*)	X						
Pine warbler (*Setophaga pinus*)					X	X	
Redwinged blackbird (*Agelaius phoeniceus*)	X				X	X	
Red-bellied woodpecker (*Melanerpes carolinus*)					X	X	
Reddish egret (*Egretta rufescens*)		X	X				
Red-headed woodpecker (*Melanerpes erythrocephalus*)					X	X	
Red knot (*Calidris canutus)*		X					X
Red-tailed hawk (*Buteo jamaicensis*)					X	X	
Snowy egret (*Egretta thula*)	X						
Song sparrow (*Melospiza melodia*)					X	X	
Spotted sandpiper (*Actitis macularia*)		X		X			X
Tricolored heron (*Egretta tricolor*)	X						X
Whip-poor-will (*Caprimulgus vociferus*)					X	X	
White-faced ibis (*Plegadis chihi*)		X					X
Wild turkey (*Meleagris gallopavo*)					X	X	
Wood duck (*Aix sponsa*)	X						
Wood stork (*Fusconaia askewi*).		X					
Wood thrush (*Hylocichla mustelina*)					X	X	
Yellow warbler (*Setophaga petechia*)					X	X	
Reptiles and Amphibians							
American alligator (*Alligator mississippiensis*)		X		X			
Bronze frog (*Rana clamitans*)	X						X

TABLE 4.6.1-1 (cont'd) **Typical Wildlife Species in the Projects Area by Associated Habitat**							
Species	PEM Wetlands	PSS wetlands	PFO Wetlands	EEM Wetlands	Forested Uplands	Open Uplands	Open Water
Buttermilk racer (*Coluber constrictor anthicus*)						X	
Cornsnake (*Pantherophis guttatus*)						X	
Cottonmouth water moccasin snake (*Agkistrodon piscivorus*)	X	X	X	X			X
Diamondback water snake (*Nerodia rhombifer*)	X	X	X	X			X
Eastern hognose snake (*Heterodon platirhinos*)						X	
Eastern newt (*Notophthalmus viridesens louisianenisis*)		X	X				X
Green anole (*Anolis carolinensis*)						X	
Mud snake (*Farancia abacura*)						X	
Narrow-mouth toad (*Gastrophryne carolinensis*)	X						X
Northern cricket frog (*Acris crepitans*)						X	
Rough earth snake (*Virginia striatula*)						X	
Six-line racerunner (*Aspidoscelis sexlineata*)						X	
Speckled king snake (*Lampropeltis getula holbrooki*)	X						
Timber rattlesnake (*Crotalus horridus*)						X	
Woodhouse's toad (*Anaxyrus woodhousii*)	X						X

4.6.1.1 Existing Wildlife Habitat

Liquefaction Project

The wildlife habitat types at the Liquefaction Project site include PSS, PEM, and EEM wetlands, forested uplands, developed/disturbed lands, and open water. Open water habitat, both palustrine and estuarine, is present at the Liquefaction Project site; aquatic resources are discussed in section 4.6.2 and EFH is discussed further in section 4.6.3. A limited amount of forested cover is located primarily on dredge material levees and elevated spoil placement areas; these areas are dominated by the invasive Chinese tallow, which provides only low-quality wildlife habitat. Developed lands provide minimal habitat for wildlife species, and wildlife diversity in these areas is often limited to species that are adapted to human disturbance, such as raccoons, muskrat, squirrels, and sparrows.

Approximately 7.7 million yd^3 of dredge materials associated with construction of the marine berth, turning basin, MOF, and Pioneer Dock would be disposed of off-site. Of this, about 2.9 million yd^3 would be deposited on the J.D. Murphree WMA as beneficial reuse. The existing wildlife habitat at the WMA is comprised of coastal wetland communities, including freshwater, intermediate, and brackish wetlands and marshes. The WMA is a key nesting and brooding area for waterfowl, marsh birds, shorebirds, and wading birds. It also hosts a diverse population of reptiles, amphibians, and mammals (TPWD, 2017c). Deposition of dredge material would increase the elevation at the WMA, which is currently being lost through subsidence, erosion, and saltwater intrusion (TPWD, 2017b).

The remaining 4.8 million yd^3 of dredge material would be deposited in existing Dredge Disposal Areas 8, 9A, and 9B owned and managed by the SNND. Wildlife habitat at existing Dredge Disposal Areas 8, 9A, and 9B consists of open water, and PEM and EEM wetlands.

Pipeline Projects

Wildlife habitat within and around the Texas Connector and Louisiana Connector Projects include forested uplands; upland open lands; scrub-shrub uplands; agricultural lands (including pasture lands); PFO, PSS, PUB, PEM, and EEM wetlands; and developed/disturbed lands. Fisheries habitats are discussed in section 4.6.2.

Upland forested areas, as well as open water and the various wetland habitats, provide foraging and nesting habitat for a variety of waterfowl, raptors, songbirds, mammals, reptiles, and amphibians. Wildlife species typical to these habitats are listed in table 4.6.1-1 above.

The various upland open lands (e.g., agricultural lands, road ditches, maintained utility rights-of-way), as well as upland scrub-shrub habitat provide foraging and breeding habitat for many species. For example, hayfields, small grains, fallow and old fields, pastures, idled croplands, and grasslands provide nesting and foraging habitats for grassland birds (USDA, 1999). Utility rights-of-way maintained in early successional communities also provide valuable nesting and foraging habitats for grassland bird species (USDA, 1999). Grasslands and old fields can be used as foraging and denning habitat by mammals, and provide nesting and breeding habitat to upland game birds such as pheasants. Shrublands provide sources of food and nesting sites for various birds, as well as cover for invertebrates, reptiles, and amphibians. Open fields and shrublands provide habitat for small mammal species such as mice, rabbits, and voles, which make them prime hunting grounds for predator species. Developed lands provide minimal habitat for wildlife species.

Open water areas crossed by the Texas Connector and Louisiana Connector Projects include creeks, streams, and rivers. Open water cover type provides important foraging habitat for species listed above. Aquatic resources and EFH are discussed further in sections 4.6.2 and 4.6.3.

Nonjurisdictional Facilities

Because the 295-foot-wide right-of-way associated with the relocation of SH 87, pipelines, and utilities is within the liquefaction facility boundary, wildlife habitat and species present would be similar to those discussed for the Liquefaction Project above.

4.6.1.2 Wildlife Resources Impacts and Mitigation

Liquefaction Project

A total of about 845.3 acres of terrestrial/vegetated wildlife habitat would be affected by construction of the Liquefaction Project. Overall, the greatest impacts would be on open wetlands. Construction of the Liquefaction Project would result in permanent impacts on 808.0 acres of habitat, primarily through the conversion of these habitats to industrial land and open water.

Impacts on wildlife from construction of the liquefaction facilities would include displacement, stress, and direct mortality of some individuals. Vegetation clearing would potentially reduce suitable cover, nesting, and foraging habitat for some wildlife species. More mobile wildlife, such as birds and mammals, may relocate to similar habitats nearby when construction activities commence. However, smaller, less mobile wildlife (e.g., some reptiles and amphibians) could be inadvertently injured or killed by construction equipment. The permanent reduction in available habitat within the liquefaction facility 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.

Although the liquefaction facility site has been previously disturbed by the historic deposition of dredge material and is in proximity to routine dredging activity, wildlife habitat would be affected within the liquefaction facility by permanent conversion to industrial land use. However, a large amount of similar or higher quality habitat exists at the J.D. Murphree WMA, adjacent to the liquefaction facility, which could be used by mobile animals able to vacate the liquefaction site.

Pilings would be installed during the construction of the liquefaction facility using hammer or vibratory methods. Noise resultant from pile driving activities has the potential to alter wildlife behavior, including foraging and nesting activities within the Liquefaction Project area. Pile-driving noise would be intermittent and temporary, and preparatory activities likely would encourage mobile species to leave the immediate area prior to commencing pile driving. Less mobile species would be subject to resulting noise.

Construction activities would require vegetation clearing, grading, and filling to level the site. This would reduce cover, nesting, and foraging habitat for some species and may result in mortality of less mobile forms of wildlife, such as small rodents and reptiles. The greatest impacts on terrestrial wildlife would result from the permanent loss of approximately 808.0 acres of vegetated lands within the liquefaction facility site, which would result in a permanent reduction in habitat in the general vicinity of the Liquefaction Project. Due to the site's previous use as a dredge disposal site, vegetation species diversity is low, which lessens its habit value for wildlife and, as such, impacts would be permanent but minor. Of the 808.0 acres that would be permanently converted to developed land, 725.7 acres are wetlands. Wetland habitats support a diverse ecosystem that provides nutrients, cover, shelter, and water for a variety of terrestrial and aquatic wildlife species. Additionally, construction of the marine facilities would convert approximately 151 acres of vegetated land (and terrestrial wildlife habitat) to open water habitat. See section 4.6.3 for more detail.

Placement of dredge material at the J.D. Murphree WMA and dredge disposal areas 8, 9A, and 9B would disturb the existing habitat and affect wildlife foraging, nesting, and use of cover. Similar to the liquefaction site, because dredge disposal areas 8, 9A, and 9B have been previously disturbed, vegetation species diversity is low, which lessens its habit value for wildlife. Wildlife habitat at the WMA is higher quality than surrounding areas; however, impacts are expected to be minor and temporary, lasting until the areas are stabilized. Further, placement of dredge material would ultimately improve the vegetation quality, as discussed in section 4.5.2.1, and as a result, improve the overall wildlife quality.

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

To minimize project-related impacts on wildlife, PALNG would implement its project-specific *Environmental Plan*, which includes the Commission's Plan and Procedures, as well as its *Spill Prevention Plan* during construction, and would develop and implement a SPCC Plan during operation.

Based on the previous use of the liquefaction site for dredge material placement, adequate similar habitat for wildlife near the site, presence of exotic and/or invasive species (e.g., Chinese tallow), limited amount of forest habitat impacts, proposed beneficial use of dredge material(which would create additional wildlife habitat), and implementation of PALNG's proposed mitigation measures, we have determined that construction and operation of the proposed Liquefaction Project would have permanent, but minor impacts on wildlife.

Pipeline Projects

Texas Connector Project

Construction of the Texas Connector Project would temporarily disturb 482.8 acres of vegetation during construction, of which 169.6 acres would be permanently altered during operation for maintenance of the pipeline right-of-way and aboveground facilities, including the new pipelines and laterals, compressor stations, meter stations, and access roads (see table 4.5-1). Of this, a total of 0.1 acre of upland forest would be permanently affected by construction. Approximately 225 acres of vegetation impacts would be avoided through use of the HDD construction method at 24 locations. Vegetation clearing would be minimal (about 3 acres) between HDD entry and exit locations on the Texas Connector Project. Fencing would limit the wildlife use of suitable habitat at the North and South Compressor Stations and meter stations, particularly for larger mammals. Increased noise levels near the compressor and meter stations may result in avoidance of the area by wildlife until they become acclimated to the new noise source.

The impact of construction on wildlife species and their habitats would vary depending on the resource requirements of each species and the existing habitat present along the pipelines and lateral routes and at aboveground facilities. The greatest effects to wildlife would occur during cutting, clearing, and/or removal of existing vegetation, which would reduce the amount of available habitat within the construction right-of-way and temporary workspaces. The degree of temporary impact would depend on the rate at which vegetation regenerates after construction. Herbaceous and scrub-shrub habitats generally revegetate within 4 years of disturbance, while forested areas may longer to recover. Impacts on forested areas that are not in areas of regular mowing would be longer term, though tree species common to southern pine forests (such as loblolly pine) tend to grow quickly, adding up to 2 feet of height growth per year (Texas Forest Service, 2010). Deciduous hardwood species such as the sweet gum and red maple also tend to grow at a medium to fast rate (Arbor Day Foundation, 2017).

Clearing of the temporary construction right-of-way would reduce cover, nesting, and foraging habitat for some species and may result in direct mortality for less mobile forms of wildlife, such as small rodents and reptiles. Larger or more mobile wildlife, such as birds and large mammals, would be expected to leave the right-of-way as construction begins and relocate into similar habitats near the project. However, if a lack of adequate territorial space exists, some individuals could be forced into suboptimal habitats. This could increase inter- and intra-specific competition and lower reproductive success and survival. The potential influx and increased density of species in some undisturbed areas could reduce the reproductive success of animals that are not displaced by construction. These effects would cease after completion of construction and right-of-way restoration, when wildlife could return to the disturbed areas and adjacent undisturbed habitats after restoration is complete. Species that use early successional shrub or forest communities may benefit from the clearing and revegetation process, as additional habitat of this type would be created by construction and operation of the pipeline projects. In addition, non-woody, early successional vegetation may provide forage for small mammals and birds, as well as breeding habitat for ground-nesting birds, mammals, and reptiles.

In forested areas, construction of the Texas Connector Project would increase edge habitats, which are used by various wildlife species, such as songbirds and small mammals. Many species can adapt to this habitat shift and could take advantage of edge habitats. Predatory species such as red-tailed hawk and coyote commonly use utility rights-of-way for hunting; other species, such as the eastern cottontail, mourning dove, field and song sparrow, white-tailed deer, and red fox, could benefit from the transition to early successional habitat for foraging.

Noise could impact wildlife during all phases of the Texas Connector Project. Certain species rely on hearing for courtship and mating, prey location, predator detection, and/or homing. These life functions could be affected by construction and operational noise.

Research has demonstrated various wildlife reactions to noise from traffic, airplanes, sonic booms, helicopters, military activities, and blasting; however, specific noise studies from pipeline construction have not been conducted. Studies show that some species avoid roadways due to noise from a few meters to over 3 kilometers in distance (Bennett, 1991). These species appear to be most sensitive during the breeding season. Conversely, the abundance of small mammals and birds (e.g., starlings, house sparrows, song sparrows, red-winged blackbirds) increases closer to the roadway, possibly due to increased availability of prey species such as insects. Construction-related sounds may have an adverse impact on raptors and bird species during nesting and breeding. These impacts occur when noise levels substantially exceed ambient conditions that existed prior to a project (i.e., by 20 to 25 dB, as experienced by the animal) and/or when the total sound level exceeds 90 dB. Such impacts could result in nest abandonment, egg failure, reduced juvenile growth and survival, or malnutrition or starvation of the young. During construction, these impacts are generally related to areas immediately adjacent to the construction right-of-way but can extend to greater distances for activities such as blasting (Benítez-López et al., 2010).

Noise generated from construction of the Texas Connector Project would result from heavy equipment and machinery use. Most construction activities would be limited to daytime hours, except for a limited number of 24-hour activities, such as water pump operation, road bores, and HDD installations. Noise impacts from construction are expected to be minor to moderate and temporary.

The proposed compressor stations would generate noise on a continuous basis once in operation. The noise impacts associated with the compressor stations would be limited to the general vicinity of the facilities; however, certain operations, such as blow-downs, would generate infrequent, but high noise levels that would extend for a greater distance from the compressor stations. Noise emissions associated with compressor stations are described in section 4.11.1.4. While compressor station noise could affect birds in the area, we expect that in subsequent years birds and other wildlife would either be habituated to the noise source, or would have moved into similar available habitat farther from the noise source. This, in turn, could lead to increased competition for preferred habitats, depending on the amount of habitat available. During pipeline operation, noise emissions also would be generated during monitoring and maintenance activities, such as vegetation clearing on the permanent right-of-way, or during ground or air surveillance of the pipeline, as required by regulations.

Short- or long-term impacts on wildlife habitat could occur if construction spreads noxious weeds and other invasive species (see section 4.5.3 for a discussion regarding noxious weed impacts on vegetation). Noxious weeds can out-compete native vegetation and displace native species by spreading rapidly and co-opting resources (i.e., nutrients, water, and sunlight) that can eventually lead to a weed-dominated monoculture. Such transformed habitat can be unsuitable to former wildlife inhabitants. Often, as habitat quality degenerates, wildlife diversity declines. Invasive plant species can form dense monocultures that inhibit native vegetation from flourishing, cause a decrease in species diversity, limit water flow and wildlife access to water, and in some instances, make waterfowl nesting areas unsuitable. Section 4.5.3 discusses invasive species, including proposed mitigation measures.

Fragmenting contiguous wildlife habitats into smaller units could alter wildlife habitat and species survival. Many wildlife species require large, undisturbed habitats. When these habitats are affected, wildlife may be subject to increased predation, parasitism, or inter-specific competition; reduced pairing, nesting, and reproductive success; inhibited migration, dispersal, and foraging; and expansion of non-native vegetation.

Fragmentation generally affects birds by creating dispersal barriers, resulting in smaller suitable microhabitats, smaller population sizes, and edge effects (Degraaf and Healy, 1990). Edge effects can cause interactions between birds that nest in the interior of forests and species that inhabit surrounding landscapes, typically lowering the reproductive success of the interior species. Other evidence suggests that certain mammals, amphibians, reptiles, and plants are also adversely affected by forest fragmentation. Species that require large tracts of unbroken forest land may be forced to seek suitable habitat elsewhere. Less mobile species, such as reptiles and amphibians, could experience greater impacts from habitat fragmentation, as they are less mobile and less likely to relocate to more suitable habitat. The loss of forest habitat, expansion of existing corridors, and the creation of open, early successional and induced edge habitats could decrease the quality of habitat for forest interior wildlife species in a corridor much wider than the actual cleared right-of-way. The distance an edge effect extends into a woodland is variable, but most studies point to at least 300 feet (Rodewald, 2001; Jones et al., 2000; Ontario Ministry of Natural Resources, 2000; Robbins, 1988; Rosenberg et al., 1999). Edge effects within this distance could include a change in available habitat for some species due to an increase in light and temperature levels on the forest floor and the subsequent reduction in soil moisture, thereby resulting in habitat that would no longer be suitable for species that require these specific habitat conditions, such as salamanders and amphibians. An alteration of habitat could affect the fitness of some species and increase competition both within and between species, possibly resulting in an overall change to the structure of the forest community.

Habitat fragmentation would generally result where the pipeline facilities are not collocated with existing rights-of-way and forested and scrub habitats are crossed. As outlined in section 2.0, the Texas Connector Project's Northern and Southern Pipeline segments would parallel existing, maintained rights-of-way and corridors for 43 percent of their total length, which would reduce fragmentation effects. When collocated with existing corridors, it is unlikely that the relatively small widening of existing permanently cleared right-of-way would impede the movement of most wildlife species. Where the facilities would create a new corridor through shrub and forested habitats, wildlife composition would shift from those species favoring shrub and forest habitat to those favoring edge habitat or open areas.

Potential positive impacts from creating or widening utility rights-of-way would include increased diversity and density of bird species, increased access to a variety of food resources, and increased ground cover, which would favor ground-nesting species (Rosenberg and Raphael, 1986). The proximity of cover and forage areas at forest edges provides ideal habitat for many bird and game species. For example, bird species diversity in power line corridors through forested vegetation was found to be higher in the corridor than within the adjacent forest (Kroodsma, 1984). Higher levels of flower and fruit production, pollinator, and frugivore densities are often found along the edge.

To adequately minimize fragmentation impacts, the construction right-of-way would be restored according to PAPL's *Environmental Plan*, which includes reseeding measures using site-specific seed mixtures recommended by local seeding authorities, augmented by recommendations from the FWS, land-managing agency, and/or landowner to enhance wildlife habitat. PAPL would also adopt the NRCS' recommendation for Jefferson and Orange Counties, which includes revegetating disturbed areas with common bermudagrass and *Pensicola bahia* in upland areas, and full bermudagrass seeding in hydric saline soils. The NRCS also recommended that native topsoil be stockpiled in marshes and used to sod areas of disturbance during restoration. The right-of-way would be monitored as required by FERC and other agency permit conditions.

Although individuals of some wildlife species would be affected by construction and operation of the proposed aboveground facilities, most impacts on wildlife would be temporary (limited to the construction period) to long term where forested vegetation is affected. With the implementation of PAPL's *Environmental Plan*, which includes the Commission's Plan and Procedures, the measures identified above (e.g., collocating pipeline, revegetation), and the presence of abundant similar wildlife habitat adjacent to the affected areas, construction and operation of the Texas Connector Project would not have a significant impact on local wildlife populations or habitat.

<u>Louisiana Connector Project</u>

Construction of the Louisiana Connector Project (and associated aboveground facilities, access roads, and yards) would temporarily disturb 2,043.7 acres of vegetated wildlife habitat during construction, of which 646.7 acres would be permanently altered during operation for maintenance of the pipeline right-of-way and aboveground facilities, including the new pipeline, compressor stations, interconnections, and access roads (see table 4.5-1). Of this, a total of 184.3 acres of upland forest and 68.4 acres of wetland forest would be permanently affected. In addition, 0.4 acre of open wetlands would be permanently converted to developed land for aboveground facilities. About 185 acres of vegetation impacts would be avoided through use of the HDD construction method at 26 locations.

Impacts on wildlife habitat would be similar to those described above for the Texas Connector Project. Agricultural lands, open wetlands, and upland areas would be revegetated to a cover state similar to pre-construction conditions. The degree of temporary impact would depend on the rate at which vegetation regenerates after construction. The 50-foot-wide permanent right-of-way centered on the pipeline would be maintained in an herbaceous state. Routine clearing would occur every 3 years. Forested areas of the temporary right-of-way and ATWS would be allowed to revert to forested cover, considered a long-term impact.

Construction of the Louisiana Connector Project would fragment habitat where the pipeline facilities are not parallel to existing right-of-way; forested and scrub habitats would be affected. As outlined in section 2.0, the Louisiana Connector Project would parallel existing, maintained rights-of-way and corridors for 73 percent of its total length, which would reduce fragmentation effects. When collocated with existing corridors, it is unlikely that the widening of permanently cleared right-of-way by an additional 50 to 75 feet would impede the movement of most wildlife species. Where the facilities create a new corridor through shrub and forested habitats, wildlife composition would shift from those species favoring shrub and forest habitat to those favoring edge habitat or open areas.

Additionally, construction of the Louisiana Connector Project would require dredging and excavation operations necessary to install the pipeline through Sabine Lake. The lake entrance and exits would be constructed using the HDD method. The project would resurface approximately 500 feet from the shoreline, reducing impacts to the shoreline and associated wildlife and wildlife habitat. In the open water of Lake Sabine, the project would be constructed using the Barge Lay and S-lay construction method and would require a 300-foot-wide construction right-of-way. The primary impacts associated with the installation of the project across Sabine Lake could be resuspension of sediment in the water column. If present, submerged aquatic vegetation may also be directly affected by construction activities or indirectly due to sedimentation and increased turbidity. Wildlife species that use the open water habitat of Sabine Lake may be affected by resuspended sediments and turbidity, temporarily limiting their ability to forage and/or utilize cover within submerged aquatic vegetation, if present. Impacts on EFH and aquatic species are discussed in sections 4.6.2 and 4.6.3, respectively.

Similar to the Texas Connector Project, some wildlife species would be affected by construction and operation of the aboveground facilities. Most impacts on wildlife would be temporary (limited to the construction period) to long term where forested vegetation is affected. With the implementation of PAPL's *Environmental Plan*, which includes the Commission's Plan and Procedures, the measures identified above (e.g., collocating pipeline, revegetation), and the presence of abundant similar wildlife habitat adjacent to the affected areas, construction and operation of the Louisiana Project would not have a significant impact on local wildlife populations or habitat.

Nonjurisdictional Facilities

A total of 115.1 acres of vegetated wildlife habitat would be affected by construction activities (see table 4.5-1). The impacts from nonjurisdictional facilities would be similar to the impacts described in section 4.6.1.2 for the Liquefaction Project. Impacts on wildlife species and cover, nesting, and foraging habitat for some species and may result in mortality of less mobile forms of wildlife, such as small rodents and reptiles. Other wildlife, such as birds and larger mammals, would be expected to leave the area as construction activities approach. Indirect impacts due to noise and dust generation would be temporary.

Following completion of the relocation of SH 87, pipelines, and utilities, 175 feet of the construction right-of-way would be revegetated in accordance with PALNG's *Environmental Plan*; the remaining area would consist of permanently paved highway surface. Operation of nonjurisdictional facilities would affect 43.5 acres of wildlife habitat, resulting in a permanent conversion of these habitats to industrial land. Permanent loss of wetland habitat would be mitigated through the USACE permitting process.

4.6.1.3 Unique and Sensitive Wildlife

Migratory Birds, Birds of Conservation Concern, and Bird Fallout Sites

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. Some species migrate from breeding areas in the north to the Gulf Coast for the non-breeding season. Migratory birds are protected under the MBTA, which prohibits the intentional 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 (Responsibilities of Federal Agencies to Protect Migratory Birds, issued January 10, 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. The executive order states that emphasis should be placed on species of concern, priority habitats, and key risk factors, and that particular focus should be given to addressing population-level impacts. On March 30, 2011, the FWS and the Commission entered into a Memorandum of Understanding (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, BGEPA, ESA, Federal Power Act, NGA, or any other statute and does not authorize the take of migratory birds.

In order to accurately identify bird species with the greatest conservation priority and stimulate action by federal/state agencies and private parties, the FWS Migratory Bird Office issued a report describing the Birds of Conservation Concern (BCC) (FWS, 2008a). The report identifies priority bird species at the national, regional, and Bird Conservation Region levels. The proposed Projects, including the nonjurisdictional facilities, are within Bird Conservation Region 37 – Gulf Coastal Prairie (FWS, 2008a). Appendix N identifies the BCCs with the potential to occur near the Projects, which species breed within the region, and the nesting habitat of the breeding species. BCC species within the Gulf Coastal Prairie Region include migratory species, non-migratory birds, game and nongame species, and ESA candidate, proposed, and recently delisted species.

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 (Audubon Texas, 2017). Colonial waterbirds return to the same rookery year after year. Rookeries are typically established in marshes or near the shores of ponds or streams. Although some colonial waterbirds (e.g., least terns) do nest in developed areas, many waterbirds (e.g., great blue heron and great egrets) are wary of human activity.

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, where they remain throughout the non-breeding season. Project elements in Louisiana are within the Mississippi Flyway. Project elements in Texas are within the Central Flyway. The Gulf Coast provides wintering and migration habitat for large numbers of continental duck and goose populations that use the Central and Mississippi Flyways. The Gulf Coast is considered one of the most important waterfowl areas in North America, specifically for Nearctic-neotropical migrating birds (Shackelford et al., 2005).

Beyond the MBTA, the BGEPA provides additional protection to bald and golden eagles. The BGEPA prohibits the take, possession, sale, offer to sell, purchase, barter, transport, export or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit. "Take" under this act is defined as "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest or disturb." Disturb is defined as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." If a proposed project or action occurs in an area where nesting, feeding, or roosting eagles occur, the proponent often needs to implement special conservation measures to comply with the BGEPA.

Liquefaction Project

Though one potential colonial waterbird rookery was identified in TPWD mapping of the liquefaction facility, field surveys and correspondence with the J.D. Murphree WMA confirmed that no rookery was present (TPWD, 2015).

Several migratory bird fallout sites were identified by the TWPD in the Texas Natural Diversity Database. During spring migration periods, birds traveling north may encounter southward-moving storms, slowing their progress across or along the Gulf of Mexico. Exhausted birds "fall out" in large numbers when they reach the coast, stopping to seek shelter and forage (Butcher, 2008). The four known occurrences of fallout sites occurred in 1981 and were about 4.5 miles south of the Liquefaction Project.

Round Lake, which is within the Liquefaction Project site but would be avoided by construction and operation, is commonly used by waterfowl species and was identified as a birding hotspot by eBird, an online birding checklist program developed through a partnership between the Cornell Lab of Ornithology and the National Audubon Society (Cornell Lab of Ornithology, 2017a). The lake is located along the eastern boundary of the site, adjacent to the Port Arthur Canal. While the Liquefaction Project would not directly affect Round Lake, construction activities would occur around the lake. Wildlife species would be impacted due to noise from equipment and machinery, as discussed below.

Pipeline Projects

Along the Texas Connector Project, seven rookeries were identified by the TWPD in the Texas Natural Diversity Database within 6 miles of the Northern Pipeline. The most recent observed rookery record is from 1992. Additionally, the TPWD identified one rookery about 1 mile northeast of the South

Compressor Station, which is within the proposed Liquefaction Project site. A total of four migratory bird fallout sites were also identified by the TPWD about 3.5 miles south of MP 5.5 along the Southern Pipeline. Along the Louisiana Connector Project, potential rookery/wading bird colonies were identified about 0.2 mile southeast of MP 39 and 0.2 mile south of MP 90, according to a review of the Louisiana Natural Heritage Program (LNHP) database.

An Important Bird and Biodiversity Area (IBA) is an area defined as places of international significance for the conservation of birds and other biodiversity, recognized as practical tools for conservation and action. More than 12,000 sites in over 200 countries worldwide have been identified as IBAs (BirdLife International, 2017). The Texas Connector and Louisiana Connector Projects in Texas are not within any IBAs. However, the Texas Connector Project in Louisiana (Southern Pipeline) would be in the Chenier Plain IBA. Additionally, the Louisiana Connector Project would cross the Chenier Plain IBA between approximate MPs 18 and 58 and between approximate MP 96 and the CST Meter Station at the end of the pipeline route. Louisiana’s largest at over 2,300,000 acres, this IBA is a mix of open water, marsh, and woodland habitat in southern Louisiana. The biggest threat to this IBA is coastal erosion and wetland habitat loss (Audubon Texas, 2017).

Bald eagles are listed as threatened in Texas and endangered in Louisiana and have the potential to occur throughout the Projects area.

Impacts and Mitigation

The vegetation communities within the Projects areas provide potential habitat for migratory bird species and BCC species, including songbirds, waterbirds, and raptors. However, much of the vegetated land associated with the Liquefaction Project and nonjurisdictional facilities is previously disturbed and/or within or adjacent to existing facilities. Removal or conversion of these habitat types would reduce bird nesting and foraging habitat value. Impacts on migratory birds and BCC species and their habitat due to construction and operation of the Projects would typically be similar to impacts on general wildlife resources (see section 4.6.1.2). In addition, potential impacts specific to migratory birds include loss of habitat and injury or disorientation due to flaring and other artificial illumination. Many migratory birds use natural light from the sun, moon, and stars for navigation. Artificial lighting can hide natural light sources, having unknown effects on birds at the population level. Fatalities to avian species due to artificial light are well documented. Avian fatalities are associated with attraction to light sources, especially in low light, fog, and when there is a low cloud ceiling (Patterson, 2012).

Adjacent vegetation clearing would potentially reduce suitable cover, nesting, and foraging habitat for some wildlife species. The influx of displaced 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.

During a November 13, 2015 meeting between PALNG, PAPL, and the Texas Coastal Ecological Services Field Office of the FWS (Texas FWS), the Texas FWS stated that its primary project-related concern was habitat loss due to inadequate restoration practices and lighting impacts on migratory birds. The Texas FWS confirmed that no significant impacts on migratory birds are anticipated at the liquefaction facility site but encouraged the applicants to use mitigation measures to avoid or reduce impacts. In addition, during an interagency meeting on September 28, 2016, the Texas FWS requested implementation of BMPs for flares and lighting to minimize impacts on migratory birds. The Texas FWS indicated that flare lights are lower luminescence than artificial lighting at facilities and are of less concern.

In its June 8, 2018 letter, the Texas FWS identified the following voluntary avoidance and minimization measures to protect migratory birds, which PALNG and PAPL have agreed to adopt for the Projects:

- PALNG facility lighting would be designed to minimize the quantity of lights required to that needed to safely operate the facility.
- Lighting would be installed with downward oriented shrouds, unless safety concerns warrant otherwise.
- Red strobe lights, rather than white, would be used to mark taller cranes if permitted by the Federal Aviation Administration.
- Any temporary lighting associated with pipeline construction would be restricted to the boundaries of the pipeline corridor and associated staging areas and pointed downwards.
- Any permanent lighting needed for the pipeline facilities, such as meter stations, compressor stations, or security features, would be restricted to the boundaries and pointed downwards.
- PAPL has minimized the construction workspace to what it believes would permit the safe installation of the 42-inch-diameter pipeline and implemented several HDDs to avoid and minimize impacts on wetlands, waterbodies, and forested areas along the route.
- PAPL would attempt to avoid construction during the primary migratory bird nesting season, March through August. If, however, this is not possible, prior to construction, PAPL would coordinate with the FWS to identify specific MBTA species of concern and potential avoidance, surveys, or other measures to protect these migratory birds.
- PALNG understands Entergy would install "avian friendly" power poles that eliminates avian fatalities due to electrical contact at the structure.
- PALNG would immediately notify the FWS if a large number of bird strikes occur within the vicinity of the project site (such as powerline strikes) in order to develop additional avoidance and/or diversion measures necessary to prevent future impacts on migratory birds.

Additionally, PALNG would use nesting inhibitors (pennant flagging) in parking areas to discourage migratory birds from nesting in unsuitable areas. PALNG committed to using ground flares as opposed to elevated flares to minimize impacts on migratory birds. With the implementation of these mitigation measures, temporary flaring during construction and the occasional flaring during operation would not adversely or significantly impact migratory birds.

Construction and operation of the Liquefaction Project would result in the permanent loss of 808.0 acres of vegetated wildlife habitat, including open uplands and open wetlands. This habitat loss would directly impact the available nesting and foraging habitat for migratory birds. In addition, a total of 903.0 acres of open wetlands at the J.D. Murphree WMA and up to 1,095.4 acres of open wetlands at the SNNW Dredge Disposal Areas 8, 9A, and 9B would be affected due to dredge material disposal. While we acknowledge that placement of dredge material at the J.D. Murphree WMA would create about 1,268.8 acres of coastal marsh wetland, resulting in a beneficial impact on wildlife species associated with this habitat, the activity could also result in the mortality of migratory and nesting birds and their eggs at the WMA.

Although impacts may be advantageous for some species, construction and operation of the Texas Connector and Louisiana Connector Projects may result in bird species that use tree cavities for roosting suffering direct mortality during right-of-way clearing. Species that prefer large tracts of unbroken forest would be indirectly affected by clearing of forest habitat. In addition, nesting success may be reduced for one annual breeding cycle for adult birds that normally would breed in the area but would avoid it during construction activities. The slow regeneration of forested communities within the temporary right-of-way would result in a long-term reduction in forested habitat for species that use these communities; however, abundant similar habitats are available for wildlife adjacent to the project.

To reduce impacts on nesting birds during pipeline operation, temporary workspace and ATWS areas would be revegetated to preconstruction conditions. Routine vegetation mowing or clearing would not be conducted along the entire width of the permanent right-of-way more frequently than every 3 years, except for a corridor not exceeding 10 feet in width centered on the pipeline that would be cleared at a frequency necessary to maintain the right-of-way in an herbaceous state. Also, routine vegetation mowing or clearing would not occur during the migratory bird nesting season between April 15 and August 1.

PAPL would conduct surveys for rookeries prior to the start of construction and has committed to constructing outside of nesting periods at active rookeries and colonial nesting areas. If nesting wading bird colonies are identified within 300 meters (about 984 feet) of the project, construction activities would be conducted during the non-nesting period of September 1 to February 15 for these species. If colonies of gulls, terns, and/or skimmers are identified within 400 meters (about 1,312 feet) or brown pelicans are identified within 700 meters (about 2,297 feet) of the project, construction activities would be conducted during the non-nesting period of September 16 to April 1 for these species. If PAPL believes impacts on rookeries or nesting colonies are unavoidable, it would prepare and submit a Migratory Bird Conservation Plan to the FWS, TPWD, and LDWF for review and concurrence.

PAPL would perform bald eagle nest surveys prior to construction of the Texas Connector and Louisiana Connector Projects. If active nests are identified, PAPL would comply with buffers recommended in the FWS' National Bald Eagle Management Guidelines (FWS, 2007).

Pollinators

On June 20, 2014, President Barack Obama signed a Presidential Memorandum titled "Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators." According to the memorandum, "there has been a significant loss of pollinators, including honey bees, native bees, birds, bats, and butterflies, from the environment." The memorandum also states that, "given the breadth, severity, and persistence of pollinator losses, it is critical to expand federal efforts and take new steps to reverse pollinator losses and help restore populations to healthy levels." In response to the Presidential Memorandum, the federal Pollinator Health Task Force published a National Strategy to Promote the Health of Honey Bees and Other Pollinators in May 2015. This strategy established a process to increase and improve pollinator habitat.

Pollinator habitat in and adjacent to the Projects area can be found in a variety of vegetation types, including open upland, open wetland, forested upland, and forested wetland as described in table 4.5-1. Common insect pollinators in the Projects area include various species of bees, butterflies, and moths. The temporary loss of this habitat would increase the rates of stress, injury, and mortality experienced by honey bees and other pollinators. In its June 7, 2017 letter, the FWS Louisiana Ecological Field Office requested that PAPL revegetate disturbed areas using native vegetation (seed mixes and live transplants) with regard to nectar producing species to facilitate pollinator species. PAPL and PALNG would consult with landowners and the NRCS to determine seed mixes for revegetation, some of which would restore and/or promote pollinator habitat.

4.6.2 Aquatic Resources

4.6.2.1 Existing Aquatic Resources

Aquatic habitat associated with waterbodies that would be affected by the Projects include the marine and estuarine habitats of the Port Arthur Canal adjacent to the Liquefaction Project, and the marine, estuarine, and freshwater habitats of the Texas Connector and Louisiana Connector Projects. Fifty-five (55) waterbodies would be crossed by the Texas Connector Project and 167 waterbodies would be crossed by the Louisiana Connector Project that support warmwater fisheries. Bottom sediments in these waterways are fine, consisting primarily of mud and silt (Gulf of Mexico Fishery Management Council [GMFMC], 1998), with a turbid water column. Salinity is probably the most important factor in determining the distribution and relative abundance of marine and estuarine organisms (NMFS, 1998). Tables 4.3.1-1 and 4.3.1-2 list the waterbodies affected by the Projects and table 4.6.21 identifies the representative fish species that occur within those waterbodies.

TABLE 4.6.2-1

Fisheries Species within the Waterbodies Affected by the Projects [a]

Waterbody/Common Name	Scientific Name	Common Name	Scientific Name
Sabine Lake, Sabine Neches Canal, Black Bayou, ICWW, Choupique Cutoff, Multiple Waterbodies [b]			
Alligator gar [d]	*Atractosteus spatula*	Mutton snapper	*Lutjanus analis*
Almaco jack	*Seriola rivoliana*	Nassau grouper	*Epinephelus striatus*
Anchor tilefish	*Caulolatilus intermedius*	Oyster [d]	*Crassostrea virginica*
Atlantic croaker [d]	*Micropogonias undulatus*	Pink shrimp	*Penaeus duorarum*
Banded rudderfish	*Seriola zonata*	Queen snapper	*Etelis oculatus*
Bay anchovy	*Anchoa mitchilli*	Red drum [c]	*Sciaenops ocellatus*
Black Drum [c]	*Pogonias cromis*	Red grouper	*Epinephelus morio*
Black grouper	*Mycteroperca bonaci*	Red hind	*Epinephelus guttatus*
Blackfin snapper	*Lutjanus buccanella*	Red snapper	*Lutjanus campechanus*
Blackline tilefish	*Caulolatilus cyanops*	Rock hind	*Epinephelus adscensionis*
Blue crab [d]	*Callinectes sapidus*	Royal Red shrimp	*Pleoticus robustus*
Blueline tilefish	*Caulolatilus microps*	Sand perch	*Diplectrum formosum*
Brown shrimp [c, d]	*Penaeus aztecus*	Sand trout [d]	*Cynoscion arenarius*
Channel catfish [d]	*Ictalurus punctatus*	Scamp grouper	*Mycteroperca phenax*
Cobia	*Rachycentron canadum*	Schoolmaster	*Lutjanus apodus*
Dog Snapper	*Lutjanus jocu*	Sheepshead	*Archosargus probatocephalus*
Dwarf sand perch	*Diplectrum bivittatum*	Sheepshead minnow	*Cyprinodon variegatus*
Gag grouper	*Mycteroperca microlepis*	Silk snapper	*Lutjanus vivanus*
Gizzard shad	*Dorosoma cepedianum*	Silverside	*Menidia menidia*
Golden tilefish	*Lopholatilus chamaeleonticeps*	Snowy grouper	*Epinephelus niveatus*
Goldface tilefish	*Caulolatilus chrysops*	Southern Flounder [d]	*Paralichthys albigutta*
Goliath Grouper	*Epinephelus itajara*	Spanish Mackerel	*Scomberomorus maculatus*
Grass shrimp [d]	*Palaemonetes pugio*	Speckled hind	*Epinephelus drummondhayi*
Gray Snapper [c]	*Lutjanus griseus*	Spot	*Leiostomus xanthurus*
Gray triggerfish	*Balistes capriscus*	Spotted gar	*Lepisosteus oculatus*
Greater amberjack	*Seriola dumerili*	Spotted Seatrout [d]	*Cynoscion nebulosis*

TABLE 4.6.2-1 (cont'd)			
Fisheries Species within the Waterbodies Affected by the Projects [a]			
Waterbody/Common Name	Scientific Name	Common Name	Scientific Name
Gulf killifish	*Fundulus grandis*	Striped mullet [d]	*Mugil cephalus*
Hardhead catfish	*Ariopsis felis*	Vermilion snapper	*Rhomboplites aurorubens*
Hogfish	*Lachnolaimus maximus*	Warsaw grouper	*Epinephelus nigritus*
King Mackerel	*Scomberomorus cavalla*	Wenchman	*Pristipomoides aquilonaris*
Lane snapper [c]	*Lutjanus synagris*	Western mosquitofish	*Gambusia affinis*
Lesser amberjack	*Seriola fasciata*	White shrimp [c, d]	*Penaeus setiferus*
Longnose gar	*Lepisosteus osseus*	Yellowedge grouper	*Epinephelus flavolimbatus*
Mahogany snapper	*Lutjanus mahogoni*	Yellowfin grouper	*Mycteroperca venenosa*
Marbled grouper	*Epinephelus inermis*	Yellowmouth grouper	*Mycteroperca interstitialis*
Misty grouper	*Epinephelus mystacinus*	Yellowtail snapper	*Ocyurus chrysurus*
Multiple Waterbodies [b]			
Black bullhead	*Ameiurus melas*	Green sunfish	*Lepomis cyanellus*
Black crappie [d]	*Pomoxis nigromaculatus*	Largemouth bass [d]	*Micropterus salmoides*
Blackspotted topminnow	*Fundulus olivaceus*	Longear sunfish	*Lepomis megalotis*
Blackstripe topminnow	*Fundulus notatus*	Paddlefish	*Polyodon spathula*
Blue catfish [d]	*Ictalurus furcatus*	Red shiner	*Cyprinella lutrensis*
Bluegill [d]	*Lepomis macrochirus*	Redear sunfish	*Lepomis auritus*
Bowfin	*Amia calva*	Smallmouth buffalo	*Ictiobus bubalus*
Bullhead minnow	*Pimephales vigilax*	Spotted bass [d]	*Micropterus punctulatus*
Common carp	*Cyprinus carpio*	Warmouth	*Lepomis gulosus*
Flathead catfish [d]	*Pylodictis olivaris*	White bass	*Morone chrysops*
Golden shiner	*Notemigonus crysoleucas*	White crappie [d]	*Pomoxis annularis*
Grass carp	*Ctenopharyngodon idella*	Yellow bass [d]	*Morone mississippiensis*

[a] Lee et al., 1980; GMFMC, 2004; TPWD, 2017d.

[b] Vinton Waterway, Bayou Choupique, Houston River Canal, Houston River, Little River, West Fork Calcasieu River, Beckwith Creek, Hickory Branch, Indian Bayou Marsh Bayou, Barnes Creek, Clear Creek, Bear Creek, Bunchs Creek, Calcasieu River, Bayou Blue, Bayou Doza, Bayou Des Cannes, Bayou Nezpique, Coulee Valentine UNT, Bayou Mallet

[c] EFH-managed species.

[d] Common species associated with commercial and recreational fisheries.

Note: All named waterbodies include unnamed tributaries crossed by the Projects.

Liquefaction Project

The Liquefaction Project would be located within the Sabine Lake Watershed, which includes the Port Arthur Canal and its surrounding tributaries and estuaries. Within the Liquefaction Project area, habitat for aquatic resources present includes the Port Arthur Canal, Round Lake Canal, and Round Lake, and in the areas surrounding the dredged material disposal and beneficial reuse sites (i.e., J.D. Murphree WMA, Dredge Disposal Areas 8, 9A, and 9B). The Port Arthur Canal and Round Lake Canal are classified by the TPWD as warmwater marine fisheries; Port Arthur Canal is also classified as EFH by NMFS and is further discussed in section 4.6.2. Port Arthur Canal and Round Lake Canal provide year-round warmwater habitat for aquatic resources. Direct impacts on Round Lake, which is in the project area, would be avoided during construction and operation of the Liquefaction Project.

Salinities in Port Arthur Canal range from 10 parts per thousand (ppt) to 30 ppt, consistent with the salinities in Sabine Lake and the SNWW at the Gulf of Mexico (greater than 30 ppt) (Tolan, 2007). They support a wide variety of commercial and recreational fisheries that are adapted to salinity fluctuations characteristic of Gulf Coast estuaries by providing foraging, nursery, migratory, and spawning habitat within Sabine Lake (TPWD, 2017d; GMFMC, 1998). Common fish and aquatic species caught during TPWD sampling between 1986 and 2013 are provided in table 4.6.2-1. The dominant recreational species in the Sabine Lake watershed (including the Port Arthur Canal) include Atlantic croaker, red drum, spotted sea trout, black drum, bull shark, and sand trout. In addition, red drum, black drum, white shrimp, brown shrimp, gray snapper, lane snapper, and bull shark are EFH-managed species found in this area (see section 4.6.2). Dominant commercial species include white and brown shrimp, oyster, blue crab, southern flounder, striped mullet, and grass shrimp (TPWD, 2017d).

Dredge material would be placed within an open area of degraded marsh habitat associated with the J.D. Murphree WMA, and within three existing dredge disposal areas (Dredge Disposal Areas 8, 9A, and 9B). The J.D. Murphree WMA site is surrounded by aquatic resources including the ICWW to the north, Shell Lake to the west, and Johnson Lake to the south. Dredge Disposal Areas 9A and 9B are surrounded by Taylor Bayou to the west and the ICWW to the south. Dredge Disposal Area 8 is surrounded by the Port Arthur Canal to the west and Sabine Lake to the east. Aquatic and fish species in these waterways are the same or similar to the species found within the Sabine Watershed, as all waterways discussed are hydrologically connected, and possesses many of the same physical water conditions (e.g., salinity, temperature).

Texas Connector and Louisiana Connector Projects

<u>Texas Connector Project</u>

The Texas Connector Project would cross 55 waterbodies, including the ICWW, Taylor Bayou, Hildebrandt Bayou, Gallier Canal, Neches River, and Sabine Pass (see appendix O). All waterbodies within the Texas and Louisiana portions of the Texas Connector Project area are designated as warm water marine fisheries by the TPWD and LDWF, respectively. Of these, the ICWW, Taylor Bayou, Hildebrandt Bayou, Neches River, and Sabine Pass are designated as EFH (see section 4.6.2). Further inland, where freshwater inflow from the Neches River, Sabine Pass, and other smaller tributaries occur, there is reduced mixing with marine waters and the fisheries become more estuarine and brackish. These waterbodies support a wide variety of commercial and recreational fisheries that are adapted to salinity fluctuations characteristic of Gulf Coast estuaries by providing foraging, nursery, migratory, and spawning habitat. Common commercial species include brown shrimp, white shrimp, grass shrimp, southern flounder, striped mullet, oyster species, and blue crab. Recreational species include Atlantic croaker, red drum, black drum, southern flounder, sand trout, and spotted seatrout (see table 4.6.2.1).

Life histories of many Gulf fish species are characterized as estuarine-dependent, typically spawning in the Gulf, allowing their larvae to be carried inshore by currents, or spawning in near shore estuarine environments (GMFMC, 1998). Juvenile fish generally remain in these estuarine nurseries to take advantage of the greater availability of food and protection that estuarine habitats offer. Upon reaching maturity, estuarine fishes either remain in the estuary, migrate to sea to spawn (then return to the estuary between spawning), or migrate offshore to spend the rest of their lives in deeper waters (Marx and Herrnkind, 1986).

Small estuarine fish such as bay anchovy, sheepshead minnow, gulf killifish, hardhead catfish, and silversides spend their entire lives within the estuary, whereas adult southern flounder, spot, Atlantic croaker, sheepshead, and striped mullet seasonally occupy the estuary. Many other species spawn in more saline waters, but use the estuary as a juvenile nursery (Pattillo et al., 1997). While some coastal pelagic marine fishes such as *Carcarhinidae* (requiem sharks), *Scombridae* (mackerels and tunas), *Mugilidae* (mullets), and *Rachycentridae* (cobia) aren't reliant on estuarine environments for particular life stage development, they are reliant on the food web provided by the high productivity of estuaries (GMFMC, 1998)

The TPWD publishes and maintains the list of ecologically unique river and stream segments. Four waterbodies affected by the Texas Connector Project are listed as ecologically significant waters by the TPWD, including Taylor Bayou, Big Hill Bayou, Hillebrandt Bayou, and the Neches River. Table 4.6.2-2 identifies the waterbodies crossed by the pipelines and laterals that are listed by the TPWD as meeting the criteria to be classified as ecologically unique, including biological function, hydrological function, riparian conservation areas, high water quality/exceptional aquatic life/high aesthetic value, and threatened or endangered species/unique communities.

TABLE 4.6.2-2

Ecologically Significant Waterbodies Affected by the Texas Connector Project

Project Facility	Milepost	Waterbody Name	Criteria
Pipeline	2.5	Taylor Bayou	Biological Function: Freshwater marshes/ forested wetlands with significant habitat value Riparian Conservation Area: J.D. Murphree WMA
Pipeline	5.0	Big Hill Bayou	Biological Function: Fresh and intermediate coastal marshes with significant habitat value Riparian Conservation Area: J.D. Murphree WMA and part of the Great Texas Coastal Birding Trail; McFaddin National Wildlife Refuge
Pipeline	12	Hillebrandt Bayou	Riparian Conservation Area: J.D. Murphree WMA
Pipeline	22.1	Neches River	Biological Function: Freshwater wetland with significant habitat values Riparian Conservation Area: Big Thicket National Preserve, Lower Neches River WMA, part of Great Texas Birding Trail High Water Quality Area/Exceptional Aquatic Life/High Aesthetic Value: Exceptional Aesthetic Value Threatened or Endangered Species/Unique Communities: Paddlefish sandbank pocketbook freshwater mussels, Texas heelsplitter freshwater mussels

Louisiana Connector Project

The Louisiana Connector Project would cross 167 waterbodies, including Sabine Lake. All waterbodies within the Texas and Louisiana portions of the Louisiana Connector Project area are designated as warm water marine fisheries by the TPWD and LDWF, respectively. Further inland, where freshwater inflow from the Neches River, Sabine Pass, and other smaller tributaries occur, there is reduced mixing with marine waters and the fisheries become more estuarine and brackish, ultimately becoming freshwater fisheries (Tolan, 2007).

These waterbodies support a wide variety of commercial and recreational fisheries that are adapted to salinity fluctuations characteristic of Gulf Coast waterbodies by providing foraging, nursery, migratory, and spawning habitat. Common fish and aquatic species are provided in table 4.6.2-1 and would be similar to the species found within the Texas Connector Project area. Common commercial species include brown shrimp, white shrimp, grass shrimp, southern flounder, striped mullet, oyster species, and blue crab. Recreational species include Atlantic croaker, red drum, black drum, southern flounder, sand trout, and spotted seatrout (see table 4.6.2.1). Additionally, common freshwater recreational species include multiple catfish species, alligator gar, bluegill, crappie species, and bass species (TPWD, 2017d).

Small estuarine fish (e.g., minnow, killifish, catfish, and silversides) spend their entire lives within the estuary, whereas others seasonally occupy estuaries (e.g., flounder, mullet), and others use the estuarine as a spawning and/or juvenile nursery area, as discussed under the Texas Connector Project (Pattillo et al., 1997). While some coastal pelagic marine fishes such as *Carcarhinidae* (requiem sharks), *Scombridae* (mackerels and tunas), *Mugilidae* (mullets), and *Rachycentridae* (cobia) aren't reliant on estuarine environments for particular life stage development, they are reliant on the food web provided by the high productivity of estuaries (GMFMC, 1998). Non-estuarine dependent fishes include freshwater families including *Lepisosteidae* (gars), *Amiidae* (bowfins), *Ictaluridae* (catfishes), *Anguillidae* (freshwater eels), *Cyprinidae* (minnows and carp), and *Centrarchidae* (sunfishes, basses, and crappies) (Gosselink et al., 1979).

Oyster habitat occurs along the pipeline route and is managed by TPWD (management sections 12.015, 12.019, and 66.015) where the stocking of fish (including shellfish) is regulated in public waters of the State of Texas. There is also a TPWD-managed oyster restoration site within one mile of the project, as well as natural oyster reefs adjacent to the restoration site. Agency consultations with TPWD on April 18, 2016 recommend that a bathymetry and side-scan survey be conducted as part of an oyster assessment within Sabine Lake (both Texas and Louisiana portions) to document areas of potential impacts. PAPL conducted a bathymetry and side-scan survey in three separate visits in July, August, and September 2017, as well as an oyster resource assessment in September 2017. The results of the oyster assessment included approximately 2,078.4 lake bed acres representative of the project area's footprint, which identified a bottom substrate consisting primarily of moderately firm mud. About 409 sacks of marketable eastern oyster (*Crassostrea virginica*) were obtained where the project crosses the east side of Sabine Lake (MP 0.8 and within ATWS-JEF-006).

Four waterbodies within the Louisiana portion of the Louisiana Connector Project are listed as System Rivers under the Louisiana Scenic Rivers Act of 1988, including Beckworth Creek (MP 64.1), Hickory Branch (MP 65.2), Barnes Creek (MP 79.2), and Whiskey Chitto Creek (MP 91.2). No waterbodies crossed by the Texas portion of the Louisiana Connector Project are listed as ecologically significant stream segments by TPWD.

Nonjurisdictional Facilities

The nonjurisdictional facilities (e.g., highway, pipeline, and utility corridor) associated with the Liquefaction Project would affect the Port Arthur Canal and Round Lake Canal (see table 4.3.1-2). As discussed above, TPWD classifies these waters as warm water marine fisheries, and common fish and aquatic species caught during TPWD sampling are listed in table 4.6.2-1.

4.6.2.2 Impacts and Mitigation

Liquefaction Facilities

Potential impacts on aquatic resources related to construction and operation of the Liquefaction Project would be associated with the Port Arthur Canal and Round Lake Canal, including increased turbidity due to dredging, increased in-water noise from pile driving, increased vessel traffic, the release of ballast water or hull fouling, alteration of light regimes, creation of habitat for encrusting species, alterations to stormwater drainage and increased stormwater runoff, alteration of wave energy, and inadvertent spills of hazardous materials. The water column is turbid, caused by the high sediment load of inflowing waters and disturbance of bottom sediments by wind-action and vessel traffic, especially in the Port Arthur Canal.

<u>Dredging</u>

As described in section 2.1.1.1, the Liquefaction Project requires installation of a MOF, the Pioneer Dock, and a marine berth and turning basin in the Port Arthur Canal. This would require initial dredging of about 7.8 million yd^3, including 67,600 yd^3 for the MOF, 508,000 yd^3 for the Pioneer Dock, 5.3 million yd^3 for the ship slip and berthing area, and 1.4 million yd^3 for the ship turning basin. Regular maintenance dredging is anticipated to remove 287,000 yd^3 each year at the berth, turning circle, and MOF for the life of the project, which we estimate to be 30 years for a liquefaction facility, for a total of about 8.6 million yd^3 of material removed. Authorization for this activity from the USACE or other applicable agency would be required at the time it occurs. Dredging would temporarily cause sediment suspension and turbidity temporarily, lowering the water quality within a localized area surrounding the dredged area. Increases in turbidity can adversely affect fish physiology and behavior, resulting in less healthy individuals, reductions in fecundity, reduced foraging habitat, and temporary emigration of fish out of the project area. Direct effects on the physical environment would result in less sunlight absorbed throughout the water column, affecting the amount of photosynthesis by aquatic plants, dissolved oxygen in the water column, algae, and phytoplankton, ultimately affecting the food chain (Wilber and Clarke, 2001). PALNG would begin construction from the landward side, working its way into the Port Arthur Canal to minimize turbidity and sediment suspension, and would use wet dredging techniques to retain much of the entrained sediment.

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. Within the first few days after completion of dredging operations, the benthic community would be temporarily affected, where the species richness, species abundance, and biomass of the benthic community would be affected the through avoidance, and in limited instances, direct mortality. This would reduce the amount of prey available for aquatic species within the berthing area during construction but would overall create more open water habitat once operational, therefore, creating a net increase in aquatic habitat, including a net increase of the benthic community structure. Based on historic dredging of the Port Arthur Canal, polychaetes, oligochaetes, and other similar species would quickly re-colonize in the soft mud bottom of the disturbed areas following dredging through natural rapid population growth as these species take advantage of unoccupied space in newly exposed sediments. Also, increased turbidity would also be temporary during active dredging and localized to the immediate area surrounding the liquefaction facilities, and habitat would revert to pre-construction conditions after construction. The Port Arthur Canal generally has naturally high suspended sediment loads due to active dredging of the canal, and the existing vessel traffic. Therefore, while the increase in turbidity due to dredging of the work dock area would be significant for a short period of time compared to the existing environment, and the work would be temporary.

As previously mentioned, dredging material would be placed at the J.D. Murphree WMA and existing Dredge Disposal Areas 8, 9A, and 9B. About 2.4 million yd^3 would be transported from the Liquefaction Project site to the J.D. Murphree WMA, and an additional 4.9 million yd^3 would be placed in the dredge disposal areas. PALNG performed a Tier I Evaluation of Dredged Material for Beneficial Reuse in October 2017, which combined soil boring data from March 2004 coupled with an aerial review of the land use within the project area from 2014. The Tier I Evaluation determined that there would be no adverse impacts on the disposal sites from the dredged material, as the analytical results indicate that the soil within the liquefaction site fall below the Threshold Effect Limits, as described in more detail in section 4.2.1.6. Furthermore, the net increase of improved marsh habitat at the dredge disposal sites would provide a long-term benefit to the ecology of the estuary.

Potential impacts on aquatic resources from maintenance dredging include direct take and habitat modification as well as temporary increases in noise, turbidity, and suspended solid levels. These impacts would be similar to those described above for dredging during construction of the liquefaction facilities; however, impacts would be shorter in duration due to the reduced amount of material being removed from the recessed berthing area.

Because of previous disturbances as a result of similar projects in the area and the existing conditions in the SNWW (existing industrial port), activities associated with the Port Arthur Canal (shipping), PALNG's impact minimization measures (wet dredge and working landward), and the agency accepted turbidity analyses, the impacts on aquatic resources associated with dredging during construction and operation of the Liquefaction Project would be minor to moderate and permanent.

Pile Driving

Construction of the liquefaction facilities would require the installation of piles to support the proposed structures. As discussed in section 2.4.1, pile driving activities would take place 10 hours per day, up to 6 days per week. In-water pile driving would be required to install the steel sheet pile bulkhead along the shoreline of the Port Arthur Canal and the steel pipe piles supporting the LNG loading platform as well as the breasting and mooring dolphins. Marine piles would be installed using hydraulic pile drivers as discussed in section 2.4.1. Based on information from PALNG, the facilities would require 779 pilings; construction of the Pioneer Dock at the Liquefaction Project site would require four pilings installed over a 3-month period, the MOF would require 103 pilings installed over a 10-month period, and the marine vessel berth would require 672 pilings installed over a 24-month period.

The primary impacts on aquatic species from pile driving activities would be avoidance of the area, stress, and mortality or injury due to the underwater sound pressure levels. Primary impacts on aquatic resource habitat would be a temporary change in species community structure from avoidance and mortality, and a loss of benthic species habitat directly under the location of the pile. PALNG estimates that the area affected by each pile would be 0.0003 acre; cumulatively this would equate to 0.02 acre at one berth area and 0.03 acre at the MOF. In addition, 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 (Abbott and Bing-Sawyer, 2002; Popper et al., 2005). Installation of the pilings for the dock could cause rapid concussive noise underwater, ultimately affecting the gas-filled membranes of aquatic species used for navigation. Depending on the sound frequency and intensity associated with this activity, it could cause a change in aquatic species behavior in proximity to the work dock area or could cause species to avoid the area.

NMFS is currently developing guidelines for determining sound pressure level thresholds for fish and marine mammals. The agency's interim guidelines use 150 decibels (dB) re: 1 microPascal (μPa) as the threshold for behavioral effects on fish species of particular concern, citing that noise levels as low as 120 dB re: 1 μPa can cause temporary behavior or physiological changes (startle and stress) that could decrease a fish's ability to avoid predators. The current interim thresholds for the onset of injury to fish are a peak sound pressure of 206 dB re: 1 μPa regardless of fish size, a cumulative sound pressure level of 187 dB re: 1 μPa for fish 2 grams or greater, and a cumulative sound pressure level of 183 dB re: 1 μPa for fish of less than 2 grams (NMFS, 2015a; Stadlar and Woodbury, 2009; ICF Jones and Stokes, 2012).

TABLE 4.6.2-3

NMFS Preliminary Sound Pressure Level Thresholds for Fish and Marine Species

Effect on Fish and Aquatic Species	Acoustic Thresholds
Behavioral and Physiological Effects	120-160 dB re: 1 μPa
Injury Onset (general)	180 – 190 re: 1 μPa
Injury Onset (fish <2 grams)	183 dB re: 1 μPa
Injury Onset (fish >2 grams)	187 dB re: 1 μPa
Injury to Mortality	206 dB re: 1 μPa

Construction noise levels underwater would be greatest during pile driving activities which are estimated to exceed 200 dB re: 1 μPa, and would attenuate rapidly with distance (Central Dredging Association, 2011); however, studies indicate that noise impacts may still exceed NMFS's threshold for behavioral effects (141 dB re: 1 μPa to 168 dB re: 1 μPa) even at 2 kilometers (1.2 miles) from the pile driving activities. Noise levels would be above the threshold for changes in fish behavior and these levels would exceed the threshold for injury or mortality on species.

PALNG would implement construction techniques that minimize noise effects on aquatic species, including pre-drilling pile holes, the use of a vibratory hammer, bubble curtains/cofferdams, and ramping driving activities. Pre-drilling pile holes would reduce the number of number of pile strikes that would be needed, therefore minimizing noise. Vibratory hammering would be used as geotechnical conditions allow, and as able based on pile size, type, etc., and typically produces lower underwater sound pressures. The use of bubble curtains and cofferdams create a sound barrier between driving activities and the surrounding aquatic environment, providing noise abatement for aquatic species. Furthermore, PALNG would ramp pile driving activities by gradually increasing power and frequency over a period of time, which would allow sensitive aquatic species to depart the area before harmful underwater sound pressures are reached by the vibratory hammers.

Based on similar projects in the area, these species are expected to move out of the affected area temporarily during piling, and would be able to return once construction activities have ceased. Additionally, based on PALNG's noise mitigation measures, the impacts on aquatic species associated with pile driving during construction of the project would be minor and temporary.

Increased Vessel Traffic

The increase in barge traffic at and near the liquefaction facility during construction would result in increased erosion or sedimentation and noise in the area (Central Dredging Association, 2011). During construction, barges would remain when necessary to deliver materials or to facilitate maintenance dredging in the berthing area and MOF. Barge and vessel movements would not substantially increase shoreline erosion, benthic sediment disturbance, or prop scarring because the vessels are slow moving and do not create significant wakes. Some benthic sediment disturbance could occur when the barges were at the MOF, which would be short term, lasting through the initial months of construction. PALNG would minimize potential erosion of the shoreline by installing rip-rap along the shoreline, further preventing sedimentation to benthic organisms (TCEQ, 2003).

Underwater noise generated by large vessels calling on the work dock is estimated to be between 180 and 190 dB re: 1 μPa at 1 meter and would be greatest during vessel transport to the work dock (Central Dredging Association, 2011). Noise would attenuate at a faster rate during vessel movement, although species would be subjected to the noise for a short period of time as the vessels pass (Central Dredging Association, 2011). During project operation, vessels moored at the dock would produce noise during engine start up and if idling. Idling noise would be lower as the propeller would not be in use. Noise levels of vessels would be similar to the noise currently generated by vessels transiting the Port Arthur Canal (between 180 and 190 dB re: 1 μPa at 1 meter), and would contribute minimally to level of existing ambient noise (between 70 and 90 dB re: 1 μPa at 1 meter for busy shipping channels [Central Dredging Association, 2011]) once noise attenuation is factored in.

Based on these considerations, the impacts associated with increased barge traffic and noise on aquatic species would be consistent with current vessel traffic noise occurring in proximity to the liquefaction facilities. As a result, the impacts on aquatic species associated with increased vessel traffic during construction and operation of the project would be minor and temporary.

Hydrostatic Testing

Hydrostatic testing of the Liquefaction Facility would require approximately 87 million gallons of test water, which would be obtained from obtained the LNVA or the City of Port Arthur municipal water source and would be discharged into the Port Arthur Canal. After completion of hydrostatic testing, PALNG would discharge the hydrostatic test water to the Port Arthur Canal in accordance with its Texas RRC discharge permit and PALNG's *Environmental Plan* to minimize impacts on surface water.

Hydrostatic testing of the liquefaction facility piping and tanks would result in a temporary, localized, and minor impact on surface waters.

Ballast Water and Hull Fouling

Traffic associated with construction and operation of the liquefaction facilities could affect aquatic habitat within the Port Arthur Canal by altering water quality from ballast water via changing the pH or temperature or causing a resuspension of sediment, or by altering the species composition of benthic organisms from hull fouling or introducing invasive species.

The aquatic species within the Port Arthur Canal are euryhaline (able to live in waters with a wide range of salinity) and are well adapted to natural variations within time and location of salinity and oxygen levels. In general, this adaptability and the ability for most aquatic species to move over a short distance to more suitable conditions prevents adverse impacts on aquatic species as a result of 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 151.2026), United Nations Convention on the Law of the Sea 1982, International Convention for the Prevention of Pollution from Ships 1973 and the 1978 Protocol (MARPOL 73/78), and Ballast Water Management for Control of Nonindigenous Species in WOUS CFR Title 33, Chapter I, Subchapter O, Part 151, Subpart D. 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 either retain their ballast water on board or undergo a mid-ocean (greater than 200 nautical miles from shore and at a water depth greater than 6,562 feet) ballast water exchange in accordance with applicable regulations. As such, ships calling on the liquefaction facilities would discharge all ballast water under USCG oversight and in accordance with federal regulations. Hull fouling could result in the deposition of invasive aquatic organisms, and sedimentation; however, these impacts would be minimized by following CFR 33, Chapter I, Subchapter O, Part 151, Subchapter (d), which limits the amount of ballast water a vessel can release based on the number of micro- and macrorganisms per cubic meter of ballast water in order to minimize the introduction of nuisance species into WOUS.

The number of additional vessels expected to visit the liquefaction site during operations is approximately 180 vessels per year, which is less than a one percent increase in current traffic patterns. Each vessel has a ballast water discharge and uptake capacity of 12 to 15 million gallons of sea water, with a rate of approximately 720,000 gallons per hour over a 10- to 16-hour timeframe.

Given the industrial activities within the Port Arthur Canal (shipping), along with implementation of the mandatory practices required by the U.S. regulations and the USCG, the effects of ballast water discharges on aquatic resources and water quality resulting from construction and operation of the Liquefaction Project would be minor and temporary.

Alteration of Light Regimes

During construction of the work dock, and particularly during operation, additional lighting within and near the Port Arthur Canal would be present at the liquefaction facility. Aquatic species in the area are generally acclimated to the current ambient light. Increased light could affect small organisms by causing minor disruptions to the food chain including changes in the vegetation community structure, and increased predation. Impacts on aquatic resources resulting from shading could include reduced plant growth and changed vegetation assemblages, which would affect the food chain, and modified animal behavior.

Additionally, reduced natural light levels in areas due to new structures providing shading would occur where previously not experienced.

Increased light during construction activities at the liquefaction facility would be nominal since construction would occur during daylight hours. During project operation, lighting would be necessary in the berth, docks, and MOF areas; on adjacent buildings for safety and security purposes; and on vessels moored at the facility. However, aquatic species in the area are likely acclimated to the current ambient light and the industrial nature from the existing use of the Port Arthur Canal and most of the berth area would become new aquatic habitat that was previously land. Changes in light regimes resulting from construction and operation of the Liquefaction Project would have minor and temporary to permanent impacts on aquatic species.

Habitat for Encrusting Species

Habitat for encrusting species would be created by constructing the new dock structure and by installing rip-rap along the shoreline for erosion control. The project facilities would create an additional 50,000 square feet of new hard surfaces, including 20,000 square feet in the LNG vessel berthing area and 30,000 square feet in the MOF. The new encrusting species expected to inhabit the new area would be consistent with the existing biota and would permanently contribute to the biodiversity of Port Arthur Canal; Common encrusting species found in the Gulf of Mexico include the eastern oyster, hook mussel (*Ischadium recurvum*), and slipper shell (*Crepidula fornicate*). Construction would have a minor and temporary impact on habitat for encrusting species based on noise and turbidity, or the occasional smothering of individuals due to sedimentation. However, the additional hard surface for operational purposes would create a permanent and beneficial impact on aquatic species.

Stormwater Runoff

During and after construction, the conversion of land to impervious surface areas at the liquefaction facility site would result in an increased volume of stormwater runoff, which could create changes in salinity, temperature, and/or dissolved oxygen in the area surrounding discharges, as well as increased potential for contamination.

To reduce direct stormwater runoff, PALNG would create catch basins and water diversion structures in accordance with its Project-specific SWPPP and *Environmental Plan*. To reduce contamination to aquatic resources, PALNG would minimize direct fueling spills by including a hazardous material containment area in the fueling facility design, and would implement its Spill Control Plan, and *Environmental Plan*.

Based on PALNG's adoption of the SWPPP, containment area, and catch basins, impacts on aquatic species resulting from stormwater runoff (including contamination) during construction and operation of the Liquefaction Project would be minor and temporary, and would be limited to heavy precipitation events (more than 1 inch in 24 hours).

Alteration of Wave Energy

Changes to wave energy within the Liquefaction Project area would result from the installation of piers, pilings, and docks during construction, and increased vessel traffic during operation. Potential impacts from increased wave energy include erosion, increased turbidity, and sedimentation, which could alter the plant and animal composition as substrate regimes change.

The Port Arthur Canal has been previously altered with shoreline stabilization devices to minimize erosion, turbidity, and sedimentation to allow for heavy vessel traffic. To further minimize the potential for erosion and sedimentation resulting from project-related vessel traffic and construction activities, PALNG would install rip-rap along the shoreline of the Port Arthur Canal.

As a result of similar projects in the area and the existing conditions and activities associated with the Port Arthur Canal, along with PALNG's impact minimization measures, the impacts on aquatic species associated with changes to wave energy during construction and operation of the project would be negligible to minor and temporary (lasting as long as the vessels are in the area).

Inadvertent Spills

During construction and operation of the Liquefaction Project, spills or leaks of hazardous materials entering the Port Arthur Canal from construction equipment could have adverse impacts on aquatic resources. Impacts would be physical (smothering, substrate regime, etc.) or chemical (contaminants, toxic effects, bioaccumulation, etc.), and would disrupt aquatic species. The timing of the disruption to habitat and individuals would depend on the volume, location, material, and response time.

To minimize the potential for petroleum product spills during construction and operation, PALNG would implement the spill prevention and containment measures included in its *Environmental Plan* for the project. The implementation of these procedures would minimize response time and ensure appropriate cleanup actions are taken in the event of a spill.

Operations

Post-construction and operational impacts on aquatic resources would be minimal and primarily associated with periodic maintenance dredging in the berthing area, turning basin, and MOF. Maintenance dredging activities would most likely be performed using a conventional barge-mounted hydraulic cutter suction dredge and dredged materials would be deposited as agreed in consultation with the USACE, Texas, and Louisiana state agencies. Long-term maintenance dredging would be conducted in accordance with applicable federal or state regulations. Any permitting or agency coordination efforts would be conducted at the time of the maintenance activities to accommodate the current environmental or regulatory conditions and requirements at that time. At a minimum, on-going maintenance dredging would require coordination with and input from the USACE, NMFS, and FWS.

The SNWW is fourth in the nation for total cargo tonnage, and refineries in the area produce 60 percent of the Unites States' jet fuel and the majority of the United States' military fuel (SNND, 2017b) and sustains heavy vessel traffic. The increased ship traffic (about 180 LNG vessels per year) represents a less than a one percent increase in the total number of annual vessels in the project area, and would not result in a measurable increase in aquatic resources impacts nor would it represent a significant change to ongoing activities in the Port Arthur Canal. As such, impacts resulting from increased ship traffic to serve PALNG's liquefaction facilities would be temporary (experienced during the time in which the vessel is in transit) to permanent (vessel traffic would last for the life of the project) and minor.

Texas Connector and Louisiana Connector Projects

Construction and operation of the Texas Connector and Louisiana Connector Projects would be conducted using similar, industry-recognized methods and mitigation measures. As such, the following discussions apply to both pipeline projects. Differences in methods or mitigation measures are described separately as appropriate by project.

Construction of the Texas Connector and Louisiana Connector Projects would temporarily impact aquatic resources from activities such as waterbody crossings, removal of streamside vegetation, hydrostatic testing, and inadvertent spills. Operational impacts would be limited to an inadvertent release, increases in impervious surfaces and associated stormwater runoff, and the clearing of streamside vegetation for operation, otherwise, the operational activities would not affect aquatic resources.

Potential impacts on aquatic resources related to construction and operation of the projects would be associated with increased erosion and sedimentation due to open-cut waterbody crossings, inadvertent release of drilling mud during HDD crossings, physical or chemical water alterations from hydrostatic testing, entrainment from hydrostatic testing, and inadvertent spills. These impacts and their potential impacts on aquatic species are discussed in the following sections.

Waterbody Crossings

As detailed in section 4.3.1, PAPL proposes to cross 24 waterbodies using the HDD crossing method for the Texas Connector Project and 26 waterbodies using the HDD method for the Louisiana Connector Project. The HDD method, as described in section 2.4.3.1, would avoid direct impacts on the features it would cross. The remaining waterbodies associated with both projects would be crossed using the conventional bore, push-pull, or open-cut methods (see section 2.4.3). In addition, specialized construction methods would be implemented for construction of the Louisiana Connector Project within Sabine Lake, such as the S-lay method (see section 2.4.3.1).

As mentioned previously, installing the proposed pipelines using the HDD method would avoid or minimize impacts on fisheries, fish habitat, and other aquatic resources within and adjacent to waterbodies unless an inadvertent release of drilling mud were to occur. An inadvertent release of drilling mud 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, PAPL would implement the corrective action and cleanup measures outlined in its Inadvertent Release Plan to minimize potential impacts on aquatic resources, including the installation of berms, silt fence, and/or hay bales to prevent silt-laden water from flowing into waterbodies, or, in the event of an in-water release, the use of temporary dams to isolate the drilling fluid and vacuum trucks to remove the released drilling mud.

The use of the 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. Benthic invertebrates, insects, and microorganisms would not be able to move out of the project areas and would result in injury or death of individuals and even populations, affecting the food chain as many macroinvertebrates and microorganisms serve as food sources for aquatic species. 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. The clearing of riparian vegetation during construction may reduce shade and cover until revegetation occurs, indirectly causing a temporary increase in water temperature in localized areas. Clearing would be adjacent to existing rights-of-way at 37 perennial waterbody crossings along the Texas Connector Project and at 63 perennial waterbody crossings along the Louisiana Connector Project, which would minimize changes in water temperature because much of the vegetation is already maintained.

The use of open-cut construction methods could have both direct and indirect impacts on aquatic resources. Direct impacts would include mortality, injury, or temporary displacement of the organisms living on, in, or near the waterbody bottom. Indirect impacts would include suspension of sediments in the water column, which could clog fish gills and obscure visual stimuli, and the redistribution of sediments that fall out of suspension, which could bury benthic and demersal species, resulting in mortality of eggs and other life stages. Benthic invertebrates and demersal (bottom-dwelling) fish species in or near the excavation area would be most affected. Open-cut construction would require clearing of streamside vegetation, resulting in reduced shading and increased water temperatures in some of the warmwater streams. However, stream bank clearing would be limited and mostly would occur adjacent to previously cleared rights-of-way, and the impact on aquatic resources is expected to be minimal and downstream water temperatures would not be significantly increased. PAPL would minimize impacts on aquatic resources by using the HDD method at nearly 50 locations for both pipeline projects, which would avoid direct and indirect impacts on aquatic resources, and implementing an Inadvertent Release Plan in the event there is an inadvertent release of drilling mud.

In addition, PAPL would implement the measures outlined in its *Environmental Plan* to minimize impacts on waterbodies and aquatic resources during pipeline construction. These mitigation measures include reduced workspace areas near waterbodies, establishing buffers to prevent run-off from entering waterbodies, installing erosion control devices, and completion of instream construction activities within 24 or 48 hours, depending on crossing length. 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.

During operation, PAPL would maintain a minimum 10-foot-wide permanent right-of-way to prevent plant roots from damaging the pipe. Due to the limited number of open-cut crossings, the implementation of HDD installation procedures, the reduction of construction workspace around waterbody crossings, and implementation of the mitigation measures described above, the projects would have minimal and localized impacts on aquatic resources.

Sabine Lake Construction

Construction within Sabine Lake would begin with an HDD entry point located at the Liquefaction Project site, where the trajectory would cross the Port Arthur Canal and resurface in Sabine Lake about 500 feet northeast of the HDD entry location (MP 0.8). The HDD exit point would be located at Shell Island (MP 18.1) and would be drilled from the shore into Lake Sabine (MP 17.5). In addition, the HDD method would be used in Sabine Lake to cross foreign pipelines between MPs 4.3 and 4.8.

Pipeline construction outside of the HDD areas in Sabine Lake would involve trenching and temporary stockpiling of excavated sediments adjacent to the pipeline trench. Construction of the pipeline within shallow lake would occur by trenching the lakebed via open cut or jetting, and implementing barge lay construction techniques. Once trenching is complete, the pipeline would be buried underneath the lakebed at a minimum depth of 4 feet. Single lengths of concrete coated steel pipe would be received from material barges, then are welded, inspected, and coated in a horizontal working plane (firing line) aboard a pipelay barge. The pipelay barge gradually releases the pipeline into the trench, until it reaches the touchdown point. About 1,403 acres of bottom sediments (EFH habitat) would be temporarily disturbed in Sabine Lake due to construction of the pipeline right-of-way, including ATWS associated with the HDDs.

Alteration of benthic community patterns could render the area of the pipeline right-of-way temporarily unavailable as feeding areas or habitat for fishes or other bottom feeding species. The duration of this impact would be for the length of construction activities plus benthic recolonization time, about 6 months or less to comply with NMFS EFH conservation measures, as discussed in section 4.6.3.2. For all aquatic species, any adverse environmental consequences would be minor due to the temporary increase in turbidity and suspended sediments. The greatest impacts would be from the turbidity created by the placement of the Louisiana Connector Project pipeline across Sabine Lake, but this impact would be localized and temporary. Effects on recreational and commercial fisheries would be minimal considering the temporary nature of the disturbance from pipeline construction activity. Based on PAPL's previous proposal to cross Sabine Lake (2006), there would be no need for operational right-of-way clearing within Sabine Lake and, as such, no impacts on aquatic species from the operation of the pipeline.

Increased Vessel Traffic

The increase of barges and delivery boats for the Louisiana Connector Project (described in section 2.4) would result in a short-term increase in vessel traffic, sedimentation, and noise in the area. During construction barges would only remain when necessary or to facilitate delivery of construction materials. Boat movements and the movements of support vessels and other supply vessels are not expected to substantially increase shoreline erosion, benthic sediment disturbance, or prop scarring in the immediate area, primarily because the vessels are slow moving and would not create substantial wakes. Some benthic sediment disturbance could occur during barges and tug delivery.

Underwater noise is discussed in section 4.6.2.2. Furthermore, Sabine Lake, the Port Arthur Canal, and the ICWW were specifically created to provide deepwater access for maritime commerce, and as such, the use of waterways by vessels to accommodate pipeline construction is consistent with the planned purpose and use of these active shipping channels. The increase in vessel traffic would be short-term and limited to construction, and associated impacts on aquatic resources due to increased shoreline erosion and resuspension of sediments would be negligible. Therefore, the Texas Connector and Louisiana Connector Projects would not have significant impacts on aquatic resources.

Hydrostatic Testing

The Texas Connector Project would require about 14.6 million gallons of water obtained from municipal sources, Taylor Bayou, and Hildebrandt Bayou (see table 4.3.2-5). Hydrostatic test water would be discharged into Sabine Pass and well-vegetated uplands. Hydrostatic testing of the Louisiana Connector Project pipeline, laterals, and tie-ins would require about 49.5 million gallons of water (see table 4.3.2-5); test water discharge locations would be identified prior to construction. In addition, about 16.8 million gallons and 4.4 million gallons of water would be obtained from municipal sources to test the HDD pipeline segments associated with the Texas Connector and Louisiana Connector Projects, respectively (see table 4.3.2-4). As required by the Commission's Procedures, PAPL would file a list identifying the final locations of all waterbodies proposed for use as a hydrostatic test water source or discharge location.

A 0.25-inch diameter mesh screen would be used over the intake hose to minimize entrainment during water withdrawals from surface waters. PAPL would not add any chemicals to the test water, would implement the hydrostatic testing measures outlined in its project-specific *Environmental Plan* (which includes the Commission's Procedures), and would adhere to the measures required by NPDES permits required for respective states. Discharges for the pipelines would be dissipated into their respective waterways so as to minimize the localized turbidity and minor changes of the salinity and temperature.

With the implementation of these measures, impacts on water quality due to hydrostatic testing would be temporary and minor.

Inadvertent Spills

Impacts on waterways and aquatic species as a result of an inadvertent spill of hazardous material during construction of the Texas Connector and Louisiana Connector Projects would be similar to those described for the Liquefaction Project described above. PAPL would implement the measures identified in its project-specific *Environmental Plans* to minimize response time and ensure appropriate cleanup actions are taken in the event of a spill. Therefore, impacts on aquatic resources from an inadvertent spill would be minimized to avoid causing a significant or adverse impact on aquatic species.

Stormwater Runoff

During and after construction, the conversion of land to impervious surface areas at the aboveground facilities would result in an increased volume of stormwater runoff, which could create changes in salinity, temperature, and/or dissolved oxygen in the area surrounding discharges, as well as increased potential for contamination. To reduce direct stormwater runoff, catch basins and water diversion structures would be used in accordance with the project-specific SWPP and *Environmental Plan*.

Operations

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

Nonjurisdictional Facilities

Construction of the nonjurisdictional facilities would temporarily affect 0.6 acre of estuarine water column and estuarine mud/soft bottom EFH (Round Lake Canal), and additionally, the construction corridor parallels another tidally influenced (unnamed) canal to the west. Similar to the pipeline projects, construction impacts on aquatic resources could result from waterbody crossings, increased stormwater runoff, erosion and sedimentation, and the potential for an inadvertent spill. To minimize these impacts, PALNG would implement the measures described in its *Environmental Plan*.

4.6.3 Essential Fish Habitat

The MSA (16 USC 1801 et seq.) establishes procedures to identify, conserve, and enhance EFH for federally managed species. EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 USC 1802[10]). EFH designations apply to inshore marine and estuarine WOUS to the mixing zone at the upstream limit of saline intrusion. EFH designations do not apply to freshwater habitats.

Federal agencies that authorize, fund, or undertake activities that may impact EFH must consult with NMFS about potential impacts. Although NMFS has not established specific criteria for conducting EFH consultations, NMFS recommends consolidated EFH consultations with interagency coordination procedures required by other statutes, such as NEPA or 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 an EIS).

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 the following:

   a. A description of the proposed action.

   b. An analysis of the effects (including cumulative effects) of the proposed action on EFH, managed fish species, and major prey species.

   c. The federal agency’s views regarding the effects of the action on EFH.

   d. Proposed mitigation, if applicable.

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

4. Agency Response – The MSA requires the action agency to respond to NMFS within 30 days of receiving the recommendations. If the action agency cannot respond completely to the NMFS recommendations during this timeframe, 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.

As discussed during agency consultations between PAPL/PALNG and NMFS on July 24, 2015, NMFS recommended that, “…the EIS include sections titled “Essential Fish Habitat” and “Fishery Resources” which describe the potential impacts of the proposed project on the various categories of EFH and on marine fishery species within the project area. We have prepared the responsive sections of the EIS pursuant to EFH Guidelines (50 CFR 600.05 - 600.930) and agency consultations, and as such, the FERC requests that NMFS consider this EIS as the EFH Assessment.

4.6.3.1 Essential Fish Habitat within the Projects Area

NMFS was granted legislative authority to establish regional fishery management councils, each responsible for the proper management of resources within each council’s respective geographic region. Fishery management councils develop regional FMP, which outline measures to ensure the proper management and harvest of the finfish and shellfish within these waters. All aspects of the Projects lie within jurisdiction of the GMFMC FMP. Although these Projects would not include the harvest of any of the species addressed in the FMP, the proposed project construction and operation could still affect the habitat for these species.

GMFMC data indicate that all marine and tidally influenced estuarine habitats within the Projects area are designated as EFH for six marine groups, including coastal migratory pelagic species, corals, red drum, reef fish, shrimp, and spiny lobster. The following categories of EFH occur within the Projects area and support EFH-managed species: EEM wetlands, estuarine water column, and estuarine mud/soft bottom. Correspondence with NMFS further indicates that the following federally managed EFH species occur within the Projects area outlined in table 4.6.3-1. Existing EFH and EFH-supported species that could be affected by the Projects are discussed below.

TABLE 4.6.3-1

EFH-Managed Species in the Projects Area

Project	Common Name	Scientific Name
Liquefaction Project	Red drum	*Sciaenops ocellatus*
	Gray snapper	*Lutjanus griseus*
	Lane snapper	*Lutjanus synagris*
	Brown shrimp	*Farfantepenaeus aztecus*
	White shrimp	*Litopenaeus setiferus*
	Bull shark	*Carcharhinus leucas*
Texas Connector Project	Red drum	*Sciaenops ocellatus*
	Gray snapper	*Lutjanus griseus*
	Lane snapper	*Lutjanus synagris*
	Brown shrimp	*Farfantepenaeus aztecus*
	White shrimp	*Litopenaeus setiferus*
	Bull shark	*Carcharhinus leucas*
Louisiana Connector Project	Red drum	*Sciaenops ocellatus*
	Gray snapper	*Lutjanus griseus*
	Lane snapper	*Lutjanus synagris*
	Brown shrimp	*Farfantepenaeus aztecus*
	White shrimp	*Litopenaeus setiferus*
	Spanish mackerel	*Scomberomorus maculatus)*
	Bull shark	*Carcharhinus leucas*
	Scalloped hammerhead shark	*Sphyrna lewini*
	Blacktip shark	*Carcharhinus limbatus*
	Lemon shark	*Negaprion brevirostris*
	Bonnethead shark	*Sphyrna tiburo*
	Atlantic sharpnose shark	*Rhizoprionodon terraenovae*

Existing EFH Resources

Estuarine emergent marsh EFH is present along the Texas Connector Project at MP 5.1 on the Northern Pipeline, at MP 2.6 and 7.2 on the Southern Pipeline, and at various locations along the Louisiana Connector Project (see table 4.6.3-2), and within the J.D. Murphree WMA and Dredge Disposal Area 8, as shown in figure 4.6.3-1 and table 4.6.3-2.

Estuarine mud/soft bottom and estuarine water column EFH occurs in the following areas, as shown in figure 4.6.3-1 and table 4.6.3-2:

- Within the berthing area, Pioneer Dock, and MOF areas of the Liquefaction Project within the Port Arthur Canal.
- At the Round Lake Canal along the nonjurisdictional facilities relocation.
- Along the Texas Connector Project (at MPs 1.6, 2.4, 5.2, 10.2, 12.0, and 21.9 on the Northern Pipeline, and at MPs 2.4 and 6.2 on the Southern Pipeline).
- Along the Louisiana Connector Project within Port Arthur Canal, Sabine Lake, Sabine River, and the ICWW.

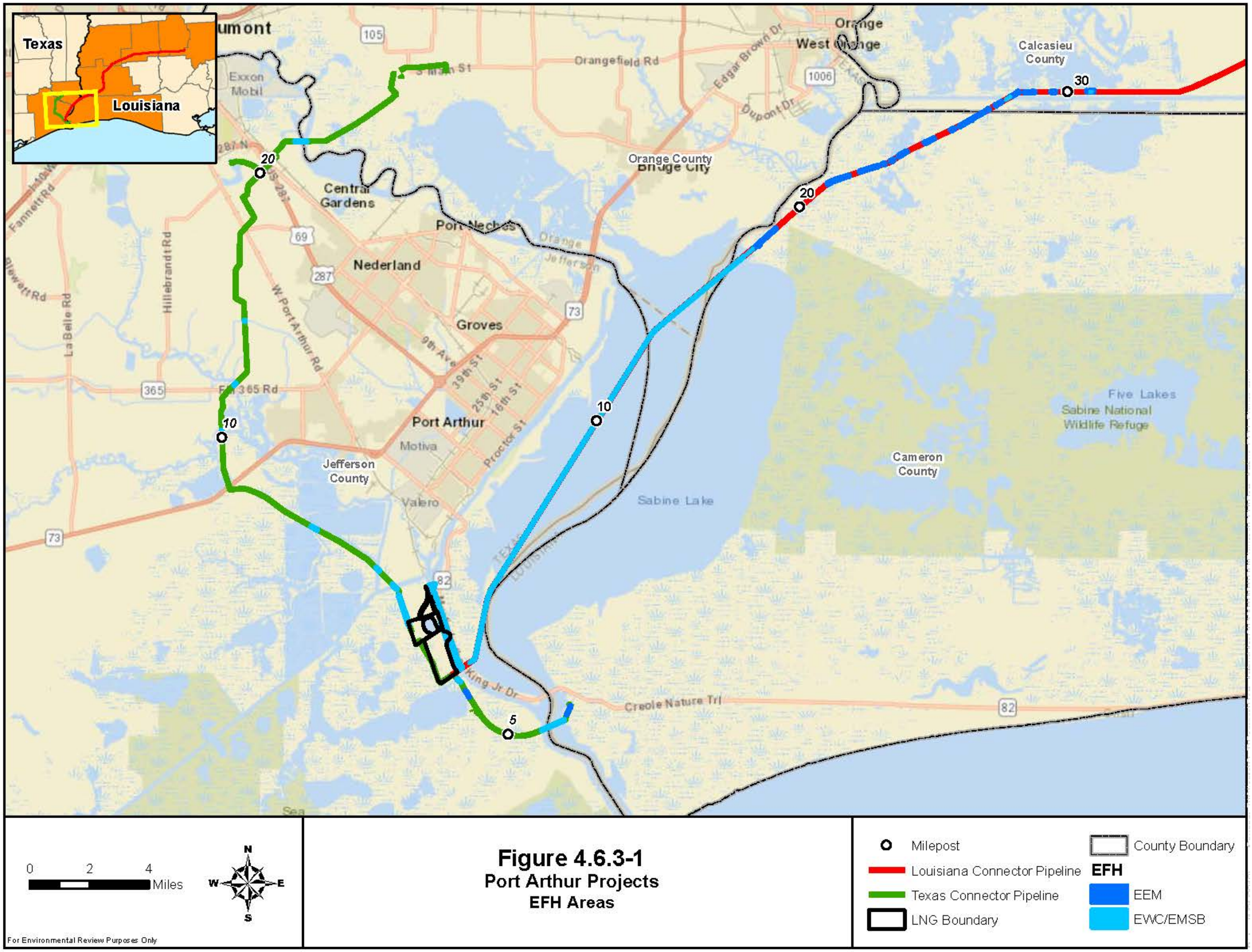

Figure 4.6.3-1
Port Arthur Projects
EFH Areas

As discussed below, dredge materials from the construction of Liquefaction Project would be placed in these areas for beneficial reuse, including the restoration of estuarine emergent marsh habitat. While temporary impacts would be incurred to the dredge disposal sites (see section 4.6.3.2), there would be a net increase in estuarine emergent marsh habitat, including estuarine emergent marsh EFH. These areas are managed by third-party entities (TPWD and SNND, respectively); as such, applicable permitting, agency coordination, and mitigation for these areas are handled independently from PALNG and the Liquefaction Project.

EFH is not present along any pipeline laterals or within Dredge Disposal Areas 9A and 9B. Therefore, these facilities are not discussed further below.

EFH Types

<u>EEM EFH</u>

EEM wetlands are among the most productive ecosystems on earth and serve as nursery habitats for the larval stages of many fish and invertebrate species (Teal and Teal, 1969; Odum et al., 1982). Estuarine wetlands are also important in the removal of contaminants, and act as a buffer to reduce the erosion of inland areas (Batzer and Sharitz, 2006). EEM wetlands that support EFH within the Projects area consist of saltgrass (*Distichlis spicata*), green bulrush (*Scirpus atrovirens*), and various cordgrasses (*Spartina spp*.).

<u>Estuarine Water Column and Estuarine Mud/Soft Bottom and EFH</u>

Estuarine water column and estuarine mud/soft bottom that support EFH within the Projects area are within Sabine Lake, the Port Arthur and Round Lake Canals, the ICWW, Taylor and Hildebrandt Bayous, and the Neches Rivers. The Sabine Lake estuary and surrounding waterbodies are naturally shallow with an average depth of 6 feet in Sabine Lake, and 13 to 24 feet in the Port Arthur Canal, ICWW, Taylor Bayou, Hildebrandt Bayou, and the Neches River. The USACE regularly dredges navigation channels to 40 feet through the lake, canals, bayous, and rivers to allow the passage of large ships through this area, so the side slopes at the edge of the navigation channels quickly transition from shallow to deep habitat (NOAA, 2017c).

Bottom sediments in these waterways are fine, consisting primarily of mud and silt (GMFMC, 1998). The water column is turbid, caused by the high sediment load of inflowing waters and disturbance of bottom sediments by wind-action and vessel traffic, especially in the Port Arthur Canal. Salinity is probably the most important factor in determining the distribution and relative abundance of marine and estuarine organisms (NMFS, 1998).

EFH-Managed Species

The EFH-managed species that would be affected by the Projects include red drum, gray snapper, lane snapper, brown shrimp, white shrimp, and bull shark (Young, 2015). Additionally, the EFH-managed Spanish mackerel, scalloped hammerhead shark, blacktip shark, lemon shark, bonnethead shark, and Atlantic sharpnose shark may be present along the Louisiana Connector Project (Chastain and Cheatwood, 2017). Table 4.6.3-2 identifies by habitat type the EFH-managed species and their relevant life stages that would be affected by the Projects. Following the table are descriptions of each EFH-managed species in the Projects area.

TABLE 4.6.3-2

EFH-Managed Species Within Tidally Influenced Waters and Wetlands Affected by the Projects

EFH Type	Project Location	EFH-Managed Species (Life Stage)
LIQUEFACTION PROJECT		
Estuarine Water Column & Estuarine Mud/ Soft Bottom	Berthing Area, MOF, Pioneer Dock	Red Drum (Larvae, Post-larvae, Early Juvenile, Adult) Gray Snapper (Adult) Lane Snapper (Early and Late Juvenile) Brown Shrimp (Early Juvenile) White Shrimp (Early Juvenile) Bull Shark (Early and Late Juvenile, Adult)
TEXAS CONNECTOR PROJECT		
Estuarine Water Column & Estuarine Mud/ Soft Bottom	MPs 2.4, 6.2 along the Southern Pipeline MPs 1.6, 2.4, 5.0, 10.2, 12.0, 13.2, 21.9 along the Northern Pipeline	Red Drum (Larvae, Post-larvae, Early Juvenile, Adult) Gray Snapper (Adult) Lane Snapper (Early and Late Juvenile) Brown Shrimp (Early Juvenile) White Shrimp (Early Juvenile) Bull Shark (Early and Late Juvenile, Adult)
Estuarine Emergent Marsh	MP 2.6 along the Southern Pipeline MP 5.2 along the Northern Pipeline	Red Drum (Larvae, Post-larvae, Early Juvenile, Adult) Gray Snapper (Adult) Brown Shrimp (Early Juvenile) White Shrimp (Early Juvenile)
LOUISIANA CONNECTOR PROJECT		
Estuarine Water Column & Estuarine Mud/ Soft Bottom	MPs 0.1, 0.6, 18.9, 28.0, 30.8	Red Drum (Larvae, Post-larvae, Early Juvenile, Adult) Gray Snapper (Adult) Lane Snapper (Early and Late Juvenile) Brown Shrimp (Early Juvenile) White Shrimp (Early Juvenile) Spanish Mackerel (Juvenile, Adult) Bull Shark (Early and Late Juvenile, Adult) Scalloped hammerhead shark (Early and Late Juvenile) Blacktip Shark (Early and Late Juvenile) Lemon Shark (Early and Late Juvenile) Bonnethead Shark (Early and Late Juvenile, Adult) Atlantic Sharpnose Shark (Early and Late Juvenile, Adult)
Estuarine Emergent Marsh	MPs 17.9, 19.1, 19.4, 20.3, 20.4, 20.6, 21.1, 21.2, 21.3, 21.5, 21.7, 21.9, 22.4, 22.7, 23.0, 23.2, 23.5, 23.8, 24.0, 24.7, 24.8, 24.9, 25.2, 25.8, 26.1, 26.2, 26.3, 26.5, 26.7, 27.2, 27.4, 27.5, 28.3, 28.5, 28.6, 28.7, 28.8, 29.4, 29.6, 30.0, 30.5, 30.6, 30.7, 30.9, 31.2, 31.5	Red Drum (Post-larvae, Early Juvenile, Adult) Gray Snapper (Adult) Brown Shrimp (Early Juvenile) White Shrimp (Early Juvenile) Spanish Mackerel (Juvenile, Adult)

Red Drum

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

Gray Snapper

The gray snapper occurs on the shelf waters of the Gulf of Mexico and spawn offshore from June to August. Eggs are present June through September in pelagic areas after the summer spawn and post-larval gray snapper move into estuarine habitats (Burton, 2000). Juveniles and adults are demersal and occupy marine, estuarine, and riverine habitats, and may be found on tidal waterbodies, seagrass beds, or offshore near reefs (GMFMC, 1998).

Lane Snapper

The lane snapper occurs throughout the Gulf of Mexico shelf in depths ranging from 1 to 425 feet. Like the gray snapper, this species is demersal, occurring over all bottom types in various salinities. Spawning occurs offshore in March through September, where juveniles are commonly found inshore near seagrass beds. Nursery areas include the estuarine areas and shallow areas with soft/mud bottoms, where early- and late–stage juvenile utilize soft bottom substrates in estuaries for feeding and growth (GMFMC, 1998; GMFMC, 2016). Adults utilize a wide variety of habitats ranging from inshore to offshore, and soft bottom habitats to seagrass beds, to hard-bottom substrates (TPWD, 2018).

Brown Shrimp

Brown shrimp adults inhabit offshore marine environments where spawning takes place. The eggs are demersal, while the larvae are planktonic, and brown shrimp begin to migrate to estuarine habitats as post-larvae, migrating on flood tides at night from February through April. (GMFMC, 1998; U.S. Gulf of Mexico Fisheries Information, 2018). The juvenile stage occurs within estuarine habitats and post-larval and juvenile brown shrimp are common to highly abundant in all Gulf of Mexico estuaries from Apalachicola Bay in Florida to the Mexican border, although they are generally not present between December and February. The species is typically associated with shallow vegetated habitats, silty sand, and non-vegetated mud bottom where salinities range from 0 to 70 ppt. The densities of post-larval and juvenile brown shrimp are highest in marsh edge habitat and submerged vegetation. At maturity, the juveniles migrate back to ocean waters. Larval brown shrimp feed on phytoplankton and zooplankton; post-larvae feed on epiphytes, phytoplankton, and detritus; and juveniles and adults prey on polychaetes, amphipods, chironomid larvae, algae, and detritus (GMFMC, 1998).

White Shrimp

White shrimp eggs and larvae are common in nearshore marine waters. The eggs are demersal and the larvae are planktonic. Post-larvae migrate into estuarine habitats from May through November, with peaks occurring June through September. After entering the estuaries, post-larval white shrimp become benthic and typically inhabit shallow water estuarine habitats on muddy-sandy substrates with high organic detritus content or estuarine marsh habitats on a year-round basis. Densities of post-larval and juvenile white shrimp are usually highest in marsh edge and submerged aquatic vegetation habitats. Juveniles are common to highly abundant in all Gulf of Mexico estuaries; when they reach maturity they migrate from estuarine habitats back to marine habitats in late August and September (Smithsonian Marine Station at Fort Pierce, 2018; GMFMC, 1998). Larval white shrimp feed on phytoplankton and zooplankton; post-larvae feed on epiphytes, phytoplankton, and detritus; and juveniles and adults prey on polychaetes, amphipods, chironomid larvae, algae, and detritus (South Carolina Department of Natural Resources, 2015).

Spanish Mackerel

Spanish mackerel are pelagic fish that spend much of their life cycle in the open waters of the Gulf of Mexico (North Carolina Department of Environmental Quality, 2018). This species spawns in the nearshore zone of the Gulf in water less than 180 feet in depth from July to September. As the nearshore waters warm throughout the summer, individuals migrate north, and may ascend estuaries; Juveniles are known to ascend into brackish water up to a minimum salinity of approximately 10 ppt (GMFMC, n.d.). The Sabine estuary serves as transient habitat for juvenile Spanish mackerel during the summer months where Spanish mackerel may be found in river mouths (North Carolina Department of Environmental Quality, 2018). This species is not dependent on unique physical habitat parameters, and may be found wherever oxygen, salinity, and temperature levels are adequate and where forage is available. In addition, the NMFS Estuarine Living Marine Resources database indicates that adults are rare (as described by NMFS abundance codes)[23] in the Projects area except from December through May, when they migrate out of the area. Juveniles are rare throughout the year, and eggs, larvae, and spawning adults not present.

Bull Shark

Bull sharks inhabit shallow coastal waters such as river mouths and bays, and are euryhaline organisms able tolerate marine salinities (greater than 30 ppt) to freshwater salinities (less than 0.5 ppt; Florida Museum of Natural History [FLMNH], 2018a). Bull sharks are dependent on estuarine habitats for nursery areas and are a highly migratory species known to travel long distances. Because of their migratory behavior, bull shark juveniles, neonates, and adults are rare within the SNWW (NMFS, 2015b).

Scalloped Hammerhead Shark

Scalloped hammerhead sharks are a coastal pelagic species that are found within estuarine, inshore, and offshore habitats including continental and insular shelves as well as adjacent to deeper water (NMFS, 2017a; FLMNH, 2018b). This species of shark is known to spend time inshore during the day, and hunts offshore at night in search of prey. Young scalloped hammerhead sharks aggregate in large schools, while adults either occur individually or aggregate in pairs or small schools (FLMNH, 2018b).

Blacktip Shark

Blacktip sharks are known to occur within estuarine river mouths, estuaries, and shallow coastal waters (National Geographic, 2017). The species is known to feed together in sexually segregated aggregations as juveniles and as adults. During mating season, the species typically intermixes sexes within schools, and often use warm equatorial waters (including the Gulf of Mexico) as nursery areas for juveniles (NMFS, 2017b).

23 In the query results, the NOAA abundance codes are defined as follows:
5: Highly Abundant
4: Abundant
3: Common
2: Rare
0: Not Present

Lemon Shark

Lemon sharks inhabit deeper waters during the day including the continental and insular shelves of the Gulf of Mexico, and occasionally adjacent offshore waters, and move inshore at night for foraging. This species typically prefers shallow subtropical water including closed bays, river mouths, and estuaries, and form aggregations based on size and sex (FLMNH, 2018c). Mating occurs in spring and summer months near shallow nursery areas (Sundstrom, 2015).

Bonnethead Shark

The bonnethead shark is a small coastal shark commonly found in shallow estuaries containing seagrass, as well as mud and sandy bottom substrates. They are very common in the southeast portion of the United States' coastal waters, especially near Florida, where seagrass beds provide foraging habitat and nursery for young (Cortés et al., 2016). As discussed in section 4.5.1.2, seagrasses have been extirpated from Sabine Lake.

Atlantic Sharpnose Shark

Atlantic sharpnose sharks are found off sandy beaches and estuaries with mud or sand substrates in warmer summer months, and migrate offshore in cooler winter months (Cortés, 2009; FLMNH, 2018d). Atlantic sharpnose sharks have been observed in sexually segregated groups during migrations from inland to offshore (FLMNH, 2018d). Enclosed estuarine environments support nursery habit for juveniles. While their hunting and prey patterns aren't well known, their preferred prey consists of teleosts and crustaceans (Cortés, 2009).

4.6.3.2 Impacts and Mitigation

Adverse impacts on EFH, as defined in 50 CFR 600.910(a), include any impact that reduces the quality and/or quantity of EFH. Adverse impacts may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions, including direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species, or their habitat. Table 4.6.3-3 identifies the EFH that would be affected by the Projects.

TABLE 4.6.3-3

EFH Affected by the Construction and Operation of the Projects [a]

Wetland Type	Wetland ID	MP	Crossing Method	Crossing Length (feet)	Temporary Impacts (acres)	Permanent Impacts (acres)	Temporary Impacts (yd^3)	Permanent Impacts (yd^3)	New Habitat Created (acres)
LIQUEFACTION PROJECT									
Estuarine Water Column	Port Arthur Canal	N/A	N/A	N/A	3.2	3.2	1,975,600	1,467,600	68.3
Estuarine Mud/Soft Bottom	Port Arthur Canal	N/A	N/A	N/A	3.2	3.2	1,975,600	1,467,600	68.3
Estuarine Emergent Marsh	J.D. Murphree WMA	N/A	N/A	N/A	903.0	0	0	0	1,268.8
			Liquefaction Project Subtotal[b]	**N/A**	**906.2[b]**	**3.2**	**1,975,600[b]**	**1,467,600[b]**	**1,268.8 (EEM) [b]** **68.3 (EWC/EMSB)**
NONJURISDICTIONAL FACILITIES									
Estuarine Water Column	Round Lake Canal	N/A	N/A	N/A	0.6	0	0	0	0
Estuarine Mud/Soft Bottom	Round Lake Canal	N/A	N/A	N/A	0.6	0	0	0	0
			Nonjurisdictional Facilities Subtotal[b]	**N/A**	**0.6**	**0**	**0**	**0**	**0**
TEXAS CONNECTOR PROJECT - NORTHERN PIPELINE									
Estuarine Emergent Marsh	North Route Wetland 31	5.1	HDD/Open-Cut	100	1.2	0	592	0	0
			Texas Connector Project - Northern Pipeline Subtotal	**100**	**1.2**	**0**	**592**	**0**	**0**
TEXAS CONNECTOR PROJECT - SOUTHERN PIPELINE									
Estuarine Emergent Marsh	South Route Wetland 19	2.6	HDD/Open-Cut	1,800	8.4	0	10,667	0	0
			Texas Connector Project - Southern Pipeline Subtotal	**1,800**	**8.4**	**0**	**10,667**	**0**	**0**
TEXAS CONNECTOR PROJECT - ACCESS ROADS									
Estuarine Emergent Marsh	South Route Wetland 21	2.8	N/A	900	0.8	0	4,000	0	0
			Texas Connector Project - Access Roads Subtotal	**900**	**0.8**	**0**	**4,000**	**0**	**0**
LOUISIANA CONNECTOR PROJECT - PIPELINE									
Estuarine Emergent Marsh	CAM-WL-001	18.1	HDD/Push-Pull	300.0	2.1	0.0	666.7	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-004	19.0	HDD/Push-Pull	975.9	3.9	0.0	2,168.7	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-005	19.6	Push-Pull	5,166.3	14.7	0.0	11,480.7	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-006	20.3	Push-Pull	0.0	0.8	0.0	0.0	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-007	20.6	Push-Pull	1,391.2	3.9	0.0	3,091.6	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-008	20.7	Push-Pull	1,173.7	3.5	0.0	2,608.2	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-009	21.0	Push-Pull	1,210.3	3.5	0.0	2,689.6	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-010	21.2	Push-Pull	561.1	1.7	0.0	1,247.0	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-012	21.3	Push-Pull	1,971.1	5.6	0.0	4,380.1	0.0	0.0
Estuarine Emergent Marsh	WR-CAM-02	21.5	Push-Pull	0.0	0.4	0.0	0.0	0.0	0.0

TABLE 4.6.3-3 (cont'd)

EFH Affected by the Construction and Operation of the Projects [a]

Wetland Type	Wetland ID	MP	Crossing Method	Crossing Length (feet)	Temporary Impacts (acres)	Permanent Impacts (acres)	Temporary Impacts (yd^3)	Permanent Impacts (yd^3)	New Habitat Created (acres)
Estuarine Emergent Marsh	CAM-WL-013	21.7	Push-Pull	1,084.3	3.0	0.0	2,409.6	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-014	21.9	Push-Pull/Open-Cut	1,290.8	7.1	0.0	2,868.4	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-015	22.4	Push-Pull	5.2	<0.1	0.0	11.6	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-016	22.4	Push-Pull	1,104.4	3.5	0.0	2,454.1	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-017	22.7	Push-Pull	544.3	1.6	0.0	1,209.5	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-018	23.0	Push-Pull	20.6	0.2	0.0	45.7	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-019	23.2	Push-Pull	889.5	2.5	0.0	1,976.7	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-020	23.5	Push-Pull	660.9	2.1	0.0	1,468.7	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-021	23.8	Push-Pull	166.7	0.5	0.0	370.4	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-022	24.0	Push-Pull	1,590.8	4.6	0.0	3,535.1	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-024	24.7	Push-Pull	0.0	0.2	0.0	0.0	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-025	24.7	Push-Pull	274.4	0.8	0.0	609.8	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-027	24.9	Push-Pull	101.5	4.4	0.0	225.5	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-028	25.2	Push-Pull	254.1	0.7	0.0	564.6	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-030	25.9	Push-Pull	1,094.8	3.1	0.0	2,432.9	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-031	26.1	Push-Pull	31.9	0.2	0.0	70.9	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-032	26.1	Push-Pull	65.6	0.2	0.0	145.8	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-034	26.1	Push-Pull	1,181.2	0.6	0.0	2,624.8	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-035	26.3	Push-Pull	1,181.2	1.4	0.0	2,624.8	0.0	0.0
Estuarine Emergent Marsh	CAM-WL-036	26.5	HDD/Push-Pull	1,181.2	0.1	0.0	2,624.8	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-001	27.2	HDD/Push-Pull	1,508.0	3.4	0.0	3,351.2	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-002	27.4	HDD/Push-Pull	0.0	0.0	0.0	0.0	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-006	28.3	HDD/Push-Pull	1,179.6	4.3	0.0	2,621.4	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-007	28.5	Push-Pull	0.0	0.4	0.0	0.0	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-008	28.6	Push-Pull	0.0	0.1	0.0	0.0	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-009	28.6	Push-Pull	100.1	0.2	0.0	222.4	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-234	28.6	Push-Pull	0.0	0.3	0.0	0.0	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-010	28.7	Push-Pull	294.6	0.4	0.0	654.6	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-011	28.7	Push-Pull	4,888.7	13.1	0.0	10,863.8	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-235	28.7	Push-Pull	0.0	1.0	0.0	0.0	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-012	28.8	Push-Pull	131.3	0.2	0.0	291.8	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-236	28.8	Pullback	0.0	3.1	0.0	0.0	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-013	29.6	Push-Pull	4,757.4	13.8	0.0	10,572.0	0.0	0.0

TABLE 4.6.3-3 (cont'd)

EFH Affected by the Construction and Operation of the Projects [a]

Wetland Type	Wetland ID	MP	Crossing Method	Crossing Length (feet)	Temporary Impacts (acres)	Permanent Impacts (acres)	Temporary Impacts (yd^3)	Permanent Impacts (yd^3)	New Habitat Created (acres)
Estuarine Emergent Marsh	CAL-WL-015	30.5	HDD/Push-Pull	5,384.4	2.3	0.0	11,965.4	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-16	30.7	HDD	0.0	0.3	0.0	0.0	0.0	0.0
Estuarine Emergent Marsh	CAL-WL-017	30.9	HDD/Push-Pull	3,740.2	11.9	0.0	8,311.5	0.0	0.0
Estuarine Mud/Soft Bottom	N/A	N/A	HDD/Push-Pull	109,613.9	1,403.0	0.0	243,586.4	0.0	0.0
Estuarine Water Column	N/A	N/A	HDD/Push-Pull	109,613.9	1,403.0	0.0	0.0	0.0	0.0
Louisiana Connector Project - Pipeline Subtotal[b]				**157,071.2**	**1,534.7**	**0.0**	**349,046.8**	**0.0**	**0.0**
LOUISIANA CONNECTOR PROJECT – VALVE STATIONS									
Estuarine Emergent Marsh	CAM-WL-004	19.2	N/A	50.0	0.1	0.1	0	150 .0	0
			Valve Station Subtotal	50.0	0.1	0.1	0	150.0	0
LOUISIANA CONNECTOR PROJECT - ACCESS ROADS									
Estuarine Emergent Marsh	N/A	N/A	N/A	N/A	5.2	1.2	6,388.8	1,984.40	0.0
Estuarine Mud/Soft Bottom	N/A	N/A	N/A	N/A	0.8	0.5	548.5	838.9	0.0
Estuarine Water Column	N/A	N/A	N/A	N/A	0.8	0.5	0.00	0.00	0.0
Access Roads Subtotal[b]				**N/A**	**6.0**	**1.7**	**6,937.3**	**2,823.3**	**0.0**
			Estuarine Emergent Marsh Subtotal		1,050.4	1.3	719,741.3	1,984.4	1,268.8
			Estuarine Mud/Soft Bottom Subtotal		1,407.6	3.7	2,219,734.9	1,468,438.9	68.3
			Estuarine Water Column Subtotal		1,407.6	3.7	1,975,600.0	1,467,600.0	68.3
			Projects Total		**2,458.0**	**4.9**	**2,939,476.2**	**1,470,423.3**	**1,337.1**

[a] Does not include EFH areas that are completely avoided by HDD or push-pull methods, including:

- Parts of Sabine Lake along the Texas Connector Project's Southern Pipeline and along the Louisiana Connector Project
- The Port Arthur Canal along the Louisiana Connector Project
- The ICWW along the Texas Connector and Louisiana Connector Projects
- Big Hill Bayou along the Texas Connector Project
- Taylor Bayou along the Texas Connector Project
- Hildebrandt Bayou along the Texas Connector Project
- Neches River along the Texas Connector Project

[b] The estuarine water column and estuarine mud/soft bottom habitats overlap vertically in the water column; therefore, spatial (horizontal, 2-dimensional) impact acreages for each habitat type are the same. These impacts were not double-counted when summing the subtotals or totals for each project or habitat type (i.e., the Nonjurisdictional Facilities impact 0.6 acre of EWC and 0.6 acre of EMSB habitat; however, the total impacts are only 0.6 acre, not 1.2 acres).

Liquefaction Project

Construction and operation of the Liquefaction Project would affect 3.2 acres of estuarine water column and estuarine mud/soft bottom EFH, which would result in temporary and permanent impacts (see table 4.6-3). Temporary impacts on EFH and EFH-managed species would result from construction dredging, pile driving, increased barge traffic, the release of ballast water or hull fouling, alteration of light regimes, stormwater runoff, and inadvertent spills, as discussed in section 4.6.2.2, and below. Permanent impacts on EFH and EFH-managed species would result from the direct removal of EFH, maintenance dredging, increased vessel traffic, the release of ballast water or hull fouling, or an accidental spill in the following text as discussed in section 4.6.2.2.

The Liquefaction Project would create 68.3 acres of additional open water habitat for aquatic species and EFH-managed species by dredging the berthing area and MOF, resulting in a net increase of estuarine mud/soft bottom and estuarine water column EFH. Additionally, the restoration of marsh habitat within the J.D. Murphree WMA would create an additional 1,268.8 acres of estuarine emergent marsh EFH offsite, and the installation of riprap along the shoreline would provide habitat for encrusting species (discussed below).

<u>Dredging</u>

Dredging would remove 3.2 acres of estuarine water column and estuarine mud/soft bottom EFH within the Port Arthur Canal. EFH-managed species including red drum, lane snapper, gray snapper, brown shrimp, and white shrimp could be present during active dredging. As described in section 4.6.2.2, dredging activities would cause sediment suspension and turbidity, which would lower the water quality within a localized area surrounding the dredged area for several hours. Increases in turbidity could adversely affect fish physiology and behavior, resulting in less healthy individuals, reductions in fecundity, and reduced foraging habitat.

Naturally occurring sedimentation would decrease the depth of the dredged areas over several years. Maintenance dredging of the recessed berthing area would be required during operation of the liquefaction facility to account for this natural sedimentation. As discussed is section 4.6.2.2, potential impacts on EFH from maintenance dredging include direct take and habitat modification as well as temporary increases in noise, turbidity, and suspended solid levels. Impacts from maintenance dredging would be smaller than the initial project construction dredging because of the smaller amount of material being removed from the recessed berthing area.

The dredge material from construction and operation (maintenance) activities would be placed at the J.D. Murphree WMA. The J.D. Murphree WMA would use this material to restore about 1,269 acres of estuarine emergent marsh habitat, thereby creating a net increase of about 1,266 acres of EFH. Additional volumes of dredged material would be placed at USACE-approved dredge disposal areas 8, 9A, or 9B.

Dredging and disposition of dredged material associated with the proposed Projects would permanently create additional EFH in the in the Port Arthur Canal and within the J.D. Murphree WMA. Individuals of EFH species could be killed during creation of this additional EFH; however, this permanent impact would be beneficial overall to EFH-protected species after construction is complete. We conclude that PALNG's impact minimization measures (see section 4.6.2.2) and creation of additional EFH would reduce the Liquefaction Project's adverse impacts on EFH and EFH-associated species during construction and operation to minor and temporary levels.

Pile Driving

Construction of the liquefaction facility would require the installation of piles to support the proposed structures. Details of pile-driving activities for the Liquefaction Project are discussed in sections 2.4 and 4.6.2.2. In summary, in-water pile driving would be required to install the steel sheet pile bulkhead, the steel pipe piles supporting the LNG loading platform, and the breasting and mooring dolphins. Based on information from PALNG, the facilities would require 779 pilings installed over a 24-month period that would take place 10 hours per day, up to 6 days per week.

The primary impacts on EFH and EFH-managed species would be similar to those described in our evaluation of aquatic resources (see section 4.6.2.2): avoidance of the area, stress, or injury due to the underwater sound pressure levels. NMFS is currently developing guidelines for determining sound pressure level thresholds for fish and marine mammals. The agency's interim guidelines use 150 dB re: 1 μPa as the threshold for behavioral effects on fish species of particular concern. As discussed in section 4.6.2.2, construction noise levels underwater would be greatest during pile driving activities and are estimated to exceed 200 dB re: 1 μPa.

PALNG would implement construction techniques that minimize noise effects on aquatic species, including pre-drilling pile holes, which would reduce the number of number of pile strikes needed; using a vibratory hammer, which typically produces lower underwater sound pressures; using bubble curtains/cofferdams, which create a sound barrier between pile-driving activities and the surrounding aquatic environment, providing noise abatement for aquatic species; and ramping driving activities, which would allow sensitive aquatic species to depart the area before harmful underwater sound pressures are reached by the vibratory hammers.

Based on similar projects, including Cameron Interstate Pipeline, LLC's Liquefaction Project and the Magnolia LNG and Lake Charles Expansion Projects, PALNG's noise mitigation measures, and existing conditions and activities associated with the Port Arthur Canal, these species are expected to move out of the affected area temporarily during pile driving, and would be able to return once construction activities have ceased. As a result, the impacts on EFH and EFH-associated species associated with pile driving during construction of the Liquefaction Project would be minor and temporary.

Increased Vessel Traffic

The increase in barge traffic at and near the Liquefaction Project during construction would result in increased erosion or sedimentation, and noise in the area, potentially affecting EFH and EFH-managed species. As described in section 4.6.2.2, barges during construction would remain when necessary to deliver materials or to facilitate maintenance dredging in the berthing area and MOF. Barge and vessel movements would not substantially increase shoreline erosion or benthic sediment disturbance because the vessels are slow moving and do not create significant wakes. Some benthic sediment disturbance could occur when the barges are at the MOF, which would be short term, lasting through the initial months of construction. PALNG would minimize potential erosion of the shoreline by installing rip-rap along the shoreline, further preventing sedimentation to benthic organisms. Additionally, PALNG would implement a Restoration Plan, to ensure that EFH areas have been restored following construction.

Based on these considerations, the impacts associated with increased barge traffic and noise on EFH and EFH-associated species would be consistent with current vessel traffic noise occurring in proximity to the liquefaction facilities and minor as the increase of barge traffic represents a less than one percent increase. As a result, the impacts on EFH and EFH-associated species associated with increased vessel traffic during construction and operation of the Liquefaction Project would be minor and temporary.

Ballast Water and Hull Fouling

Traffic associated with construction and operation of the liquefaction facility could affect EFH within the Port Arthur Canal by altering water quality from ballast water via changing the pH, salinity, or temperature, causing a resuspension of sediment; or by altering the species composition of benthic organisms from the introducing invasive species from ballast water discharges and hull fouling (see section 4.6.2.2).

The number of additional vessels expected to visit the liquefaction site (approximately 180 vessels per year) is less than a 1 percent increase in current traffic patterns. Each vessel has a ballast water discharge and uptake capacity of 12 to 15 million gallons of sea water, with a rate of approximately 720,000 gallons per hour over a 10- to 16-hour timeframe.

Given the existing conditions and activities within the Port Arthur Canal, along with implementation of the mandatory practices required by U.S. regulations and the USCG as described in section 4.6.2.2, the effects of ballast water discharges on four ambient water quality parameters (temperature, pH, dissolved oxygen, and salinity), the resulting impact on EFH from construction and operation of the Liquefaction Project would be minor and temporary.

Alteration of Light Regimes

During construction of the work dock, and particularly during operation, additional lighting within and near the Port Arthur Canal would be present at the liquefaction facility. EFH-managed species in the area are generally acclimated to the current ambient light; however, increased light could affect small organisms by causing minor disruptions to the food chain including changes in the vegetation community structure (photosynthesis), behavioral changes (light cues), and increased predation. Impacts on EFH resulting from shading could include reduced plant growth and changed vegetation assemblages (reduced photosynthesis), which would affect the food chain; and from modified animal behavior. Additionally, reduced natural light levels in areas due to new structures providing shading would occur where previously not experienced.

As described in section 4.6.2.2, impacts on EFH and EFH-managed species would be similar to that of general aquatic species (temporary and minor changes to light and shading during construction, as well as nominal increases in lighting during operation for safety, security, and mooring purposes). EFH-managed species are likely acclimated to the current ambient light and the industrial nature from the existing use of the Port Arthur Canal. As a result, changes in light regimes resulting from construction and operation of the Liquefaction Project would have minor to moderate and temporary to permanent impacts on EFH-managed species.

Habitat for Encrusting Species

Habitat for encrusting species would be created by constructing the new dock structure and by installing rip-rap along the shoreline for erosion control. Much of Port Arthur Canal is covered in hard substrate, and the project facilities would create 50,000 square feet of new hard surfaces (see section 4.6.2.2). The new encrusting species expected to inhabit the new area would be consistent with the existing biota and would permanently contribute to the biodiversity of Port Arthur Canal, including EFH. The increased habitat for encrusting species would not have any adverse significant impacts on aquatic species (see section 4.6.2.2).

Stormwater Runoff

During and after construction, the conversion of land to impervious surface areas at the liquefaction facility site would result in an increased volume of stormwater runoff, which could create changes in salinity, temperature, and/or dissolved oxygen in the area surrounding discharges, as well as increased potential for contamination within EFH areas. Stormwater impacts and minimization measures are discussed in section 4.6.2.2, where impacts on EFH and EFH-managed species would be similar to that of general aquatic resources.

Based on PALNG's adoption of these measures, impacts on EFH and EFH-managed species resulting from stormwater runoff during construction and operation of the Liquefaction Project would be minor and temporary.

Alteration of Wave Energy

Changes to wave energy within the Liquefaction Project area would result from the installation of piers, pilings, and docks during construction, and increased vessel traffic during operation. Potential impacts on EFH and EFH-managed species would be similar to general aquatic resources, which is discussed in section 4.6.2.2, from increased wave energy include erosion, increased turbidity, and sedimentation, which could alter the plant and animal composition as substrate regimes change.

As a result of similar projects in the area and the existing conditions and activities associated with the Port Arthur Canal, along with PALNG's impact minimization measures (see section 4.6.2.2), the impacts on EFH and EFH-associated species associated with changes to wave energy during construction and operation of the Liquefaction Project would be negligible to minor and temporary.

Inadvertent Spills

During construction and operation of the Liquefaction Project, spills or leaks of hazardous materials entering the Port Arthur Canal from construction equipment could have adverse impacts on EFH. Impacts and minimization measures on EFH would be similar to the impacts on general aquatic resources: physical (smothering, substrate regime, etc.) or chemical (contaminants, toxic effects, bioaccumulation, etc.). Mitigation measures are described in section 4.6.2.2, and the implementation of these procedures would minimize response time and ensure appropriate cleanup actions are taken in the event of a spill.

Pipeline Projects

Construction and operation of the Texas Connector and Louisiana Connector Projects would be conducted using industry-recognized methods and mitigation measures. As such, the following discussions apply to both pipeline projects. Differences in methods or mitigation measures are described separately as appropriate by project.

Regarding the Texas Connector Project, construction of the Northern Pipeline would affect 1.2 acres of estuarine emergent marsh EFH; construction of the Southern Pipeline would affect 8.4 acres of estuarine emergent marsh EFH; and access roads would temporarily affect 0.8 acre of estuarine emergent marsh EFH (see table 4.6.3-2). Estuarine scrub-shrub EFH is crossed at MP 7.1 along the Southern Pipeline but would be avoided using the HDD method.

Regarding the Louisiana Connector Project, pipeline construction would affect 1,534.7 acres of EFH, including 131.7 acres of estuarine emergent marsh EFH and 1,403.0 acres of estuarine water column and mud/soft bottom EFH (see table 4.6.3-2). The Louisiana Connector Project would temporarily affect 6.0 acres of EFH for access roads during construction including 5.2 acres of estuarine emergent marsh and

0.8 acre of estuarine water column and estuarine mud/soft bottom (see table 4.6.3-2). Operation of the Louisiana Connector Project for access roads would permanently affect 1.7 acres of EFH – 1.2 acres of estuarine emergent marsh and 0.5 acre of estuarine water column and estuarine mud/soft bottom (see table 4.6.3-2). Operation of the Louisiana Connector Project would also result in 0.1 acre of estuarine emergent EFH impacts from a permanent placement of the MLV at MP 19.2. Several EFH areas would be avoided by implementing the HDD method along the route, including parts of Sabine Lake and the ICWW.

Temporary impacts on EFH and EFH-managed species could result from waterbody crossings, hydrostatic testing activities, or the accidental spill of petroleum or LNG.

Wetland and Waterbody Crossings with Designated EFH

Along the Texas Connector Project, PAPL would cross designated estuarine mud/soft bottom and water column EFH waterbodies along the Northern Pipeline using the HDD method to avoid 11.3 acres of EFH impacts. In addition, one estuarine emergent marsh crossing at MP 5.1 would be partially crossed using the HDD method and the open-cut method, resulting in 1.2 acres of estuarine emergent marsh impacts. PAPL would cross designated estuarine mud/soft bottom and water column EFH waterbodies along the Southern Pipeline using the HDD method to avoid 1.4 acres of EFH impacts. One designated estuarine emergent marsh EFH location along the Southern Pipeline at MP 2.6 would be partially crossed using HDD and the open-cut methods, and would result in 8.4 acres of estuarine emergent marsh EFH impacts.

Along the Louisiana Connector Project, PAPL would implement HDD crossings where feasible along EFH-designated waterbodies, and would HDD EEM wetland habitats as feasible, avoiding 25.6 acres of EFH habitat within the Project area. In areas where HDD construction is not feasible (i.e., due to crossing length constraints), typical open cut (dry-ditch and wet-ditch), flume crossing, or dam and pump methods would be used. Specialized construction methods would be implemented for construction of the Louisiana Connector Project within Sabine Lake, including the S-lay method (see table 4.3-2 and sections 2.4.3.1 and 4.6.2.2).

Impacts on EFH resulting from the open-cut method would be similar to the impacts associated with other open-cut waterbody crossings: increased turbidity and sedimentation. Also, vegetation clearing for construction would result in reduced shading along waterbody banks and increased water temperature. To reduce impacts on EFH, PAPL would install erosion and sediment controls in accordance with its *Environmental Plan*[24] to minimize sedimentation into the waterbody. Restoration would be achieved using the wetland and waterbody restoration procedures as outline in PAPL's *Environmental Plan,* and would be completed within 6 months to avoid permanent EFH impacts. PAPL would restore EFH areas beginning during the final grading phase, which would include reestablishing vegetation communities. Based on our consultations with NMFS on October 5, 2017, reestablishment of 80 percent vegetation cover within disturbed EFH areas within one year of restoration would be considered complete. If the vegetation within the impacted EFH areas does not achieve the revegetation criteria set forth by NMFS, PAPL would develop a Mitigation Plan in coordination with NMFS and USACE offices. During operation, PAPL would minimize impacts on riparian vegetation along EFH waterways by maintaining a 25-foot-wide strip of vegetation between the pipeline and waterbody.

Construction of the Louisiana Connector Project within Sabine Lake would involve the S-Lay or Barge Lay method, which begins with an HDD entry point at the Liquefaction Project, open-cutting the lake floor of Sabine Lake, and finalizing at an HDD exit point on the shore of Shell Island, and would be

24 *Environmental Plans* for the Texas Connector Project and Louisiana Connector Project were filed on December 12, 2017 and October 16, 2017, respectively. These plans can be found on the FERC eLibrary website using Accession Numbers 20171212-5147 (Texas Connector Project) and 20171016-5210 (Louisiana Connector Project).

drilled into Lake Sabine. Sections 2.4.3 describes the construction methods. The impacts on EFH would be similar to those of general aquatic resources described in section 4.6.2.2.

Based on the use of the HDD crossing method at most EFH crossings, the installation of erosion and sediment controls, and implementing the restoration measures identified in the PAPL's *Environmental Plan*, impacts on EFH and EFH-managed species from construction and operation of the Texas Connector and Louisiana Connector Projects would be minor to moderate and temporary.

Hydrostatic Testing

As discussed in section 4.6.2.2, hydrostatic testing of the pipeline would require water to be withdrawn from waterbodies and municipal sources, and water would be discharged into waterbodies or at upland locations within the compressor stations (see table 4.3.1-5). PAPL would implement minimization measures on EFH and EFH-managed species by using a 0.25-inch diameter mesh screen over the intake hose to minimize entrainment during water withdrawals. Additionally, discharges into waterbodies would be dissipated into their respective waterways to minimize the localized turbidity and minor changes of the salinity and temperature. PAPL would not add any chemicals to the test water and would adhere to the measures required by NPDES permits. As such, impacts on EFH or EFH-managed species from hydrostatic testing would/be minor and temporary.

Inadvertent Spills

Impacts on EFH waterways and EFH-managed species from an inadvertent spill of hazardous material during the project would be similar to those described for the Liquefaction Project and as described in section 4.6.2.2. PAPL would implement the measures identified in its project-specific SPCC Plan to minimize response time and ensure appropriate cleanup actions are taken in the event of a spill.

Nonjurisdictional Facilities

Construction/relocation of the nonjurisdictional facilities would temporarily affect 0.6 acre of estuarine water column and estuarine mud/soft bottom EFH (Round Lake Canal); the construction corridor parallels another tidally influenced (unnamed) canal to the west. Similar to the pipeline projects, construction impacts on EFH could result from increased stormwater runoff, erosion and sedimentation, and the potential for an inadvertent spill. To minimize these impacts, PALNG would implement the measures described in its *Environmental Plan*. As such, construction of the nonjurisdictional facilities would be minimized.

Applicant-Proposed EFH Conservation Measures

As discussed above, PALNG and PAPL would implement several measures to avoid or minimize impacts on EFH, based, in part, on some preliminary conservation measures recommended by NMFS, which include the following:

- Use of the HDD method.
- Implementation of an Inadvertent Release Plan.
- Restoration of EFH areas within 6 months to avoid permanent impacts.
- Adherence to NPDES permit requirements.

- Implementation of measures in the project-specific *Environmental Plans*, which includes the Commission's Plan and Procedures and a SPCC Plan.

In addition, PALNG and PAPL would implement a variety of mitigation measures to minimize impacts on EFH and the species that use them. These include the following:

- Waterbody restoration: PALNG and PAPL would re-establish original contours and monitor affected waterbodies following construction, as well as restore any levees or barriers that were removed as part of the construction activities.

- Erosion and sedimentation control. PALNG and PAPL would implement BMPs to control erosion and sediment as part of a project-specific SWPPP.

- Riparian restoration. Maintenance of the permanent right-of-way would be limited to a 10-foot-wide corridor, allowing the stream bank to revegetate to pre-construction conditions.

- Contamination control. Herbicides would not be used within 100 feet of any waterbody without the consent of the land manager or a state agency.

- Wetland and Waterbody Mitigation. PAPL would coordinate with NMFS and USACE to properly mitigate for permanent EFH impacts if the vegetation within the impacted EFH areas does not achieve the revegetation criteria set forth by NMFS within a year.

- Creation of EFH at berth area and beneficial reuse of wetland habitat at the J.D. Murphree WMA.

As mentioned above, NMFS may respond to our EFH Assessment with additional Conservation Recommendations. We (as well as PALNG and PAPL) will assess any such measures at that time. In accordance with the MSA, we will provide a written response regarding to what extent any such Conservation Recommendations can or will be implemented.

4.6.3.3 Conclusions

As a non-federal party assisting the FERC in meeting its obligations under the MSA, PALNG and PAPL coordinated with NMFS on October 29, 2015 and on July 24, 2015 regarding impacts on EFH. During the call, NMFS indicated that the Liquefaction Project and Texas Connector Project would not have significant impacts on EFH, provided the applicant addresses the EFH Conservation Measures, including the use of HDD crossing methods, the implementation of an Inadvertent Release Plan, wetland and waterbody restoration, and wetland and waterbody mitigation as applicable.

The creation of historic emergent wetlands within the J.D. Murphree WMA would offset the adverse impacts on estuarine mud/soft bottom and water column EFH at the Liquefaction Project, resulting in long-term benefits to wetlands near the Liquefaction Project. The additional adverse impacts on EFH-designated waterbodies and wetlands associated with Liquefaction Project would further be mitigated by using a combination of the USACE's in-lieu fee program and by purchasing wetland mitigation credits. PALNG would also restore any EFH impacted areas within 6 months from final grading activities, thus, avoiding permanent impacts on EFH. Additionally, the EFH created at the Liquefaction Project's berth would offset the construction impacts on EFH habitat by creating an open-water estuarine habitat for EFH-listed species, and increase biodiversity in conjunction with the habitat for encrusting species. Habitat for encrusting species would be created by installing rip-rap along the shoreline to minimize erosion and sedimentation, and to promote habitat for encrusting species which would promote biodiversity in the vicinity.

PAPL would avoid 12.7 acres of EFH along the Texas Connector Project by crossing EFH-designated wetlands and waterbodies using HDD installation methods for the Texas Connector Project. Of the 10.4 acres impacted, PAPL would restore any EFH impacted areas within 6 months, thus, avoiding permanent impacts on EFH. Any unavoidable impacts on EFH would be mitigated for through USACE wetland mitigation.

PAPL would avoid 25.6 acres of EFH by crossing EFH-designated wetlands and waterbodies using HDD installation methods for the Louisiana Connector Project. Of the 1,540.8 acres impacted, PAPL would restore EFH-impacted areas within 6 months, thus, avoiding permanent impacts on EFH. Any unavoidable impacts on EFH would be mitigated for through USACE wetland mitigation.

Maintenance-related operational impacts on EFH would be limited to a 10-foot-wide right-of-way within estuarine wetlands. Trees more than 15 feet in height, should they occur within 15 feet of the pipeline right-of-way, may be cut and removed.

Due to the relatively small area of EFH impacted by the Projects (the recessed berthing area, MOF, and Pioneer Dock), which cumulatively represents 5 percent of the total acreage within the canal; the increase in the amount of estuarine water column habitat created during construction of the berthing area, MOF, and Pioneer Dock; the increased habitat for encrusting species; avoidance of designated-EFH crossings by HDD installations; preliminary coordination with NMFS; and adherence to wetland and waterbody restoration methods per the *Environmental Plan*; the Projects would not have a significant or adverse impact on EFH.

4.7 THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

4.7.1 Regulatory Requirements and Species Identification

Special status species are afforded protection by law, regulation, or policy by state and federal agencies. Special status species generally include federally listed species that are protected under the ESA, species proposed or petitioned for listing under the ESA, are considered as candidates for such listing by the FWS or NMFS, or are species that are state-listed as threatened, endangered, or have been given other state designations.

4.7.1.1 Federal

Federal agencies are required by section 7 of the ESA (Title 19 USC Part 1536[c]), as amended (1978, 1979, and 1982), to ensure that any actions authorized, funded, or carried out by the agencies do not jeopardize the continued existence of a federally listed threatened or endangered species, or result in the destruction or adverse modification of designated critical habitat for a federally listed species. The FWS, which is responsible for terrestrial and freshwater species, and NMFS, which is responsible for most marine species, jointly administer the law and share jurisdiction over sea turtles and some anadromous fish species. As the lead federal agency for the Projects, 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 near the Projects area, and determine the proposed action's potential effects on those species or their critical habitats.

For actions involving major construction activities with the potential to affect listed species or designated critical habitats, the FERC is required to report its findings to the FWS and NMFS in a BA. A BA may be undertaken as part of a federal agency's compliance with the requirements of section 102 of NEPA (42 USC 4332). If the FERC determines that an action is likely to adversely affect a species, formal consultation is required. In response, the FWS and/or NMFS would issue a Biological Opinion (BO) as to whether or not the federal agency action would likely jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. The BO would include binding and/or discretionary recommendations to reduce impacts to an acceptable level as well as an Incidental Take Statement for those actions that may affect, but would not jeopardize the continued existence of ESA listed species or destroy or adversely modify designated critical habitat.

We have determined that the Projects *may affect, but would not adversely affect* federally listed species and their designated critical habitats. As discussed below, we have received concurrence from the NMFS for all species under its jurisdiction, and have received concurrence from the FWS for four of the six species under its jurisdiction. Thus, section 7 consultation is complete for those species. To assist with finalizing informal section 7 consultation for the remaining two species (American chaffseed and West Indian manatee), we are requesting that the FWS consider this draft EIS as our official BA for the Projects.

4.7.1.2 State

In addition to federal law, Texas and Louisiana have passed laws to protect state-listed threatened and endangered species. The state-specific regulations include the following:

- Texas – Chapter 68 of the Texas Parks and Wildlife Code protects species considered to be threatened with extinction within Texas. Per section 68.015, no person may capture, trap, take, or kill, or attempt to capture, trap, take, or kill, endangered fish or wildlife.

- Louisiana – Title 56 of the Louisiana Revised Statutes as well as relevant rules and regulations adopted by the Louisiana Wildlife and Fisheries Commission and the Secretary of the Department of Wildlife and Fisheries includes regulations to provide for the conservation of endangered or threatened species. With respect to any endangered species of wildlife, it is unlawful, except as provided in subsection G of Title 56, section 1904, for any person subject to the jurisdiction of this state to export or take any such species from the state; or possess, process, sell or offer for sale, deliver, carry transport or ship, by any means whatsoever, any such species. With respect to threatened or endangered species of native plant, it is unlawful, except as provided in subsection I of Title 56, section 1904, for any person subject to the jurisdiction of the state to willfully destroy or harvest any such species growing on the private land of another without first obtaining the written permission of the landowner or legal representative of the landowner; or willfully destroy or harvest any such species on any public land without a permit from the LDWF and written permission from the agency owning the land.

4.7.2 Action Areas

4.7.2.1 FERC-Jurisdictional Facilities

The action area (as defined in section 7(a)(2) of the ESA) considered in this section includes all areas of the Projects: the onshore and offshore (i.e., Port Arthur Canal) components of the Liquefaction Project (including the placement of dredge material at the J.D. Murphree WMA[25]); the onshore and offshore (i.e., Port Arthur Canal and Sabine Lake) pipeline routes; aboveground facilities including compressor stations, meter stations, and MLV facilities; water vessel transit routes (i.e., associated with construction activities in Port Arthur Canal and Sabine Lake); and all associated onshore and offshore temporary workspaces (see section 2.1). Areas beyond the footprint of the Projects that could be affected by project activities (i.e., construction activities causing sediments to be transported outside the Projects area) were also considered part of the action area.

4.7.2.2 Nonjurisdictional Facilities

As discussed in section 2.1.4, nonjurisdictional facilities related to the Projects and considered in this analysis include the 295-foot-wide right-of-way associated with the relocation of SH 87, pipelines, and utilities that would all be located within the liquefaction facility boundary, as well as an electric power supply to serve the proposed compressor station on the Louisiana Connector Project. In addition, based on consultation with NMFS, the increase in vessel traffic (about three to four vessels would call on the liquefaction facility per week) is integral to the Liquefaction Project objective; therefore, we consider the potential environmental impacts associated with the increase in vessel traffic in this EIS. These impacts are discussed further in sections 4.7.3.6, 4.7.3.7, 4.7.3.8, and 4.7.3.9 for giant manta ray, sea turtles, the West Indian manatee, and whales, respectively.

4.7.3 Federally Listed Species

Review of the FWS' Environmental Conservation Online System – Information for Planning and Consultation identified 11 federally listed threatened or endangered species under FWS jurisdiction that are known to occur in the Projects area: least tern, piping plover, red knot, red-cockaded woodpecker, American chaffseed, West Indian manatee, and five sea turtle species (onshore nesting habitat) (FWS, n.d.-a, n.d.-b).

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25 As discussed in section 2.1 and associated with the Liquefaction Project, dredge material removed from the Port Arthur Canal would also be deposited at Dredge Disposal Areas 8, 9A, and 9B; however, these are existing dredge disposal areas that have been previously authorized by the USACE and used as disposal areas for the maintenance dredging of Port Arthur Canal; therefore, these areas are not discussed further in this section.

Review of NMFS' lists of threatened or endangered species in Texas and Louisiana identified 16 federally listed species under NMFS jurisdiction that are known to occur in the Projects area: 4 whale species, 5 sea turtle species (marine habitat), 3 fish species, and 4 coral species (NMFS, n.d.-a, n.d.-b, n.d.-c).

To assist in compliance with section 7(a)(2) of the ESA, PAPL and PALNG, acting as the FERC's non-federal representative, initiated informal consultation with the Texas FWS on October 30, 2017. By letter dated June 8, 2018, the Texas Coastal Ecological Services Field Office concurred with the determination made by PAPL and PALNG that the Projects were *not likely to adversely affect* the piping plover, red knot, and least tern. Consultation with the Texas Coastal Ecological Services Field Office is considered complete for these species, but is ongoing for the West Indian manatee.

In addition, PAPL contacted the Louisiana Ecological Services Office of the FWS (Louisiana FWS) on March 23, 2016 regarding federally listed threatened or endangered species potentially occurring in or near the Texas Connector Project area in Louisiana. The Louisiana FWS responded on April 19, 2016, stating that the Texas Connector Project would have *no effect* on federal trust resources under its jurisdiction and concluded that this finding fulfills the requirements under section 7(a)(2) of the ESA. In a letter dated June 26, 2017, the Louisiana FWS confirmed that its April 19, 2016 *no effect* determination for the Texas Connector Project is still valid.

Regarding the Louisiana Connector Project, PAPL contacted the Louisiana Ecological Services Offices of the FWS on March 31, 2017 regarding federally listed threatened or endangered species potentially occurring in or near the Louisiana Connector area. The Louisiana FWS identified three federally listed threatened or endangered species known to occur in the Louisiana Connector Project area (West Indian manatee, red-cockaded woodpecker, and American chaffseed) in its July 7, 2017 letter. PAPL sent a habitat assessment and request for concurrence for the red cockaded woodpecker on February 26, 2018. The Louisiana FWS responded on March 21, 2018, concurring that the Louisiana Connector Project was *not likely to adversely affect* the red cockaded woodpecker, and on August 9, 2018, that the Louisiana Connector Project was *not likely to adversely affect* the West Indian manatee. Surveys for the American chaffseed have not been completed due to lack of access. Consultation with the Louisiana FWS is ongoing for the American chaffseed.

To assist in compliance with section 7(a)(2) of the ESA, PAPL and PALNG, acting as the FERC's non-federal representative, initiated informal consultation with NMFS on February 27, 2018, for federally listed threatened or endangered species potentially occurring in or near the Projects area. By letter dated August 29, 2018, the NMFS concurred that the Projects were *not likely to adversely affect* the sea turtles and the fin, sei, and sperm whales. The NMFS also added that the Projects also were *not likely to adversely affect* the recently listed giant manta ray, the North Atlantic right whale, blue whale, and the proposed Bryde's whale. Thus, ESA section 7 consultation for the Projects is complete for all species under NMFS' jurisdiction.

Because ESA consultation with the FWS is ongoing and to ensure that PALNG and PAPL do not begin construction until section 7 consultation is complete, **we recommend that:**

- **<u>PALNG and PAPL should not begin construction of the Projects until</u>:**

  a. All outstanding biological surveys are completed and filed with the FERC;

  b. The FERC staff completes any necessary ESA section 7 consultation with the FWS; and

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

Of the 25 species originally considered for the Projects, we determined that the Projects would have *no effect* on 7 (either species or critical habitat) due to the distance of their primary habitat from the Projects area or the absence of individuals observed during field surveys. A summary of these species and our justification for *no effect* determinations is provided in appendix O.

Our analysis of the potential for the Projects to impact the remaining 18 federally listed species or their critical habitat and our determination of effect for each are discussed in the following sections and listed in table 4.7.3-1. Species that are not federally listed but are protected by the Marine Mammal Protection Act of 1972 (MMPA) are further discussed in section 4.7.5. Migratory birds and bald eagles are discussed in section 4.6.1.3.

4.7.3.1 Piping Plover

The piping plover is federally listed as threatened and state-listed as threatened in Texas and Louisiana. There are three locations where piping plovers nest in North America: the shorelines of the Great Lakes, the shores of rivers and lakes in the Northern Great Plains, and along the Atlantic Coast (FWS, 2001b). In the fall, plovers migrate south and winter primarily along Gulf Coast beaches from Florida to Mexico, along the Atlantic Coast from North Carolina to Florida, and on Caribbean islands (TPWD, n.d.-a). Wintering piping plovers in Texas prefer bare or very sparsely vegetated tidal mudflats, sand flats, or algal flats – areas that are periodically covered with water and then exposed either by tides or wind. Most of the plovers that winter on the Texas coast are found in the lower Laguna Madre, where tidal flats are extensive and productive (TPWD, n.d.-b). Piping plovers feed on insects, spiders, and crustaceans. Tidal flats formed at the base of jetties and tidal passes are also important feeding areas, especially along the upper Texas coast (TPWD, n.d.-a). Threats to this species include habitat loss and degradation, particularly of coastal beaches, and nest disturbance and predation.

According to FWS county occurrence information, the piping plover is known or expected to occur in Jefferson and Orange Counties, Texas and Cameron Parish, Louisiana. During winter, this species could be present along the Texas shorelines near the Project areas. Piping plovers could transit through the Texas portions of the Liquefaction, Texas Connector Project, and Louisiana Connector Projects area during construction; however, they likely would avoid the area because of the high level of activity. The Louisiana FWS indicated in its July 7, 2017 letter, and in a conference call on September 14, 2017 that it did not anticipate this species to occur in the Louisiana portions of the Texas Connector or Louisiana Connector Projects, and therefore, would have *no effect* on the species in Louisiana.

TABLE 4.7.3-1

Federally Listed Species Potentially Occurring in the Vicinity of the Projects

Common Name *Scientific Name*	Federal Status[a –] Parish/County[b]	State Status[c–] Parish/County[b]	Project Area Where Species May Occur: Liquefaction	TX Connector	LA Connector	Suitable Habitat within Project Area?	Determination of Effect and Comments
BIRDS							
Piping plover [d, e, f, g, h, i] *Charadrius melodus*	T – OR, JE, CAM	T – JE, OR, CAM	X	X		Liquefaction Project - foraging habitat present. Texas Connector Project - foraging habitat present, however, it would be largely avoided by HDD. Not anticipated to occur in the Louisiana portions of the project area. Louisiana Connector Project – Liquefaction Project would remove any suitable foraging habitat in Texas before the Louisiana Connector Project would begin. Not anticipated to occur in the Louisiana portions of the project area.[j]	Not Likely to Adversely Affect Concurrence from FWS received on June 8, 2018; consultation complete.
Red knot [d, e, f, g, h, i] *Calidris canutus*	T – OR, JE, CAM	-	X	X		Liquefaction Project - foraging habitat present. Texas Connector Project - foraging habitat present, however, it would be largely avoided by HDD. Not anticipated to occur in the Louisiana portions of the project area. Louisiana Connector Project – Liquefaction Project would remove any suitable foraging habitat in Texas before the Louisiana Connector Project would begin. Not anticipated to occur in the Louisiana portions of the project area.[j]	Not Likely to Adversely Affect Concurrence from FWS received on June 8, 2018; consultation complete.
Least tern [d, h] *Sternula antillarum*	E – OR, CAM	-	X[k]	X[k]	X[k]	Species has utilized newly cleared and/or graveled areas as nesting sites in recent history in TX; therefore, suitable nesting habitat would be present within the Liquefaction Project area and the Texas portions of the Texas Connector Project and Louisiana Connector Project. Not anticipated to occur in the Louisiana portions of the project area.[j]	Not Likely to Adversely Affect Concurrence from FWS received on June 8, 2018; consultation complete.
Red-cockaded woodpecker [d, e, l, m] *Picoides borealis*	E – CAL, BE, AL, EV	E – AL, BE, CAL, EV			X	Suitable foraging is present; no nesting habitat identified during surveys.	Not Likely to Adversely Affect; Concurrence from FWS received on March 21, 2018; consultation complete.
PLANTS							
American chaffseed [e, l, m] *Schwalbea americana*	E – AL, BE	-			X	None identified during surveys; however, surveys are pending in areas with no access.	Surveys outstanding; consultation ongoing.
FISH							
Giant manta ray [n] *Manta birostris*	T – Gulf of Mexico	-	X			Offshore areas of the Gulf of Mexico along the LNG vessel transit routes used for migration and feeding.	Not Likely to Adversely Affect Concurrence from NMFS received on August 29, 2018; consultation complete.
MARINE REPTILES							
Green sea turtle [e, f, g, i, n, o] *Chelonia mydas*	T - JE	T – JE	X		X	Liquefaction Project – foraging and transit habitat present in SNWW. LNG vessel transit routes in the Gulf of Mexico would cross critical habitat (LOGG-S-02, *Sargassum* habitat). Texas Connector – foraging and transit habitat present in SNWW; however, would be avoided by HDD. Louisiana Connector – foraging and transit habitat present in Sabine Lake.	Not Likely to Adversely Affect Concurrence from NMFS received on August 29, 2018; consultation complete.
Hawksbill sea turtle [e, f, g, i, n, o] *Eretmochelys imbricate*	E – JE, CAM	T- JE	X		X		Not Likely to Adversely Affect Concurrence from NMFS received on August 29, 2018; consultation complete.

TABLE 4.7.3-1 (cont'd)

Federally Listed Species Potentially Occurring in the Vicinity of the Projects

Common Name *Scientific Name*	Federal Status[a –] Parish/County[b]	State Status[c–] Parish/County[b]	Project Area Where Species May Occur: Liquefaction	Project Area Where Species May Occur: TX Connector	Project Area Where Species May Occur: LA Connector	Suitable Habitat within Project Area?	Determination of Effect and Comments
Kemp's ridley sea turtle[e, f, g, i, n, o] *Lepidochelys kempii*	E – JE, CAM	E- JE	X		X		Not Likely to Adversely Affect Concurrence from NMFS received on August 29, 2018; consultation complete.
Leatherback sea turtle[e, f, g, i, n, o] *Dermochelys coriacea*	E – JE, CAM	E - JE	X		X		Not Likely to Adversely Affect Concurrence from NMFS received on August 29, 2018; consultation complete.
Loggerhead sea turtle[e, f, i, n, o] *Caretta caretta*	T – JE, CAM CH – Gulf of Mexico	T - JE	X X		X		Not Likely to Adversely Affect (Species) Not Likely to Adversely Affect (Critical Habitat) Concurrence from NMFS received on August 29, 2018; consultation complete.
MARINE/AQUATIC MAMMALS							
West Indian manatee[e, g, i, l] *Trichechus manatus*	T – JE, OR, CAL, CAM	E - CAM	X		X	Liquefaction – foraging and transit habitat present in SNWW. TX Connector – foraging and transit habitat present in SNWW, but would be avoided by HDD. LA Connector – foraging and transit habitat present in Sabine Lake and SNWW; however, SNWW impacts would be avoided via HDD.	Not Likely to Adversely Affect Concurrence from Louisiana FWS received on August 9, 2018; consultation with Texas Coastal Ecological Services Field Office is ongoing.
Sei whale[n, o, p] *Balaenoptera borealis*	E	-	X			Offshore areas of the Gulf of Mexico along the LNG vessel transit routes used for migration and feeding.	Not Likely to Adversely Affect Concurrence from NMFS received on August 29, 2018; consultation complete.
Fin whale[n, o, p] *Balaenoptera physalus*	E	-	X				Not Likely to Adversely Affect Concurrence from NMFS received on August 29, 2018; consultation complete.
Sperm whale[n, o, p] *Physeter microcephalus*	E	-	X				Not Likely to Adversely Affect Concurrence from NMFS received on August 29, 2018; consultation complete.
North Atlantic right whale[n, p] *Eubalaena glacialis*	E		X				Not Likely to Adversely Affect Concurrence from NMFS received on August 29, 2018; consultation complete.
Blue whale[n, p] *Balaenoptera musculus*	E		X				Not Likely to Adversely Affect Concurrence from NMFS received on August 29, 2018; consultation complete.

TABLE 4.7.3-1 (cont'd)

Federally Listed Species Potentially Occurring in the Vicinity of the Projects

Common Name *Scientific Name*	Federal Status[a –] Parish/County[b]	State Status[c–] Parish/County[b]	Project Area Where Species May Occur: Liquefaction	Project Area Where Species May Occur: TX Connector	Project Area Where Species May Occur: LA Connector	Suitable Habitat within Project Area?	Determination of Effect and Comments
Bryde's whale [n, o, p] *Balaenoptera edeni*	P		X				Not Likely to Adversely Affect Concurrence from NMFS received on August 29, 2018; consultation complete.

[a] Federal status includes: Endangered (E), Threatened (T), Proposed (P), Candidate (C), Delisted (DL), Recovery (R), and Critical Habitat (CH).
[b] State status includes: Endangered (E), Threatened (T), and Rare (R).
[c] Parishes/counties include Cameron (CAM), Calcasieu (CAL), Beauregard (BE), Allen (AL), Evangeline (EV), and St. Landry (STL) Parishes, Louisiana; Jefferson (JE) and Orange (OR) Counties, Texas.
[d] Species protected under the MBTA (see section 4.6.1.3).
[e] Species identified by review of FWS Environmental Conservation Online System Information Planning and Conservation (IPaC): **https://ecos.fws.gov/ipac**
[f] Species identified by review of TPWD Annotated County Lists of Rare Species: http://tpwd.texas.gov/gis/rtest/
[g] Species identified as potentially occurring within the Texas Connector Project area by TPWD (letter dated May 9, 2016).
[h] Species identified as potentially occurring within the Liquefaction and Texas Connector Project areas by Texas FWS (letter dated June 8, 2018).
[i] Species identified as potentially occurring within the Louisiana Connector Project area by TPWD (letter dated May 8, 2017).
[j] Based on correspondence from Louisiana FWS (letter dated July 7, 2017 and September 14, 2017 conference call).
[k] Listed on FWS IPaC website as potentially occurring in Orange County and requiring consideration only if the project is wind-related within the migratory route. However, because this species has used large construction areas that are newly cleared/graveled as nesting sites in recent history in Texas, those potential impacts are considered in this section.
[l] Species identified as potentially occurring within the Louisiana Connector Project area by Louisiana FWS (letter dated July 7, 2017).
[m] Species identified as potentially occurring within the Louisiana Connector Project area by LDWF (letter dated June 12, 2017).
[n] Species identified as potentially occurring within the Liquefaction Project area by NMFS (letter dated August 29, 2018).
[o] Species identified by review of NMFS Species and Critical Habitat website: http://sero.nmfs.noaa.gov/protected_resources/section_7/threatened_endangered/index.html
[p] Species also protected under the MMPA (see section 4.7.5).

Potential project-related direct and indirect impacts on piping plovers in the Texas project areas include removal of foraging habitat, noise, and other disturbances that may alter behavior and spatial and temporal distribution of this species. To adequately minimize potential project-related impacts on the piping plover, PAPL and PALNG would implement the following mitigation measures:

- PAPL and PALNG would employ biological monitors to survey the project area prior to construction to ensure no piping plovers are present. If present, PALNG and/or PAPL would notify the FWS office and coordinate specific mitigation. Per our recommendation above, PAPL and/or PALNG would not be authorized to commence or continue with construction until FERC completed any necessary section 7 consultation with the FWS.

- HDD technology would be used on the Texas Connector and Louisiana Connector Projects to avoid impacts on large waterbodies and their shorelines.

- Pipeline corridors would be returned to pre-existing conditions following construction.

- Any temporary lighting associated with the pipeline construction would be restricted to the boundaries of the pipeline corridor and associated staging areas and pointed downwards.

- Any permanent lighting needed for the liquefaction facility and pipeline would be restricted to the boundaries and pointed downward towards these sites. This includes security lighting for the facility and pipeline meter stations, pump stations, or security features.

By letter dated October 30, 2017, PALNG and PAPL, acting as our non-federal representative, determined that the Texas portions of the Projects *may affect, but are not likely to adversely affect* the piping plover. The Texas FWS responded in a June 8, 2018 letter to PALNG that it concurs with this determination. We agree. Thus, section 7 consultation for this species is complete.

4.7.3.2 Red Knot

The red knot is a federally listed threatened shorebird. The red knot migrates annually between its breeding grounds in the Canadian Arctic and several wintering regions, including the Southeast United States, the Northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America (FWS, 2014). Outside of breeding season, it is found primarily in intertidal, marine habitats, especially near coastal inlets, estuaries, and bays (Cornell Lab of Ornithology, 2017). Red knots feed on small clams, mussels, snails and other invertebrates, swallowing their prey whole (FWS, 2005). Red knots may be particularly vulnerable to climate change, which is likely to affect the arctic tundra ecosystem where the red knots breed; coastal habitats due to rising sea levels; food resources throughout the bird's range; and storm and weather patterns (FWS, 2015).

According to FWS county occurrence information, the red knot is known or expected to occur in Jefferson and Orange Counties, Texas and Cameron Parish, Louisiana. During winter, this species could forage along shorelines, herbaceous wetlands, and mudflats within the Texas portions of the Liquefaction, Texas Connector, and Louisiana Connector Projects area. Red knots could transit through the area during construction; however, they likely would avoid the area because of the high level of activity. The Louisiana FWS stated in its July 7, 2017 letter, and in a call on September 14, 2017 that it did not anticipate this species to occur in the Louisiana portions of the Texas Connector or Louisiana Connector Projects, and therefore, would have *no effect* on the species in Louisiana.

Potential project-related direct and indirect impacts on the red knot in the Texas portions of the Projects include removal of potential foraging habitat, noise, and other disturbances that may alter behavior and spatial and temporal distribution of this species. To adequately minimize potential project-related impacts on the red knot, PAPL and PALNG would implement the mitigation measures as discussed above for the piping plover.

By letter dated October 30, 2017, PALNG and PAPL, acting as our non-federal representative, determined that the Texas portions of the Projects *may affect, but are not likely to adversely affect* the red knot. The Texas FWS responded in a June 8, 2018 letter to PALNG that it concurs with this determination. We agree. Thus, section 7 consultation for this species is complete.

4.7.3.3 Least Tern

There are three subspecies of the least tern recognized in the United States (TPWD, n.d.-c). The subspecies are identical in appearance and are segregated on the basis of separate breeding ranges. The Eastern or Coastal Least Tern (*Sterna antillarum antillarum*), which is not federally listed as endangered or threatened, breeds along the Atlantic coast from Maine to Florida and west along the Gulf coast to south Texas. The California Least Tern (*Sterna antillarum browni*), federally listed as endangered since 1970, breeds along the Pacific coast from central California to southern Baja California. The endangered Interior Least Tern (*Sterna antillarum athalassos*) breeds inland along the Missouri, Mississippi, Colorado, Arkansas, Red, and Rio Grande River systems (TPWD, n.d.-c). Although these subspecies are generally recognized, recent evidence indicates that terns hatched on the Texas coast sometimes breed inland. Some biologists speculate that the interchange between coastal and river populations is greater than once thought. Interior least terns breed in the areas noted above, they winter along coastal areas of Central and South America and the Caribbean Islands; however, not a lot is known about their wintering areas (TPWD, n.d.-c). Least terns nest on barren to sparsely vegetated sandbars along rivers, sand and gravel pits, lake and reservoir shorelines, and occasionally gravel rooftops (TPWD, n.d.-c). They hover over and dive into standing or flowing water to catch small fish (TPWD, n.d.-c). Dams, reservoirs, water diversions and other changes to river systems have eliminated most historic least tern nesting habitat (FWS, 2018a). Recreational activities on rivers and sandbars disturb nesting least terns, causing them to abandon their nests (FWS, 2018a).

According to FWS county occurrence information, the least tern is known or expected to occur in Orange County, Texas and need only be considered if the project is wind-related within the migratory route (FWS, n.d.-b). However, based on additional correspondence with the Texas FWS, because natural nesting sites have become scarce, least terns have utilized manmade sites that are newly cleared/graveled (e.g., LNG sites) for nesting in recent history (TPWD, n.d.; FWS, 2018b). Therefore, potential impacts from the construction of the Projects in Jefferson County are also addressed in this section. The Louisiana FWS stated in its July 7, 2017 letter to PAPL and in a call on September 14, 2017 that it did not anticipate this species to occur in the Louisiana portions of the Texas Connector or Louisiana Connector Projects, and therefore, would have *no effect* on the species in Louisiana.

Potential project-related direct and indirect impacts on the least tern in the Texas portions of the Projects include reduced foraging opportunities in areas of elevated sediments where in-water work occurs; direct mortality by construction equipment and nest abandonment due to human disturbance, if nesting birds are present; and other disturbances such as noise and artificial lighting that may alter behavior and spatial and temporal distribution of this species. To adequately minimize potential project-related impacts on the least tern, PAPL and PALNG would implement the mitigation measures committed to for the piping plover and would also install nesting inhibitors (i.e., pennant flagging) in parking areas at the liquefaction site to discourage nesting during construction.

By letter dated October 30, 2017, PALNG and PAPL, acting as our non-federal representative, determined that the Texas portions of the Projects *may affect, but are not likely to adversely affect* the least tern. The Texas FWS responded in a June 8, 2018 letter to PALNG that it concurs with this determination. We agree. Thus, section 7 consultation for this species is complete.

4.7.3.4 Red-cockaded Woodpecker

The red-cockaded woodpecker is federally listed as endangered and state-listed as endangered in Louisiana. Red-cockaded woodpeckers were once considered common throughout the longleaf pine ecosystem, which covered approximately 90 million acres before European settlement (FWS, 2016b). Historical population estimates are 1 million to 1.6 million "groups," the family unit of red-cockaded woodpeckers (FWS, 2016b). The birds historically inhabited the open pine forests of the southeast from New Jersey, Maryland, and Virginia to Florida, west to Texas and north to portions of Oklahoma, Missouri, Tennessee, and Kentucky (FWS, 2016b). The longleaf pine ecosystem initially disappeared from much of its original range because of early (1700s) European settlement, widespread commercial timber harvesting and the naval stores/turpentine industry (1800s) (FWS, 2016b). Early to mid-1900 commercial tree farming, urbanization, and agriculture contributed to further declines. Much of the current habitat is also very different in quality from historical pine forests in which red-cockaded woodpeckers evolved. Today, many southern pine forests are young and an absence of fire has created a dense pine/hardwood forest (FWS, 2016b).

The red-cockaded woodpecker's habitat consists of mature pine forests. Longleaf pines (*Pinus palustris*) are most commonly preferred, but other species of southern pine are also acceptable (FWS, 2016b). Red-cockaded woodpeckers excavate cavities in pine trees for roosting and nesting. While other woodpeckers bore out cavities in dead trees where the wood is rotten and soft, the red-cockaded woodpecker is the only one that excavates cavities exclusively in living pine trees, generally those at least 60 years old (FWS, 2016b). The older pines favored by the red-cockaded woodpecker often suffer from a fungus called red heart disease, which attacks the center of the trunk, causing the inner wood, the heartwood, to become soft. Cavity excavation takes 1 to 6 years (FWS, 2016b).

The aggregate of cavity trees is called a cluster and may include 1 to 20 or more cavity trees on 3 to 60 acres (FWS, 2016b). The average cluster is about 10 acres (FWS, 2016b). Cavity trees that are being actively used have numerous, small resin wells which exude sap (FWS, 2016b). The typical territory for a group ranges from about 125 to 200 acres, but observers have reported territories running from a low of around 60 acres, to an upper extreme of more than 600 acres (FWS, 2016b). The size of a particular territory is related to both habitat suitability and population density (FWS, 2016b).

Foraging habitat is located within 0.5 mile of the cluster and comprises of pine and pine-hardwood stands (i.e., 50 percent or more of the dominant trees are pines) that are at least 30 years of age and have a moderately low average basal area (40 to 80 square feet per acre is preferred) (FWS, 2017a).

Dying and recently dead pines are an important foraging resource for red-cockaded woodpeckers (Ligon, 1968; Hooper and Lennartz, 1981; Schaefer, 1996; Bowman, et al., 1997). Pines infested with or recently killed and vacated by southern pine beetles may be an especially important, though unpredictable, food source in shortleaf and loblolly habitats (Schaefer, 1996). Red-cockaded woodpeckers feed on southern pine beetles themselves, especially pupae in the bark (FWS, 2003). The birds also feed on adults and larvae of secondary attackers to beetle-infested trees, such as long-horned beetles (*Cerambycidae*) and metallic wood-boring beetles (*Buprestidae*) (FWS, 2003).

Potential project-related direct and indirect impacts on the red-cockaded woodpecker include removal of foraging and breeding habitat, noise, and other disturbances that may alter behavior and spatial and temporal distribution of this species.

According to FWS parish occurrence information, the red-cockaded woodpecker is known or expected to occur in Calcasieu, Beauregard, Allen, and Evangeline Parishes, Louisiana. PAPL conducted a habitat assessment for potential nesting and foraging habitat for the red-cockaded woodpecker within the Louisiana Connector Project area based on the habitat criteria included in the FWS' Red-cockaded Woodpecker Recovery Plan. Although no cluster trees or red-cockaded individuals were observed by PAPL during the habitat assessment, potential foraging habitat was identified near MPs 69, 79.5, and 80.2 along the Louisiana Connector Project route. In a letter dated July 7, 2017, the Louisiana FWS requested that PAPL complete surveys for the presence of red-cockaded woodpecker cavity trees within 0.5 mile of any suitable nesting or foraging habitat identified within the project area.

PAPL provided the Louisiana FWS with red-cockaded woodpecker survey results from a previous project at MP 69, which indicated that no cavity trees are present within 0.5 mile of the project area. PAPL met with the Louisiana FWS and LDWF on January 11, 2018, to discuss methodology and the areas that would be surveyed in proximity to MPs 79.5 and 80.2. As a result of the meeting, it was determined that PAPL would conduct surveys for nesting clusters within 0.5 mile of MPs 79.5 and 80.2, excluding areas of recent timber harvest, and also excluding those tracts managed under the Red-cockaded Woodpecker Safe Harbor Agreement with LDWF, as LDWF confirmed there are no known current or historical occurrences of individuals or cavity trees within the Safe Harbor tracts.

PAPL conducted a pedestrian survey on January 19 and 22, 2018, in accordance with the protocol outlined in the FWS 2003 Red-cockaded Woodpecker Recovery Plan. Approximately 43 of the 118 acres proposed for survey were not accessible due to landowner restrictions; however, PAPL observed potential habitat and conducted visual and audible surveys to the extent possible from adjacent property boundaries. No red-cockaded woodpecker individuals were visually or audibly detected, and no cavity trees were observed in the area surveyed. On February 26, 2018, PAPL submitted the results of the surveys (suitable foraging habitat but no individuals or nesting habitat) to the FWS and requested concurrence that the Louisiana Connector Project is *not likely to adversely affect* the red-cockaded woodpecker.

In a letter dated March 21, 2018, the Louisiana FWS confirmed its review of the survey report and concurred that the Louisiana Connector Project is *not likely to adversely affect* the red-cockaded woodpecker. In an e-mail dated February 27, 2018, the LDWF confirmed its review of the survey report and also agreed with the determination made by PAPL for the red-cockaded woodpecker on the Louisiana Connector Project. We agree. Thus, section 7 consultation for this species is complete.

4.7.3.5 American Chaffseed

Federally listed as an endangered plant species, the American chaffseed is a tall perennial herb in the snapdragon family that can be identified by its two-inch-long, purplish-yellow, tubular flowers (FWS, 2016a). The plant, a partial parasite on the roots of other plants, grows to a height of 12 to 24 inches at the time of flowering in the spring. Its leaves are alternate, lance-shaped to elliptic, and its flowers are borne singularly on short stalks (FWS, 2016a). The fruit is a long, narrow capsule enclosed in a sac-like structure (FWS, 2016a). Flowering occurs from April to June in the south and from June to mid-July in the north. Fruits mature from early summer in the south to October in the north (FWS, 2016a).

The American chaffseed grows on "pimple mounds" in the longleaf pine flatwoods of Allen and Beauregard Parishes in southwestern Louisiana (FWS, 2016a). American chaffseed occurs in fire-maintained longleaf pine flatwoods and savannas (FWS, 2017b). Often it is found in transition zones between peaty wetlands and xeric (dry) sandy soils (FWS, 2017b). American chaffseed habitat has been described as open grass-sedge systems in moist acidic sandy loams or sandy peat loams (FWS, 2017b). Historically, this species occurred along the coast from Massachusetts to Louisiana and inland to Kentucky and Tennessee. Currently, this species occurs in seven states along the coast: New Jersey, North Carolina, South Carolina, Georgia, Alabama, Florida, and Louisiana (FWS, 2017b). A major threat to this species is the decline in prescribed burning throughout the Atlantic and Gulf coasts (FWS, 2016a).

According to FWS county occurrence information, the American chaffseed is known or expected to occur in Beauregard and Allen Parishes, Louisiana. PAPL conducted pedestrian surveys for American chaffseed individuals during the flowering period within potentially suitable habitat where access was granted; no individuals were found. Additional surveys are pending where it appears appropriate habitat may be present, but complete survey access has not been granted. Because the American chaffseed may be present in these unsurveyed areas, **we recommend that:**

- **<u>Prior to construction of the Louisiana Connector Project</u>, PAPL should conduct surveys for the American chaffseed on the no-access parcels with potential habitat and file the results of the survey with the Secretary and the FWS. If the American chaffseed is found, PAPL should incorporate methods to avoid impacts on the American chaffseed. Any proposed avoidance methods should be filed with the Secretary and the Louisiana FWS.**

Based on the results of surveys conducted to date and our recommendation to avoid impacts on any plants discovered during surveys, we conclude that the Louisiana Connector Project *may affect, but is not likely to adversely affect* the American chaffseed. As per our previous recommendation in section 4.7.3, if surveys discover this species and indicate that the Louisiana Connector Project is likely to adversely affect the American chaffseed, FERC would complete formal consultation with the FWS prior to authorizing construction of the pipeline.

4.7.3.6 Giant Manta Ray

Federally listed as a threatened fish species, the giant manta ray is found worldwide in tropical, subtropical, and temperate bodies of water and is commonly found offshore, in oceanic waters, and near productive coastlines (NMFS, n.d.-d). The giant manta ray is a migratory species and a seasonal visitor along productive coastlines with regular upwelling, in oceanic island groups, and near offshore pinnacles and seamounts. The timing of these visits varies by region and seems to correspond with the movement of zooplankton, current circulation and tidal patterns, seasonal upwelling, seawater temperature, and possibly mating behavior (NMFS, n.d.-d). The most significant threat to the giant manta ray is overutilization for commercial purposes. Giant manta rays are both targeted and caught as bycatch in a number of global fisheries throughout their range (NMFS, n.d.-d).

Giant manta rays inhabit the Gulf of Mexico and are known to congregate in the Flower Garden Banks National Marine Sanctuary approximately 130 miles off the coast of Texas. This species is more surface-oriented than most fish, and the increased traffic within the Gulf of Mexico due to LNG vessel transit to and from the liquefaction site could pose an increased risk to the giant manta ray from vessel strikes (NMFS, 2018). However, the proposed action is estimated to result in an increase of 0.038 percent of overall shipping transits throughout the Gulf of Mexico. Therefore, the potential for the increased vessel traffic to result in an increase in giant manta ray vessel strikes is highly unlikely, and therefore, discountable (NMFS, 2018).

In an August 29, 2018 letter, the NMFS determined that because PALNG would adhere to the NMFS-issued mitigation guidelines for vessel strikes, the Liquefaction Project *may affect, but is not likely to adversely affect* the giant manta ray. We agree. Thus, section 7 consultation for this species is complete.

4.7.3.7 Sea Turtles

Sea turtles are found throughout the tropical and subtropical seas of the world where they occur at or near the surface of the water. All species found in U.S. waters are listed as threatened or endangered under the ESA and are under the shared jurisdiction of the FWS and NMFS (NMFS, 2017c). The major threats to sea turtle populations are destruction and alteration of nesting and feeding beaches, incidental capture in commercial and recreational fisheries, entanglement in marine debris, and vessel strikes (NMFS, 2017c).

Five species of federally listed sea turtles could occur within the SNWW, Sabine Lake, and along the LNG vessel transit routes in the Gulf of Mexico, including the green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. Suitable nesting habitat for sea turtles is not available near the Liquefaction Project area, and sea turtles have not been documented in the upstream area of Port Arthur Canal where the Liquefaction facility would be constructed (NMFS, 2018). Further, the highly altered habitat conditions in this portion of Port Arthur Canal do not support the features necessary for sea turtle foraging (e.g., sea grasses or prey species) (NMFS, 2018). Therefore, the following discussion is specific to the portion of the Texas Connector Project that crosses the SNWW via HDD, the portion of the Louisiana Connector Project within Sabine Lake,[26] and the LNG vessel transit routes in the Gulf of Mexico that would be used during operation of the liquefaction site. In addition, the LNG vessel transit routes would cross designated critical habitat for the loggerhead sea turtle. Species-specific discussions are presented below.

Green Sea Turtle

The green sea turtle is federally listed as threatened (North Atlantic and South Atlantic Distinct Population Segments) (NMFS, 2018). 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, 2016a). Adult females migrate from foraging areas to mainland or island nesting beaches and may travel hundreds or thousands of kilometers each way (NMFS, 2016a). 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 (NMFS, 2016a). Once the juveniles reach a certain age/size range, they leave the pelagic habitat and travel to nearshore foraging grounds (NMFS, 2016a). Once they move to these nearshore benthic habitats, adult green turtles are almost exclusively herbivores, feeding on sea grasses and algae (NMFS, 2016a). Suitable nesting habitat for this species is not available near the Texas Connector and Louisiana Connector Projects area; however, green sea turtles could potentially occur within the SNWW and Sabine Lake during foraging and along the LNG vessel transit routes in the Gulf of Mexico.

Atlantic Hawksbill Sea Turtle

The Atlantic hawksbill sea turtle is federally listed as endangered. Hawksbills frequent rocky areas, coral reefs, shallow coastal areas, lagoons or oceanic islands, and narrow creeks and passes. They are seldom seen in water deeper than 65 feet (FWS, 2018c). Hatchlings are often found floating in masses of sea plants, and nesting may occur on almost any undisturbed deep-sand beach in the tropics (FWS, 2018c). Adult females can climb over reefs and rocks to nest in beach vegetation (FWS, 2018c). Hawksbill sea turtles prefer to feed on sponges and other invertebrates, and algae (NMFS, 2014). Suitable nesting habitat for this species is not available near the Texas Connector and Louisiana Connector Projects area; however,

26 The portion of Louisiana Connector Project that would cross Port Arthur Canal via HDD occurs near the proposed Liquefaction Project facility and, therefore, is not suitable habitat for sea turtles.

Atlantic hawksbill sea turtles could potentially occur within the SNWW and Sabine Lake during foraging and along the LNG vessel transit routes in the Gulf of Mexico.

Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle is the smallest of the sea turtles found in the Gulf of Mexico and is federally listed as endangered. Adult and sub-adult habitat consists primarily of neritic zones, which typically contain muddy or sandy bottoms where prey can be found (NMFS, 2017d). Their diet consists mainly of swimming crabs, but may also include fish, jellyfish, and an array of mollusks (NMFS, 2017d). Newly emerged hatchlings inhabit a much different environment than adult turtles (NMFS, 2017d). After emerging from the nest, hatchlings enter the water and must swim quickly to escape nearshore predators (NMFS, 2017d). Juveniles of many species of sea turtles have been known to associate with floating *Sargassum* seaweed, using the *Sargassum* as an area of refuge, rest, and/or food (NMFS, 2017d). In a study conducted between 2004 and 2007, immature Kemp's ridley sea turtles were tracked to document their movement patterns, primarily during warmer months. The results showed the turtles exhibited preferences for tidal passes, bays, coastal lakes, and nearshore waters, including documentation of an immature Kemp's ridley sea turtle in Sabine Lake in 2007 (Seney and Landry, 2011). Although nesting occurs mainly in Mexico from May to July, Kemp's ridley sea turtles also nest in small numbers along the Gulf Coast, mostly in southern Texas (NMFS, 2017d). Suitable nesting habitat for this species is not available near the Texas Connector and Louisiana Connector Projects area; however, Kemps' ridley sea turtles could potentially occur within the SNWW and Sabine Lake during foraging, and along the LNG vessel transit routes in the Gulf of Mexico.

Leatherback Sea Turtle

The leatherback sea turtle is federally listed as endangered. Leatherbacks are the most migratory and wide ranging of sea turtle species. They are commonly known as pelagic (open ocean) animals, but they also forage in coastal waters (NMFS, 2016b). They feed mainly on jellyfish, salps, and pyrsomes, and mate in the waters adjacent to nesting beaches and along migratory corridors (NMFS, 2016b). Found worldwide, their primary nesting beaches in the Atlantic are on the northern coast of South America and at various locations around the Caribbean. A few nest in Florida and on the Gulf of Mexico coastline in Mexico (National Park Service [NPS], 2015). One leatherback nest was found at Padre Island National Seashore in 2008 (NPS, 2015). Prior to this, the most recent nesting records in Texas were from the 1920s and 1930s at what later became Padre Island National Seashore (NPS, 2015). The Padre Island National Seashore, which is approximately 250 miles from the Projects area, is the only location in Texas where leatherback nests have been recorded (NPS, 2015). After nesting, female leatherbacks migrate from tropical waters to more temperate latitudes, which support high densities of jellyfish prey in the summer (NMFS, 2016b). Suitable nesting habitat for this species is not available near the Texas Connector and Louisiana Connector Projects area; however, leatherback sea turtles could potentially occur within the SNWW and Sabine Lake during foraging and along the LNG vessel transit routes in the Gulf of Mexico.

Loggerhead Sea Turtle

The loggerhead sea turtle is federally listed as threatened. Loggerheads nest on ocean beaches, generally preferring high energy, relatively narrow, steeply sloped, coarse-grained beaches (NMFS, 2017e). Immediately after hatchlings emerge from the nest, they move to the surf, swim, and are swept through the surf zone, and continue swimming away from land for up to several days (NMFS, 2017e). Post-hatchling loggerheads take up residence in areas where surface waters converge to form local downwellings. These areas are often characterized by accumulations of floating material, such as seaweed (for example, *Sargassum* sp.) (NMFS, 2017e). Loggerheads feed on hard-shelled prey such as whelks and conch (NMFS, 2017e). Somewhere between 7 to 12 years old, oceanic juveniles migrate to nearshore coastal areas (neritic zone) and continue maturing until adulthood (NMFS, 2017e). To a large extent, these habitats overlap with the juvenile stage, the exception being most of the bays, sounds, and estuaries along the Atlantic and Gulf coasts of the United States from Massachusetts to Texas, which are infrequently used by adults (NMFS, 2017e). Suitable nesting habitat for this species is not available near the Texas Connector and Louisiana Connector Projects area; however, loggerhead sea turtles could potentially occur within the SNWW and Sabine Lake during foraging and along the LNG vessel transit routes in the Gulf of Mexico. Designated critical habitat for the loggerhead sea turtle is discussed separately below.

Sea Turtle Species Impacts and Mitigation

As noted above, no suitable nesting habitat for sea turtles is present at the Texas Connector or Louisiana Connector Projects area or LNG vessel transit routes, although some foraging and transit habitat for these species is present within these areas.

Potential impacts on sea turtles related to construction of the Texas Connector Project would be associated with the portion of the project that crosses the SNWW via HDD, and impacts on sea turtles related to construction of the Louisiana Connector Project would be associated with Sabine Lake. Potential construction-related impacts would include increased turbidity due to dredging, increased vessel traffic, inadvertent release of drilling mud, and inadvertent spills of hazardous materials. These potential impacts are further discussed in section 4.6.2.2.

An increase in turbidity would be produced by the placement of the Louisiana Connector Project pipeline across Sabine Lake, but this impact would be localized and temporary. Sediment would likely be deposited immediately adjacent to the trench, potentially affecting benthic habitat along the construction corridor. This disturbance could increase the levels of stress, injury, and mortality of benthic species that may serve as food for sea turtles. However, any effects on sea turtles or their foraging success would be insignificant as these benthic-dwelling species are acclimated to high turbidity levels and frequent disturbance due to the dynamic nature of Sabine Lake (i.e., currents, wave/tidal action, and storm frequency) (NMFS, 2018). Further, these natural forces would be expected to redistribute the disturbed sediments, quickly restoring the natural equilibrium of the lakebed.

Sea turtles are highly mobile and would be expected to move away from construction activities (NMFS, 2018). During in-water construction in Sabine Lake, PAPL would follow the *Sea Turtle and Smalltooth Sawfish Construction Conditions* (NMFS, 2006b) to reduce the risk of sea turtles being injured or killed by construction equipment or vessels.

In the event of an inadvertent release during HDD activities, PAPL would implement the corrective action and cleanup measures outlined in its Inadvertent Release Plan to minimize potential impacts on aquatic resources, the use of temporary dams to isolate the drilling fluid and vacuum trucks to remove the released drilling mud.

The increased traffic within the SNWW, Sabine Pass, and Gulf of Mexico due to LNG vessel transit to and from the liquefaction site could pose an increased risk to sea turtles from vessel strikes (NMFS, 2016c). Vulnerability to collision with an LNG vessel would be greatest while sea turtles feed, swim, and rest near the surface of the water. LNG vessels operating within the U.S. EEZ in the Gulf of Mexico are generally slower and generate more noise than typical large vessels and would be more readily avoided by sea turtles (NMFS, 2016c; 2018). Additionally, LNG vessels push a considerable bow wave when underway on the open ocean because of their design and large displacement tonnage. This wave pushes water, flotsam, and other small objects (such as sea turtles) away from the vessel (NMFS, 2006a). LNG transit vessels (LNG vessels and LNG barges) would also use well-traveled shipping lanes. In total, LNG transit vessels could make up to 180 trips to the liquefaction facility per year (approximately 3 to 4 carriers per week), which would result in an estimated increase of 0.038 percent of overall shipping transits throughout the Gulf of Mexico (NMFS, 2018). When compared to the annual large vessel traffic to the local ports in the vicinity of the proposed liquefaction site (i.e., Galveston Bay, Sabine Pass, and Calcasieu Pass), the increase in vessel traffic associated with operation of the Liquefaction Project would result in an estimated increase of 0.3 percent in the local area (NMFS, 2018). Based on this, the potential for vessel traffic associated with operation of the Liquefaction Project to result in an increase in sea turtle vessel strikes is highly unlikely, and therefore, discountable (NMFS, 2018).

To further minimize the potential for vessel strikes, PALNG would provide LNG ship captains with the NMFS-issued document entitled *Vessel Strike Avoidance Measures and Reporting for Mariners* (NMFS, 2008), which outlines collision avoidance measures. In addition, although the likelihood of a fuel spill or release of hazardous materials at sea would be extremely remote, the carrier would implement spill prevention procedures and clean-up measures (see appendix F).

PALNG, acting as our non-federal representative, determined that based on the sea turtles' characteristics and habitat requirements; and because PALNG and PAPL would adhere to the NMFS-issued mitigation guidelines for vessel strikes and in-water construction noted above; and would implement spill prevention procedures and clean-up measures, the Liquefaction Project and Texas Connector and Louisiana Connector Projects *may affect, but are not likely to adversely affect* the green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. The NMFS responded on August 29, 2018, that it concurs with this determination (NMFS, 2018). We agree. Thus, section 7 consultation for these species is complete.

Loggerhead Sea Turtle – Designated Critical Habitat

On August 11, 2014, the NMFS issued a final rule designating critical habitat for the Northwest Atlantic Ocean Distinct Population Segment of the loggerhead sea turtle within the Atlantic Ocean and the Gulf of Mexico (79 FR 39855). Specific areas for designation include 38 occupied marine areas within the range of the Northwest Atlantic Ocean Distinct Population Segment. These areas contain one or a combination of habitat types: nearshore reproductive habitat, winter area, breeding areas, constricted migratory corridors, and/or *Sargassum* habitat. The LNG vessel transit routes in the Gulf of Mexico would cross the *Sargassum* habitat type.

The NMFS describes the physical or biological features of loggerhead *Sargassum* habitat as developmental and foraging habitat for young loggerheads where surface waters form accumulations of floating material, especially *Sargassum*. The NMFS has identified the following primary constituent elements as habitat features necessary to support *Sargassum* habitat (79 FR 12572):

(i) Convergence zones, surface-water downwelling areas, the margins of major boundary currents (Gulf Stream), and other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads.

(ii) *Sargassum* in concentrations that support adequate prey abundance and cover.

(iii) Available prey and other material associated with *Sargassum* habitat including, but not limited to, plants and cyanobacteria and animals native to the *Sargassum* community such as hydroids and copepods.

(iv) Sufficient water depth and proximity to available currents to ensure offshore transport (out of the surf zone), and foraging and cover requirements by *Sargassum* for post-hatchling loggerheads, i.e., greater than 10 meters depth.

The increase in vessel traffic associated with the Liquefaction Project may affect primary constituent elements (ii) and (iii) of loggerhead critical habitat (NMFS, 2018). Although the LNG transit vessels could drive through the *Sargassum*, the vessel tracks resulting from these activities are not expected to scatter *Sargassum* mats or the organisms within those mats to the point of affecting the functionality of the loggerhead critical habitat primary constituent elements (NMFS, 2018). The wakes and surface water disruption associated with the vessels may temporarily disturb *Sargassum* mats; however, any potential disturbance would not be expected to result in measurable effects to the distribution, size, or composition of mats or their ability to support loggerheads or their prey resources (NMFS, 2018).

PALNG, acting as our non-federal representative, determined that the increased LNG vessel traffic associated with operation of the Liquefaction Project *may affect, but is not likely to adversely affect* designated loggerhead turtle critical habitat. The NMFS responded on August 29, 2018, that it concurs with this determination (NMFS, 2018). We agree. Thus, section 7 consultation for loggerhead critical habitat is complete.

4.7.3.8 West Indian Manatee

The West Indian manatee is federally listed as threatened. Manatees live in marine, brackish, and freshwater systems in coastal and riverine areas throughout their range (FWS, 2017c). Preferred habitats include areas near the shore featuring underwater vegetation like seagrass and eelgrass. Manatees feed along grass bed margins with access to deep water channels, where they flee when threatened (FWS, 2017c). Manatees can be found throughout Florida for most of the year (FWS, 2017c). However, they cannot tolerate temperatures below 68 °F for extended periods of time, and during the winter months these cold temperatures keep the population concentrated in peninsular Florida (FWS, 2017c). During the summer manatees expand their range, and on rare occasions are seen as far north as Rhode Island on the Atlantic coast and as far west as Texas on the Gulf coast (FWS, 2017c). Manatees may travel hundreds of miles during a year's time, preferring to travel along channels and shorelines (FWS, 2017c).

Manatees are extremely rare in Texas although near the turn of the 19^{th} - 20^{th} century they apparently were not uncommon in the Laguna Madre (Davis and Schmidly, 1994). Texas records also include specimens from Cow Bayou, near Sabine Lake, Copano Bay, the Bolivar Peninsula, and the mouth of the Rio Grande River (Davis and Schmidly, 1994). In 2012, multiple manatees were observed near Galveston, Texas (Rice 2012). The greatest threats to manatee survival are collisions with boats and, in Florida, loss of warm water habitat (FWS, 2008b). The manatee often rests suspended just below the water's surface with only the snout above water, leaving it vulnerable to encounters with boats (FWS, 2008b).

The West Indian manatee was identified as potentially occurring in Jefferson and Orange Counties, Texas and Calcasieu and Cameron Parishes, Louisiana (FWS, n.d.-a; n.d.-b; 2017d). Although their presence within the Liquefaction and Louisiana Connector Projects area is unlikely, increased traffic within the SNWW due to LNG vessel transit to and from the liquefaction site, and increased vessel traffic and in-water work required to install the Sabine Lake portion of the Louisiana Connector Project could pose an increased risk to manatees from vessel strikes. As described in section 4.7.3.5, PALNG would provide LNG vessel captains with a NMFS-issued guidance document that outlines collision avoidance measures to minimize impacts on manatee from vessel strikes.

In a letter dated July 7, 2017, regarding the Louisiana Connector Project, the Louisiana FWS provided the following recommendations to minimize impacts on the West Indian manatee, which PAPL has agreed to implement for the Louisiana Connector Project:

- During in-water work in areas that potentially support manatees, all personnel associated with the project should be instructed about the potential presence of manatees, manatee speed zones, and the need to avoid collisions with and injury to manatees. All personnel should be advised that there are civil and criminal penalties for harming, harassing, or killing manatees, which are protected under the MMPA of 1972 and the ESA. Additionally, personnel should be instructed not to attempt to feed or otherwise interact with the animal, although passively taking pictures or video would be acceptable.

- All on-site personnel would be responsible for observing water-related activities for the presence of manatees. The following measures are recommended to minimize potential impacts to manatees in areas of their potential presence:

  - All work, equipment, and vessel operation should cease if a manatee is spotted within a 50-foot radius (buffer zone) of the active work area. Once the manatee has left the buffer zone on its own accord (manatees must not be herded or harassed into leaving), or after 30 minutes have passed without additional sightings of manatees in the buffer zone, in-water work can resume under careful observation for manatees.

  - If a manatee is sighted in or near the project area, all vessels associated with the project should 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 four-foot clearance from the bottom. Vessels should follow routes of deep water whenever possible.

  - If used, siltation or turbidity barriers should be properly secured, made of material in which manatees cannot become entangled, and be monitored to avoid manatee entrapment or impeding their movement.

  - Temporary signs concerning manatees should be posted prior to and during all in-water project activities and removed upon completion. Each vessel involved in construction activities should display at the vessel control station or in a prominent location, visible to all employees operating the vessel, a temporary sign (at least 8.5 by 11 inches) reading language similar to the following: "CAUTION BOATERS: MANATEE AREA/IDLE SPEED IS REQUIRED IN CONSTRUCTION AREA AND WHERE THERE IS LESS THAN FOUR FOOT BOTTOM CLEARANCE WHEN MANATEE IS PRESENT." A second temporary sign measuring 8.5 by 11 inches should be posted at a location prominently visible to all personnel engaged in water-related activities and should read language similar to the following: "CAUTION: MANATEE AREA/EQUIPMENT MUST BE SHUTDOWN IMMEDIATELY IF A MANATEE COMES WITHIN 50 FEET OF OPERATION."

  - Collisions with, injury to, or sightings of manatees should be reported immediately to the Louisiana FWS ([337] 291-3100) and the LDWF, Natural Heritage Program ([225] 765-2821). Provide the nature of the call (report of an incident, manatee sighting, etc.); time of the incident/sighting; and the approximate location, including the latitude and longitude coordinates, if possible.

PALNG and PAPL, acting as our non-federal representative, determined that the Liquefaction Project and Louisiana Connector Project *may affect, but are not likely to adversely affect* the West Indian manatee. The Louisiana Ecological Services Field Office of the FWS responded on August 9, 2018, that it concurs with this determination (FWS, 2018e). We agree with the conclusion of the Louisiana Ecological

Services Field Office. Consultation with the Texas Coastal Ecological Services Field Office is ongoing for the West Indian manatee.

4.7.3.9 Whales

Whales are long-lived marine mammals that occur throughout the world's oceans. They can be divided into two main groups: toothed whales and baleen whales. Feeding morphology and prey are the major differences between these groups. Many species of whales migrate extremely long distances to take advantage of seasonal food resources or calm wintering grounds for rearing young. Whales generally utilize warm tropical waters during winter months when the polar seas are cold and ice covered, though some species will stay in these regions year-round. Whales could use the offshore areas of the Gulf of Mexico along the LNG vessel transit routes for migration and feeding. Given the lack of impacts on marine habitat from the Texas Connector and Louisiana Connector Projects, the following discussion is specific to the LNG vessel traffic associated with operation of the Liquefaction Project.

The sperm whale is a toothed whale that inhabits the deeper waters of the world's oceans throughout the year, where they feed primarily on squid and other deep-sea creatures (NMFS, 2017f). Migrations are not as distinct as other species and are thought to primarily follow food resources (NMFS, 2017f). Sperm whales are present in the northern Gulf of Mexico in all seasons, but are more common during the summer months (NMFS, 2017f). The sperm whale is the only federally listed whale that is known to commonly occur in the Gulf of Mexico (NMFS, 2017f).

The baleen whales, including the fin, sei, North Atlantic right, blue, and Bryde's whales are identified by NMFS as occurring within the southeast region (NMFS, 2012; 2018). With the exception of the Bryde's whale, these whales are not commonly found in the Gulf of Mexico, but could occur within the area during migrations or other movements (NMFS, 2015b; 2015c). Feeding is not expected in or around the Gulf of Mexico as these species usually feed on zooplankton and small fish aggregations during summer months in the northern Atlantic Ocean or off the U.S. West Coast (NMFS, 2015b; 2015c; NMFS n.d.-e). The Bryde's whale has a wide distribution and occur in tropical, subtropical, and warm temperate waters around the world. Some populations of Bryde's whales migrate with the seasons, moving away from the equator during the summer and towards the equator during the winter (NMFS, n.d.-f). The Gulf of Mexico Bryde's whale has been consistently located in the northeastern Gulf of Mexico, along the continental shelf break between 100 and 400 meters depth. They are the only resident baleen whale in the Gulf of Mexico (NMFS, n.d.-g). Bryde's whales in the Gulf of Mexico are distinct from other Bryde's whales worldwide in that they are vulnerable to many stressors and threats, including vessel strikes, ocean noise, and whaling outside the United States. The Gulf of Mexico subspecies is also threatened by oil and gas activities, as well as oil spills and cleanup. Scientists believe that there are fewer than 100 Gulf of Mexico Bryde's whales (NMFS, n.d.-g).

The increased traffic within the Gulf of Mexico due to LNG vessel transit to and from the liquefaction site could pose an increased risk to whales from vessel strikes, and impacts would be similar to those discussed for sea turtles in section 4.7.3.7. According to NMFS, the sperm whale is the most abundant whale occurring in the Gulf of Mexico, and is the only whale with a measurable injury rate due to vessel strikes in the area. Based on data compiled from the International Whaling Commission Ship Strike Database (International Whaling Commission, 2014), and supplemented with data from Carillo and Ritter (2010), there is an estimated average of two sperm whale strikes per year throughout the entire Gulf of Mexico, with total annual ship transits of approximately 964,316 trips. As noted in section 4.7.3.7, LNG transit vessels could make up to 180 round trips to the liquefaction facility per year (totaling 360 one-way trips per year). This would result in an average of 0.000747 sperm whale strikes per year, or one sperm whale every 1,321 years (NMFS, 2018). Given that the life of the proposed facility is estimated at 50 years, the potential for the proposed action to result in a sperm whale strike in the Gulf of Mexico is highly unlikely, and would be even less likely for the other whale species in the area and is therefore discountable

(NMFS, 2018). Further, PALNG proposes to provide LNG ship captains with a NMFS-issued guidance document that outlines collision avoidance measures to be implemented to minimize the likelihood of a vessel strike.

In an August 29, 2018 letter, the NMFS determined that because the potential effects to federally listed and proposed whales would be discountable, and because PALNG would adhere to the NMFS-issued mitigation guidelines for vessel strikes, the Liquefaction Project *may affect, but is not likely to adversely affect* federally listed and proposed whales. We agree. Thus, section 7 consultation for these species is complete.

4.7.4 State-Listed and Special Status Species

PALNG and PAPL consulted with Texas and Louisiana state resource agencies to identify state-listed and special status species that could potentially occur within the Projects area. State-listed species that are also federally listed are discussed in section 4.7.1 and are not discussed again in this section.

Appendix P describes the range and habitat where state-listed and special status species are typically found. Most impacts on state-listed and special status species are a function of the type of habitat disturbed (habitat association), the length of time necessary for important habitat characteristics to be restored, species mobility, species dependence on specific habitat features, or species disturbance tolerance. Of the species listed in appendix P, eight are not expected to be affected by the Projects because suitable habitat does not exist in the Projects area, there would not be a direct impact on the species' forage species, and/or there are no roosting/breeding sites in the Projects area. These species are marked (*) and are not discussed further in this section.

4.7.4.1 Texas

As shown in appendix P, PALNG and PAPL's consultations with TPWD regarding review of the Liquefaction and Texas Connector Projects for potential impacts on species and resources of concern identified 18 state-listed threatened and endangered species (6 birds, 1 mammals, 4 reptiles, 6 mussels, 1 fish), and 16 state rare species (5 birds, 2 mammals, 1 reptile, 1 invertebrate, 4 plants, 2 fish, and 1 amphibian) that may occur within the projects area in Texas (TPWD, 2016; 2017d). PALNG and PAPL did not observe any of these state-listed threatened, endangered, or rare species during surveys.

The Texas portion of the Louisiana Connector Project would be limited to workspace associated with the HDD, beginning within the proposed liquefaction site (which would largely be cleared of vegetation, converted to mixed industrial use, prior to construction of the Louisiana Connector Project) and exiting in Sabine Lake. Therefore, no impacts on the state-listed species identified by the TPWD (TPWD, 2017e) are anticipated, and the Texas portion of the Louisiana Connector Project is not discussed further in this section.

To mitigate for potential impacts on state-listed species, PALNG and PAPL would educate workers on all sensitive habitats and wildlife species prior to construction. PALNG and/or PAPL (specified below) have committed to the following measures to minimize impacts on Texas state-listed threatened and endangered species as a result of the Liquefaction and/or Texas Connector Projects:

- Birds (see section 4.6.1.3 for additional discussion of migratory birds)
    - Whenever possible, PALNG and PAPL would construct within state-listed bird habitat outside the primary nesting season (February 1 to July 15).
    - For any activities occurring within the nesting season, PALNG and PAPL would employ a biological monitor to survey suitable habitat prior to construction.

- Any state-listed birds identified foraging within the project area would not be disturbed and would be allowed to leave the project area on their own volition before project activities would be allowed to commence.

- In accordance with TPWD recommendations, if any state-listed species nests are identified during pre-construction surveys, a buffer (100 meters for raptors, 25 feet for all other birds) would be applied to the nest, and project activities would not be allowed within the buffer until after the young have fledged.

- Rafinesque's big eared bat –

  - PALNG and PAPL would attempt to perform any tree clearing outside of the young-rearing period (May – October). If clearing outside of this period is not possible, PAPL would employ a qualified biologist to survey suitable habitat within the Texas Connector Project area and flag any tree cavities. If suitable habitat is identified, PAPL would conduct species-specific surveys in accordance with TPWD recommendations. If the Rafinesque's big-eared bat is determined to be present within the project area, PAPL would maintain a 100-foot buffer around the suitable habitat and would not conduct activities within this buffer until after the pups have left the roost.

- Alligator snapping turtle –

  - If alligator snapping turtles are observed by PALNG or PAPL, they would not be disturbed and would be allowed to leave the project area on their own.

- Northern scarlet snake and timber rattlesnake –

  - PAPL would employ a biological monitor to survey suitable habitat prior to construction. If northern scarlet snakes or timber rattlesnakes are found, they would be allowed to leave the site safely on their own, or would be transported by a permitted individual approximately 100 to 200 yards away, and not to exceed 1 mile from the initial encounter location.

- Mussels –

  - TPWD recommended that habitat for state-listed mussel species be protected and recommended that potentially impacted waterways within the range of state-listed mussels be assessed for rare mussel habitat; and if suitable habitat is identified, mussel surveys should be conducted if construction would be conducted in waters associated with mussels (TPWD, 2016; 2017a). PAPL conducted a desktop habitat assessment for mussels in the Texas Connector Project area and has committed to crossing suitable mussel habitat via HDD or push-pull methods. In an e-mail dated November 13, 2017, TPWD concurred with PAPL's desktop habitat assessment and agreed that utilization of the HDD or push-pull method in conjunction with an HDD contingency plan and SWPPP would adequately minimize potential impacts on state-listed mussel species (TPWD, 2017f). As is discussed in section 4.3.2.2, in accordance with the Commission's Procedures, PAPL is required to provide a contingency plan for each crossing in the event the HDD is unsuccessful and how the abandoned drill hotel would be sealed, if necessary. PAPL prepared a preliminary HDD Contingency Plan that describes measures PAPL would implement in the event of the HDD is unsuccessful. PAPL stated that it would finalize the HDD Contingency Plan with the selected contractor and the final plan would be incorporated into construction compliance documents. In addition, and also further discussed in section 4.3.2.2, to minimize surface water impacts, PAPL would implement the construction and mitigation measures described in PAPL's *Environmental Plan*, which includes the Commission's Procedures.

To mitigate for potential impacts on state rare species, PALNG and PAPL would educate workers on all sensitive habitats and wildlife species prior to construction. PALNG and/or PAPL (project specified below) have committed to the following measures to minimize impacts on Texas state rare species:

- Birds –
  - PALNG and PAPL would implement the same measures noted above for state-listed birds.
- Southeastern myotis bat –
  - Although suitable roosting habitat is not anticipated in the Liquefaction and Texas Connector Projects area, PALNG and PAPL would attempt to clear trees outside of the young-rearing period for this species. If that were not possible, PAPL would implement the same measures as noted above for the Rafinesque's big-eared bat.
- Plains spotted skunk –
  - If any plains spotted skunks are observed during the Liquefaction or Texas Connector Projects, they would be undisturbed and allowed to leave the Project area safely.
- Texas diamondback terrapin –
  - If the Texas diamondback terrapin is observed, PALNG and PAPL would protect them with buffers until they leave the area or could be safely relocated by a permitted individual.
- Bay skipper –
  - Any bay skippers observed would be allowed to leave the Texas Connector Project area safely on their own.
- Southern crawfish frog –
  - Any southern crawfish frogs observed by PAPL during construction would be allowed to leave the project area safely on their own.
- American eel –
  - PALNG and PAPL would implement a variety of measures to minimize impacts on aquatic habitats and the species that use them (which would include eels), such as: utilizing the HDD crossing method at numerous waterbodies, installation of erosion and sediment controls, and implementing restoration measures identified in PALNG and PAPL's *Environmental Plans*. These measures are further discussed in sections 4.6.2.2 and 4.6.3.

4.7.4.2 Louisiana

According to the LDWF, no impacts on rare, threatened, or endangered species or critical habitats within Louisiana's boundaries are anticipated for the Louisiana portion of the Texas Connector Project (LDWF, 2016). PAPL's consultation with the LDWF regarding review of the Louisiana portion of the Louisiana Connector Project for potential impacts on species and resources of concern identified nine rare species (one bird, one mussel, one crustacean, and six plants) that may occur within the project area (LDWF, 2017b). None of the rare species identified by the LDWF were observed during field surveys. As noted in appendix P, suitable habitat for the sandbank pocketbook occurs within Whiskey Chitto Creek; however, impacts on this species would be minimized by use of the HDD crossing method at this waterbody.

The LDWF recommended that PAPL use BMPs to minimize impacts on the crested caracara and recommended that PAPL protect habitat for the old prairie crawfish by avoiding disturbances such as water pollution, siltation, and the construction of dams. While PAPL has not developed any project-specific BMPs for this purpose, it would implement its *Environmental Plan* to minimize impacts on habitats crossed by the Louisiana Connector Project. Although the LDWF did not provide specific recommendations for the six rare plant species identified as potentially occurring in the Louisiana Connector Project area, PAPL has stated that it would further consult with LDWF prior to construction to determine if additional surveys for rare plant species would be necessary.

4.7.4.3 General Impacts and Mitigation

Impacts on state-sensitive species would typically be similar to those described for general vegetation communities and wildlife populations, as discussed in sections 4.5 and 4.6, respectively; migratory birds, as discussed in section 4.5.3; and aquatic species, as discussed in section 4.6.1.3. Terrestrial wildlife, such as mammals, reptiles, amphibians, and invertebrates could be subject to mortality or displacement during clearing and could lose habitat within the Projects area. Birds could be affected by loss of nesting or foraging habitat during clearing for the Projects, and they could be disturbed by human activity. Sensitive plants could also be lost during clearing and grading, and adjacent suitable habitat degraded due to changes in hydrology, soil compaction, or light, among other factors. Fish and freshwater mussel species could be affected by increased suspended sediment and turbidity levels and decreased dissolved oxygen levels within and downstream of the crossing location. 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. Construction activities could also introduce or encourage the spread of invasive and noxious plant species, further degrading suitable habitat for plants and wildlife species.

The generalized impacts described above would largely be avoided or adequately minimized through implementation of the PALNG and PAPL's proposed measures and additional measures that we recommend. PALNG and PAPL would implement the measures outlined in its *Environmental Plan*, which includes the Commission's Plan and Procedures, to minimize impacts on waterbodies and aquatic resources during pipeline construction. These mitigation measures include reduced workspace areas near waterbodies, establishing buffers to prevent run-off from entering waterbodies, installing erosion control devices, and completion of instream construction activities within 24 or 48 hours, depending on crossing length. 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. In addition, installing the proposed pipelines using the HDD method would avoid or minimize impacts on fisheries, fish habitat, and other aquatic resources within and adjacent to waterbodies unless an inadvertent release of drilling mud were to occur. An inadvertent release of drilling mud into a stream would affect water quality and could impede fish movement, potentially resulting in stress, injury, and/or direct mortality of fish present near the release. If an inadvertent release occurs, PALNG and PAPL would implement the corrective action and cleanup measures outlined in its *HDD Contingency Plan* to minimize potential impacts on aquatic resources (see appendix F), including the installation of berms, silt fence, and/or hay bales to prevent silt-laden water from flowing into waterbodies, or in the event of an in-water release, the use of temporary dams to isolate the drilling fluid and vacuum trucks to remove the released drilling mud.

Implementation of these plans would decrease the potential for erosion, restore pre-construction contours, increase the potential for successful revegetation of habitats, and prevent or control the spread of weeds. We determined that, given the nature of the species present and the measures that would be implemented as part of the Projects, impacts on state-sensitive species would be avoided or appropriately minimized. Although, due to the time associated with the re-establishment of most vegetation types in the Project area, impacts would also be long term to permanent.

4.7.5 Marine Mammal Protection Act Species

Marine mammals are federally protected under the MMPA. The MMPA established, with limited exceptions, a moratorium on the "taking" of marine mammals in waters or on lands under U.S. jurisdiction. The act further regulates, with certain exceptions, the "take" of marine mammals on the high seas by persons, vessels, or other conveyances subject to the jurisdiction of the United States.

PALNG, as the non-federal representatives to the FERC, conducted informal consultation with NMFS Office of Protected Species regarding marine mammals occurring in Liquefaction Project area that are protected under the MMPA of 1972. Given the lack of impacts on marine habitat from the Texas Connector and Louisiana Connector Projects, the following discussion is specific to the Liquefaction Project.

The primary threat to marine mammals resulting from LNG vessels would be an increased risk of vessel strikes during operation. LNG vessels operating within the SNWW and in the Gulf of Mexico are generally slower and generate more noise than typical large vessels, and would be more readily avoided by marine mammals. Additionally, LNG ships push a considerable bow wave when underway on the open ocean because of their design and large displacement tonnage. This wave pushes water, flotsam, and other small objects (e.g., dolphins) away from the vessel (NMFS, 2006a). LNG vessels would use established and well-traveled shipping lanes. As described in section 4.7.3, PALNG proposes to provide LNG vessel captains with a NMFS-issued guidance document that outlines collision avoidance measures to be implemented to minimize the likelihood of a vessel strikes. Based on PALNG's proposed use of existing, highly traveled shipping lanes and proposed mitigation measure, we determined that construction and operation of the Liquefaction Project would not result in significant adverse impacts on marine mammals.

4.8 LAND USE, RECREATION, AND VISUAL RESOURCES

4.8.1 Existing Land Use Impacts and Mitigation

4.8.1.1 Liquefaction Project

The Liquefaction Project would affect four general land use types, including open land, developed land, forest/woodlands, wetlands, and open water. The definitions of each land use type are as follows:

- Open Land: non-agricultural fields, and open land in the early stages of succession.
- Developed: roads, railroads, and utility corridors (pipelines and powerlines). Areas of low and highly developed industrial/commercial uses.
- Forest/Woodlands: mixed hardwood and evergreen forests.
- Wetlands: PEM, EEM, and PSS wetland types.
- Open Water: Port Arthur Canal.

Liquefaction Facilities

Construction and operation impacts on land use resulting from the Liquefaction Project would require the following: 1) permanent fill of wetlands to create industrial land; 2) conversion of open and developed land to industrial land and roads/transportation use; 3) conversion of open and developed land to open water; and 4) dredging of materials within existing open water (i.e., Port Arthur Canal). Other impacts on land uses would include grading, clearing, and other site preparation construction activities; temporary disturbance caused by increased truck traffic from hauling heavy equipment and machinery; use of temporary construction areas, including laydown, office, and parking areas; and placement of dredge material at four disposal areas (J.D. Murphree WMA and SNND Dredge Disposal Areas 8, 9A, and 9B). Construction of the liquefaction facilities would temporarily affect 948.0 acres, including 86.9 acres of open land, 24.3 acres of developed, 758.3 acres of wetland, and 78.5 acres of open water (see table 4.8.1-1). Impacts on wetlands at the liquefaction site are discussed further in section 4.4.

TABLE 4.8.1-1

Land Use Types Affected by Construction and Operation of the Liquefaction Project (in acres)

	Open Land		Developed		Forest/Woodland		Wetlands		Open Water		Total	
Facility/Component	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
Liquefaction Facilities [a]	86.9	82.3	24.3	24.3	--	--	758.3	725.7	78.5	65.8	948.0	898.1
Dredge Disposal/Beneficial Reuse Areas												
J.D. Murphree WMA	--	--	--	--	--	--	97.4	97.4	1,812.9	1,812.9	1,910.3	1,910.3
WMA Dredge Pipeline			--	--	--	--	--	--	16.6	0.0	16.6	0.0
Sabine Neches Area 8	146.9	146.9	36.1	36.1	93.6	93.6	2,710.4	2,710.4	614.4	614.4	3,601.3	3,601.3
Sabine Neches Area 9A	--	--	--	--	--	--	175.6	175.6	<0.1	<0.1	175.6	175.6
Sabine Neches Area 9B	--	--	--	--	10.3	10.3	354.5	354.5	--	--	364.9	364.9
Dredge Pipelines	0.1	0.0	0.1	0.0	--	--	0.5	0.0	1.8	0.0	2.5	0.0
Nonjurisdictional Facilities [b]	2.6	1.1	4.7	1.7	--	--	112.5	42.4	1.2	0.0	121.0	45.2
Liquefaction Project Total	**236.5**	**230.3**	**65.2**	**62.1**	**103.9**	**103.9**	**4,209.2**	**4,106.0**	**2,525.4**	**2,493.1**	**7,140.2**	**6,995.4**

[a] Liquefaction facilities include those described in section 2.1.1. Included with these totals is the South Compressor Station associated with the Texas Connector Project, which would permanently affect 25.0 acres of wetland.

[b] Nonjurisdictional facilities include those described in section 2.1.4.1.

Note: Addends may not sum due to rounding.

To facilitate construction and operations, PALNG would construct an access road and haul road/berm within the mixed-use areas of the project. The access road would permanently affect 1.3 acres and the haul road/berm would permanently affect 80.2 acres. The permanent access road would result in the conversion of existing open land to developed land for roads/transportation use. The haul road would be constructed along existing utility corridors, and the planned SH 87 relocation and be similar to land uses in that area.

PALNG would also temporarily use an existing access road (AR-S-2) on land owned by Jefferson County and the TPWD (Jefferson Central Appraisal District, 2017). PAPL proposes to widen/regrade the road resulting in 0.8 acre of impact (see sections 4.8.2 and 4.8.6). The proposed access road and haul road/berm are further discussed in section 2.4.1.1.

Following construction of the liquefaction facilities, disturbed areas not converted to industrial, developed land or stabilized with rock or gravel would be restored to preconstruction conditions in accordance with PALNG's *Environmental Plan*,[27] which includes the Commission's Plan and Procedures, or remain open during operations. As described in more detail in section 2.1.1, permanent liquefaction facilities include the marine facilities (two loading berths and a turning basin, MOF, and Pioneer Dock), liquefaction trains, LNG storage tanks, vaporization system, vapor handling system, hazard detection and response systems, and other facility components (electrical systems, water system, nitrogen vaporizers, fuel gas system, gas metering system, etc.). Operations would permanently affect 898.1 acres (see table 4.8.1-1 and section 4.8.2.1). Of the total area affected, 725.7 acres of wetlands and 65.8 acres of open water would be permanently filled to build the liquefaction facilities. Additionally, dredging activities associated with construction of the marine facilities would result in periodic impacts on open water. Public use of open water would be prohibited during construction of the marine facilities, and during routine maintenance dredging. Wetland and open water impacts are discussed in sections 4.4 and 4.3, respectively. Construction of the liquefaction facilities would result in a conversion of the existing land use to industrial use. However, due to the open and industrial use of adjacent land and the previously disturbed nature of the surrounding area, impacts on land use from the Liquefaction Project would be minor.

Dredge Disposal Areas

J.D. Murphree WMA

Construction of the marine facilities would require dredging 7.8 million yd^3 of material from the Port Arthur Canal. About 2.9 million yd^3 of this dredged material would be disposed of in a 1,900-acre area in the J.D. Murphree WMA (Salt Bayou Unit 16) to restore about 1,264 acres of tidally influenced coastal marsh habitat. See section 4.4 for a discussion on the proposed wetland restoration. The planned disposal site on the WMA is currently wetland, open water, and open land.

PALNG would use a temporary, above ground 30-inch-diameter pipeline to transport the dredged material from the liquefaction site to the WMA disposal areas. The dredge pipeline would be routed along existing field roads, within the canals south of Lost Lake, and would cross wetlands and open land. The temporary pipeline would be in place for up to 6 months.

Table 4.8.1-1 lists the impacts on land uses associated with the dredge material disposal areas and dredge pipelines. Overall, impacts on land uses at the WMA resulting from the place of dredge material would be permanent and beneficial.

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27 The *Environmental Plan* for the Liquefaction Project was filed on November 29, 2016 and can be found on the FERC eLibrary website using Accession Number 20161129-5254.

SNND Areas 8, 9A, and 9B

The remaining 4.9 million yd^3 of dredged material from construction of the marine facilities would be disposed of at the existing Dredge Disposal Areas 8, 9A, and 9B, which are owned by the SNND. The disposal sites encompass 4,141.8 acres of land, and have been previously authorized by the USACE and used as disposal areas for the maintenance dredging of the Port Arthur Canal. The disposal of dredged material to accommodate the marine facilities would affect up to 146.9 acres of open land, 36.1 acres of developed, 103.9 acres of forest/woodland, 3,240.5 acres of wetland, and 614.4 acres of open water (see table 4.8.1-1) at the disposal sites.

PALNG would transport the dredged material from the liquefaction site to the SNND disposal areas using a temporary, aboveground 30-inch-diameter pipeline. The dredge pipeline would be placed within the Texas Connector Project's Northern Pipeline right-of-way and would cross wetlands, open land, and the ICWW to transport material to Dredge Disposal Areas 9A and 9B. A second dredge pipeline would extend from the LNG Berth area and cross the Port Arthur Canal/SNWW to transport material to Dredge Disposal Area 8. Section 2.1.1 provides further discussion on methods PALNG would use to cross the ICWW and the Port Arthur Canal/SNWW.

Table 4.8.1-1 lists the impacts on land uses associated with the dredge material disposal areas and dredge pipelines. Overall, impacts on land uses at the SNND disposal areas resulting from the place of dredge material would be permanent and consistent with their current use.

4.8.1.2 Texas Connector Project

The Texas Connector Project would affect eight general land use types, including agricultural land, open land, forest/woodland, residential land, industrial/commercial land, roads/transportation, wetlands, and open water. The definitions of each land use type are as follows[28]:

- Agricultural: active cultivated cropland and specialty crop production, including rice, and fruit and nut tree orchards.
- Open Land: non-forested rangeland, pasture, non-agricultural fields, prairie, and open land in the early stages of succession.
- Forest/Woodland: mixed hardwood and evergreen forests.
- Residential: rural and urban developed residential yards, subdivisions, and planned new developments, including single and multiple family dwellings.
- Industrial/Commercial: electric power or gas utility stations, manufacturing or industrial plants, landfills, mines, quarries, and commercial or retail facilities.
- Roads/Transportation: roads, railroads, and utility corridors (pipelines and powerlines) that are crossed by the Texas Connector Project.
- Wetlands: PEM, EEM, PSS, ESS, PUB, and PFO wetland types.
- Open Water: lakes, ponds, streams, canals, and major waterbodies greater than 100 feet wide.

28 The land use categories identified in this EIS reflect those as characterized and grouped/combined by PAPL in its application to FERC for the proposed Texas Connector Project, which in some instances differ from the land use categories or groups used for the Liquefaction Project and Louisiana Connector Project.

Construction of the Texas Connector Project would temporarily affect 664.8 acres of land, including 106.9 acres of agricultural land, 146.1 acres of open land, 2.5 acres of forest/woodland, 10.3 acres of residential, 96.1 acres of industrial/commercial, 40.3 acres of roads/transportation, 238.4 acres of wetland, and 24.2 acres of open water (see table 4.8.1-2). Operation of the project would permanently affect 186.1 acres of land.

Pipeline Facilities and Laterals

During construction of the Texas Connector Project, the Northern and Southern Pipelines would require, in general, a 100- to 125-foot-wide temporary right-of-way (including ATWS areas) as described in section 2.2.2.1. Construction of the pipelines would temporarily affect 408.2 acres of land (including ATWS areas) (see table 4.8.1-2). Following construction, a 50-foot-wide permanent right-of-way would be maintained for operation of the pipeline facilities, except for in wetlands, as discussed further below and in section 4.4. Operation of the Northern and Southern Pipelines would permanently affect 110.6 acres.

About 14.7 miles (43.0 percent) of the pipeline rights-of-way would be collocated with (i.e., overlap or abut) existing utility rights-of-way such as other pipelines. Appendix L lists locations where the construction right-of-way would be collocated with other existing utility rights-of-way.

Construction of the seven proposed laterals (see table 2.1.2-1) would require, in general, a 100- to 125-foot-wide temporary right-of-way (including ATWS areas), as described in section 2.2.2.1. Construction of the laterals would temporarily affect 49.9 acres of land (including ATWS areas) (see table 4.8.1-2). About 3.8 miles (80.9 percent) of the lateral rights-of-way would be collocated with existing utility rights-of-way. Following construction, a 50-foot-wide permanent right-of-way would be maintained for operation of the laterals, except for wetlands, as discussed below and in section 4.4. Operation of the laterals would permanently affect 12.8 acres.

In general, constructing and operating the Texas Connector Project would result in temporary to permanent land use impacts. The effects of pipeline construction on agricultural land, open land, rangeland, residential land, and industrial/commercial land would be minor and temporary to short term as a result of clearing existing vegetation, standing or row crops, and landscaping; ground disturbance from grading, creating the pipeline trench, backfilling the pipeline trench; and increased equipment traffic associated with construction activities. Impacts would include temporary loss of land use, disturbance of the visual landscape, increased noise and dust from construction equipment, and increased local traffic congestion.

PAPL would implement its *Environmental Plan*, which includes the Commission's Plan and Procedures, to minimize land use impacts during construction. PAPL would coordinate with landowners during construction and maintain landowner access to fields, storage areas, field access roads, structures, and other agricultural areas as well as maintain irrigation and drainage systems crossed by the right-of-way. Drain tiles are not thought to be present in the area, but if any are found to be damaged during construction, PAPL would immediately mark the locations of damaged tiles, assess all drainage tile systems within the area of disturbance, and replace or repair all tiles to preconstruction conditions or better. A sufficient depth of cover would be used in areas where drain tiles are planned to avoid interference with the drain tile system. If irrigation lines are damaged during construction, PAPL would complete repairs within one week of identifying the damaged irrigation system.

TABLE 4.8.1-2

Land Use Types Affected by Construction and Operation of the Texas Connector Project (in acres)

	Agricultural		Open Land		Forest/ Woodland		Residential		Industrial/ Commercial		Roads/ Transportation		Wetlands		Open Water		Project Totals	
State, Facility	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
LOUISIANA																		
Pipeline Facilities																		
South Pipeline																		
Pipeline Right-of-Way	--	--	0.2	0.1	--	--	--	--	1.0	1.0	--	--	1.6	0.7	0.1	--	2.9	1.8
ATWS	--	--	0.3	--	--	--	--	--	3.2	--	--	--	0.9	--	0.8	--	5.2	--
KMPL Lateral																		
Pipeline Right-of-Way	--	--	--	--	--	--	--	--	--	--	--	--	1.3	0.5	--	--	1.3	0.5
ATWS	--	--	--	--	--	--	--	--	--	--	--	--	0.5	--	--	--	0.5	--
Aboveground Facilities																		
KMPL Meter Station	--	--	--	--	--	--	--	--	--	--	--	--	3.0	3.0	--	--	3.0	3.0
Access Roads	--	--	0.2	0.2	--	--	--	--	0.6	--	0.8	0.4	1.1	0.3	0.8	0.3	3.4	1.2
Pipe/Contractor Yards	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Louisiana Total	**--**	**--**	**0.7**	**0.3**	**--**	**--**	**--**	**--**	**4.8**	**1.0**	**0.8**	**0.4**	**8.4**	**4.5**	**1.7**	**0.3**	**16.4**	**6.5**
TEXAS																		
Pipeline Facilities																		
Southern Pipeline																		
Pipeline Right-of-Way	--	--	3.8	1.0	0.2	0.1	--	--	<0.1	<0.1	<0.1	<0.1	30.6	12.7	5.8	2.3	40.5	16.1
ATWS	--	--	0.8	--	--	--	--	--	--	--	0.1	--	4.0	--	2.7	--	7.6	--
Northern Pipeline																		
Pipeline Right-of-Way	57.0	23.0	52.8	17.3	0.7	<0.1	3.1	3.1	1.8	1.8	0.7	0.7	120.6	45.6	5.4	1.2	242.1	92.7
ATWS	9.6	--	18.4	--	1.1	--	4.1	--	32.7	--	1.8	--	41.4	--	0.9	--	110.0	--
NGPL Lateral																		
Pipeline Right-of-Way	--	--	--	--	--	--	--	--	--	--	--	--	3.4	1.3	--	--	3.4	1.3
ATWS	--	--	--	--	--	--	--	--	--	--	--	--	0.6	--	--	--	0.6	--
HPL Lateral																		
Pipeline Right-of-Way	--	--	0.7	0.5	--	--	--	--	<0.1	<0.1	--	--	--	--	--	--	0.8	0.5
ATWS	--	--	--	--	--	--	--	--	0.2	--	--	--	<0.1	--	--	--	0.3	--
TETCO Lateral																		
Pipeline Right-of-Way	--	--	1.8	0.7	--	--	--	--	--	--	--	--	--	--	--	--	1.8	0.7
ATWS	--	--	0.1	--	--	--	--	--	--	--	--	--	--	--	--	--	0.1	--
FGT Lateral																		
Pipeline Right-of-Way	--	--	16.0	4.4	<0.1	<0.1	--	--	1.9	0.7	--	--	2.6	0.9	0.1	0.1	20.7	6.0
ATWS	--	--	2.3	--	--	--	--	--	0.1	--	--	--	0.4	--	<0.1	--	2.7	--
GTS/CIPCO Lateral																		
Pipeline Right-of-Way	--	--	3.6	1.2	0.1	<0.1	--	--	1.4	0.5	--	--	3.1	1.5	2.3	0.8	10.6	4.2
ATWS	--	--	1.9	--	0.3	--	--	--	1.0	--	--	--	1.7	--	1.6	--	6.6	--

TABLE 4.8.1-2 (cont'd)

Land Use Types Affected by Construction and Operation of the Texas Connector Project (in acres)

	Agricultural		Open Land		Forest/ Woodland		Residential		Industrial/ Commercial		Roads/ Transportation		Wetlands		Open Water		Project Totals	
State, Facility	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
NGPL Lateral to Existing Meter Station																		
Pipeline Right-of-Way	--	--	<0.1	<0.1	--	--	--	--	0.1	--	--	--	0.5	0.2	--	--	0.6	0.2
ATWS	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aboveground Facilities																		
North Compressor Station	39.2	39.2	1.1	1.1	--	--	--	--	--	--	--	--	<0.1	<0.1	<0.1	<0.1	40.4	40.4
South Compressor Station [a]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NGPL Meter Station	--	--	--	--	--	--	--	--	3.0	3.0	--	--	--	--	--	--	3.0	3.0
HPL Meter Station	--	--	3.0	3.0	--	--	--	--	--	--	--	--	--	--	--	--	3.0	3.0
TETCO Meter Station	--	--	2.8	2.8	--	--	--	--	--	--	--	--	--	--	--	--	2.8	2.8
FGT Meter Station	--	--	3.0	3.0	--	--	--	--	--	--	--	--	--	--	--	--	3.0	3.0
GTS/CIPCO Meter Station	--	--	0.0	0.0	--	--	2.8	2.8	--	--	--	--	--	--	--	--	2.8	2.8
GTS/CIPCO Pig Launcher/ Receiver	--	--	0.2	0.2	--	--	--	--	--	--	--	--	--	--	--	--	0.2	0.2
MLV Site	0.1	0.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.1	0.1
Access Roads	0.9	--	13.3	0.5	<0.1	0.0	0.4	0.4	24.5	1.0	36.5	0.6	21.0	0.1	3.6	<0.1	100.2	2.6
Pipe/Contractor Yards	--	--	19.8	--	--	--	--	--	24.6	--	0.3	--	<0.1	--	0.1	--	44.8	--
Texas Total	**106.9**	**62.4**	**145.4**	**35.7**	**2.5**	**0.2**	**10.3**	**6.3**	**91.4**	**7.1**	**39.5**	**1.4**	**230.0**	**62.3**	**22.5**	**4.4**	**648.5**	**179.6**
Project Total	**106.9**	**62.4**	**146.1**	**36.0**	**2.5**	**0.2**	**10.3**	**6.3**	**96.1**	**8.1**	**40.3**	**1.7**	**238.4**	**66.8**	**24.2**	**4.7**	**664.8**	**186.1**

[a] Land use types affected by the South Compressor Station are listed in table 4.8.1-1.

Note: Addends may not sum due to rounding.

Based on acreage, the land use type most affected by the Texas Connector Project would be wetlands of various types. Impacts on wetlands are discussed in more detail in section 4.4.2. Impacts on upland forest/woodland represent the fewest impact acreage of the land use categories, but would include the removal of trees within the construction right-of-way and at ATWS, aboveground facility sites, and new or modified access roads. Post-construction maintenance of the permanent right-of-way would prevent the reestablishment of trees.

Following construction, forest/woodland outside of the permanent right-of-way, aboveground facility sites, and new permanent access roads would be restored in accordance with PAPL's project-specific *Environmental Plan*. It is expected that the reestablishment of forest areas that resemble preconstruction conditions would take at least 30 years, depending on the age of trees removed and the species of trees that are regenerated or replanted. The fragmenting effects of the maintained right-of-way would be permanent. Compensation for tree loss would be determined during easement negotiations between the applicant and the landowner.

Also following construction, all temporary workspaces would be restored to preconstruction conditions according to the procedures outlined in PAPL's *Environmental Plan*. Most land uses retained as permanent right-of-way would generally be allowed to revert to their former use, and landowners would have use of the permanent right-of-way, except for forest/woodland within the permanent right-of-way, as discussed below.

The entire permanent right-of-way in upland areas would be maintained in an herbaceous/scrub-shrub vegetated state. To facilitate pipeline inspection, operation, maintenance, and emergency response access, a 50-foot-wide operational right-of-way would be maintained along the pipelines and laterals, which would be maintained free of trees. Also, certain activities such as the construction of permanent structures, including houses, house additions, trailers, tool sheds, garages, poles, patios, pools, septic tanks, or other objects not easily removable, or the planting of trees, would be prohibited within the permanent right-of-way. Maintenance activities would be conducted in accordance with PAPL's *Environmental Plan*. Routine vegetation mowing or clearing over the full width of the permanent right-of-way in uplands would not be done more frequently than every 3 years. However, in wetlands and in accordance with the Commission's Procedures, a corridor not exceeding 10 feet in width centered on the pipeline may be cleared at a frequency necessary to maintain the 10-foot corridor in an herbaceous state.

Impacts on most land uses, except forest/woodland, would be minor and temporary, occurring only during the construction period and in designated work areas. Impacts resulting from tree removal in temporary construction workspaces would be long term due to the time it takes for trees to become reestablished, while impacts along the operational right-of-way would be permanent due to the loss and conversion of forested lands to a maintained herbaceous state. It is expected that the reestablishment of forest areas that resemble preconstruction conditions would take at least 30 years, depending on the age of trees removed and the species of trees that are regenerated or replanted.

Aboveground Facilities

Construction and operation of aboveground facilities for the Texas Connector Project would affect 55.2 acres of land. The North and South Compressor Stations would affect 64.2 acres of land for construction and operation. The South Compressor Station would be constructed and operated within the Liquefaction Project boundaries, affecting 25.0 acres. Table 4.8.1-2 lists the land use impacts associated with PAPL's aboveground facilities for the Texas Connector Project. As a result, construction and operation of new aboveground facilities would result in minor to moderate and temporary to permanent impacts on land use as a result of site clearing and facility installation activities at each site. Aboveground facilities are further described in section 2.2.2.2.

Access Roads

A total of 22.7 miles of access roads would be required for construction of the pipeline facilities. Most roads used to access the project would be existing federal or state highways, or locally or privately owned roads. PAPL proposes to use 7 permanent access roads and 40 temporary access roads. Of the 40 temporary access roads, 4 would be newly constructed and 36 would require expansion or regrading. The new and expanded temporary roads would impact 103.6 acres of land. Construction of access roads would primarily affect roads/transportation (99.5 percent), followed by less than 1 percent of combined forest/woodland, open land, wetland, and open water. Of the seven permanent access roads, four would be newly constructed, two are existing and would require expansion/regrading, and one is partially existing and would require expansion/regrading. Generally, access roads would be up to 40 feet wide. Permanent access roads would impact 3.8 acres of land. Appendix E lists the proposed temporary and permanent access roads and their required improvements. Access roads are also discussed in section 2.2.2.3.

Following construction, access roads not permanently maintained for operations and aboveground facility access would be restored in accordance with PAPL's project-specific *Environmental Plan* and any agency and landowner requirements. Permanent impacts on land use would result from converting the existing land use to industrial/commercial land at each site.

Access roads would result in short-term to permanent impacts on land uses, depending on if they are needed for temporary or permanent use, but these impacts would be minor given the relatively small number of new (four) and/or permanent access roads (seven) required to support construction and operation of the project.

Contractor Yards

To support construction activities, PAPL would use a total of three contractor yards on a temporary basis. Contractor yards would temporarily impact 44.8 acres of open land, industrial/commercial, roads/ transportation, wetland, and open water. Use of these yards would result in temporary (limited to the time of use for construction activities) and minor impacts as they would be restored to preconstruction conditions. Contractor yards are further described in section 2.2.2.4. Table 4.8.1-2 lists the land use impacts associated with contractor yards.

4.8.1.3 Louisiana Connector Project

The Louisiana Connector Project would affect eight general land use types, including agricultural land, open land, forest/woodland, silviculture, rangeland, residential land, industrial/commercial land, and open water. Table 4.8.1-3 summarizes the acreage of each land use type that would be affected by construction and operation of the Louisiana Connector Project. The definitions of each land use type are as follows[29]:

- Agricultural: cultivated or rotated cropland, orchards, vineyards, or hay fields. The typical crops found in the project area include rice and crawfish which are predominant along the route;
- Open Land: non-forested lands and PEM, EEM, and PSS wetlands used for open space or pasture;

29 The land use categories identified in this EIS reflect those as characterized and grouped/combined by PAPL in its application to FERC for the proposed Louisiana Connector Project, which in some instances differ from the land use categories or groups used for the Liquefaction Project and Texas Connector Project.

- Forest/woodland: wooded lands not being used for specific commercial purposes, consisting of deciduous and coniferous types, including but not limited to forested wetland (PFO) areas and state forest land;

- Silviculture: wooded lands being managed for forest products (e.g., pine plantations, sugar maple stands, or tree nurseries);

- Rangeland: non-forested lands primarily used for grazing;

- Residential: residential yards, residential subdivisions, and planned new residential developments;

- Industrial/Commercial: electric power or gas utility stations, manufacturing or industrial plants, mines, quarries, commercial or retail facilities and roads;

- Open Water: water crossings greater than 100 feet, including Sabine Lake.

Construction of the Louisiana Connector Project would temporarily affect 2,807.0 acres of land, including 413.6 acres of agricultural land, 809.7 acres of open land, 374.5 acres of forest/woodland, 343.4 acres of silviculture, 89.0 acres of rangeland, 23.3 acres of residential, 86.2 acres of industrial/commercial, and 667.3 acres of open water (see table 4.8.1-3). Operation of the project would permanently affect 771.0 acres.

Pipeline Facilities and Laterals

During construction, the pipelines would require, in general, a 125-foot-wide temporary right-of-way, and a 300-foot right-of-way for in-water construction in Sabine Lake, as described in section 2.2.3.1. Construction of the pipelines would temporarily affect 2,241.0 acres of land (including ATWS areas). Following construction, a 50-foot-wide permanent right-of-way would be maintained for operation of the pipeline facilities, except for wetlands as discussed in sections 4.8.1.1 and 4.4. Operation of the pipelines would permanently affect 694.0 acres.

About 667.3 acres of open water would be included in the construction right-of-way, the majority of which is associated with Sabine Lake. Construction within the open water portion of Sabine Lake would be conducted using a variety of construction methods. The HDD method would be used to minimize shoreline impacts and to cross foreign pipelines beneath the lake bed. Areas outside the HDD areas would be excavated and trenched along the right-of-way to lay the pipe. Spoil from the pipeline trench would be temporarily side-cast within the construction right-of-way. Impacts on open water (Sabine Lake) would be short term, although, as described in sections 4.3.2 and 4.6.2, lake construction would result in sediment turbidity and impacts on aquatic species. Prior to and during construction, PAPL would minimize impacts on commercial and recreational vessels on Sabine Lake by publishing notifications and construction corridor maps in local newspapers; posting signs at boat access facilities; affixing warning signs to construction vessels; posting warning signs on temporary poles along the construction right-of-way; and illuminating the construction workspace with safety lighting. During construction, commercial and recreational vessels would temporarily be excluded from the immediate construction area. Following construction, the pipeline trench would be backfilled and the lake bed would be allowed to return to its original contours. Operation of the pipeline would not affect Sabine Lake as there would be no need for operation right-of-way clearing within Sabine Lake. Short-term, minor adverse impacts on vessel traffic and recreational fishing would occur, as discussed in sections 4.9.6.2 and 4.8.6, respectively.

About 95.4 miles (72.9 percent) of the right-of-way would be collocated with (i.e., overlap or abut) existing utility rights-of-way such as pipelines and trails. Appendix L lists locations where the construction right-of-way would be collocated with other existing utility rights-of-way.

Construction of the 24 laterals and tie-ins (see table 2.1.3-1) would require, in general, a 100- to 125-foot-wide temporary right-of-way (including ATWS areas) as described in section 2.2.3.1. Construction of the laterals would temporarily affect 3.1 acres of land (including ATWS areas) (see table 4.8.1-3). Following construction, a 50-foot-wide permanent right-of-way would be maintained for operation of the laterals, except for wetlands as discussed in sections 4.8.1.1 and 4.4. Operation of the laterals would permanently affect 1.3 acres.

Based on acreage, the land use type most affected by the Louisiana Connector Project would be open land, followed by agricultural land. Pipeline construction on open land, agricultural land, silviculture and forest land, rangeland (similar to open land), residential land, and industrial/ commercial land would result in the same temporary to permanent impacts on land uses described in section 4.8.1.2 for the Texas Connector Project.

Silvicultural land crossed by the Louisiana Connector Project includes pine plantations (primarily loblolly pine). Forest land crossed includes deciduous and coniferous trees. About 222.7 acres of silvicultural land (14.0 percent) and 358.2 acres (22.0 percent) of forest land would be impacted during construction of the pipeline, laterals, and tie-ins. Impacts would include the removal of trees within the construction right-of-way and at ATWS, aboveground facility sites, and new or modified access roads. Post-construction maintenance of the permanent right-of-way would prevent the reestablishment of trees.

Following construction, land uses outside of the permanent right-of-way, aboveground facility sites, and new permanent access roads would be restored in accordance with PAPL's *Environmental Plan* and landowner agreements. Compensation for tree loss would be determined during easement negotiations between the applicant and the landowner.

Aboveground Facilities

Construction of aboveground facilities for the Louisiana Connector Project would affect 78.2 acres of land. Of this total, 67.5 acres of land would be permanently retained for operation. PAPL proposes to construct one new compressor station at MP 96.3 in Allen Parish, Louisiana. Land use at the compressor station is privately owned pine plantation (silviculture), forest/woodland, and open land. The compressor station would temporarily impact 54.0 acres of land, and would permanently convert 45.1 acres of land into industrial/commercial land use during operation. Table 4.8.1-3 lists the land use impacts associated with PAPL's aboveground facilities for the Louisiana Connector Project. As a result, construction and operation of new aboveground facilities would result in minor to moderate and temporary to permanent impacts on land use as a result of site clearing and facility installation activities at each site. Aboveground facilities are further described in section 2.2.3.2.

TABLE 4.8.1-3

Land Use Types Affected by Construction and Operation of the Louisiana Connector Project (in acres)

	Agricultural		Open Land		Forest/ Woodland		Silviculture		Rangeland		Residential		Industrial/ Commercial		Open Water		Project Totals	
State/ Facility/Component	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
LOUISIANA																		
Pipeline Facilities [a]																		
Pipeline Right-of-Way	235.5	95.6	635.1	263.9	302.7	129.1	202.7	73.9	19.9	8.1	19.6	7.7	4.1	3.5	62.7	19.1	1,482.2	600.8
ATWS	12.1	--	63.0	0.0	55.5	--	20.0	--	1.1	0.0	2.7	0.0	0.5	0.0	4.0	0.0	158.8	--
Laterals	2.7	1.2	0.1	0.1	<0.1	--	<0.1	<0.1	--	--	--	--	--	--	--	--	2.9	1.3
ATWS	0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.2	--
Aboveground Facilities																		
Compressor Station [a]	--	--	0.8	0.1	4.4	0.3	48.6	44.7	--	--	--	--	--	--	0.2	--	54.0	45.1
Meter Station Facilities																		
TETCO Meter Station	--	--	0.2	0.1	--	--	3.0	3.0	--	--	--	--	--	--	--	--	3.2	3.1
TGP Meter Station	3.3	3.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.3	3.1
EGAN Meter Station	0.9	0.6	2.5	2.5	--	--	--	--	--	--	--	--	--	--	--	--	3.3	3.1
Pine Prairie Meter Station	3.8	3.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.8	3.3
Texas Gas Meter Station	2.9	2.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.9	2.7
ANR Meter Station	3.5	3.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.5	3.2
CGT Meter Station	3.3	3.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.3	3.1
Holbrook Pig Launcher/Receiver	--	--	0.3	0.3	--	--	0.1	0.1	--	--	--	--	--	--	--	--	0.4	0.4
Mainline Valves																		
MLV #1	--	--	0.1	0.1	--	--	--	--	--	--	--	--	--	--	--	--	0.1	0.1
MLV #2	--	--	0.1	0.1	--	--	--	--	--	--	--	--	--	--	--	--	0.1	0.1
MLV #3	--	--	0.1	0.1	--	--	--	--	--	--	--	--	--	--	--	--	0.1	0.1
MLV #4	--	--	--	--	0.1	0.1	--	--	--	--	--	--	--	--	--	--	0.1	0.1
MLV #5	--	--	0.1	0.1	--	--	--	--	--	--	--	--	--	--	--	--	0.1	0.1
MLV #6	--	--	0.1	0.1	--	--	--	--	--	--	--	--	--	--	--	--	0.1	0.1
MLV #7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.1	0.1
MLV #8	--	--	--	--	0.1	0.1	--	--	--	--	--	--	--	--	--	--	0.1	0.1
MLV #9	<0.1	<0.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.1	<0.1
Access Roads	10.2	0.4	101.1	5.6	9.8	0.9	8.7	0.6	0.9	--	1.1	0.0	12.7	0.6	0.6	0.1	144.9	8.2
Contractor Yards																		
LY-CAL-02	8.3	--	6.0	--	--	--	--	--	67.2	--	--	--	--	--	--	--	81.5	--
LY-BEA-01	58.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	58.7	--
LY-ALL-02	--	--	0.3	--	--	--	60.3	--	--	--	--	--	--	--	--	--	60.6	--
LY-STL-01	68.1	--	--	--	1.9	--	--	--	--	--	--	--	--	--	--	--	70.0	--
Louisiana Total	**413.6**	**113.3**	**809.6**	**272.7**	**374.5**	**130.4**	**343.4**	**122.4**	**89.0**	**8.1**	**23.3**	**7.7**	**17.2**	**4.1**	**67.5**	**19.2**	**2,138.0**	**677.8**

TABLE 4.8.1-3 (cont'd)

Land Use Types Affected by Construction and Operation of the Louisiana Connector Project (in acres)

State/ Facility/Component	Agricultural		Open Land		Forest/ Woodland		Silviculture		Rangeland		Residential		Industrial/ Commercial		Open Water		Project Totals	
	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
TEXAS																		
Pipeline Facilities																		
Pipeline Right-of-Way [b]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	575.0	93.2	575.0	93.2
ATWS [b]	--	--	0.1	--	--	--	--	--	--	--	--	--	--	--	24.8	--	24.9	--
Aboveground Facilities																		
Centana Meter Station [b]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PALNG Meter Station [b]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Access Roads [b]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Contractor Yards																		
LY-JEF-01	--	--	--	--	--	--	--	--	--	--	--	--	69.0	--	--	--	69.0	--
Texas Total	**--**	**--**	**0.1**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**69.0**	**--**	**599.8**	**93.2**	**668.9**	**93.2**
Louisiana Connector Project Total	**413.6**	**113.3**	**809.7**	**272.7**	**374.5**	**130.4**	**343.4**	**122.4**	**89.0**	**8.1**	**23.3**	**7.7**	**86.2**	**4.1**	**667.3**	**112.4**	**2,807.0**	**771.0**

[a] The nonjurisdictional powerline to the compressor station is discussed in section 2.1.

[b] Impacts associated with the Centana Meter Station, PALNG Meter Station, associated tie-in facilities, access roads, and pipeline construction workspace that are located within the Liquefaction Project boundary are included in table 4.8.1-1.

Note: Addends may not sum due to rounding.

Access Roads

PAPL proposes to use 154 access routes, including 137 access roads and 17 water access routes. Of these, 19 would require permanent improvements, 62 would be used during construction and then restored, and 56 would require minimal or no improvements. The access roads would temporarily impact 144.9 acres of land. Construction of access roads would primarily affect open land, industrial/commercial land, forest/woodland, and agricultural land. Generally, access roads would be up to 40 feet wide. Permanent access roads would impact 8.2 acres of land. Appendix E lists the proposed temporary and permanent access roads and their required improvements. Access roads are also discussed in section 2.2.3.3.

Following construction, access roads not permanently maintained for operations and aboveground facility access would be restored in accordance with PAPL's project-specific *Environmental Plan* and any agency and landowner requirements. Permanent impacts on land use would result from converting the existing land use to industrial/commercial land at each site.

Access roads would result in short-term to permanent impacts on land uses, depending on if they are needed for temporary or permanent use, but these impacts would be minor given the relatively small number of new and/or permanent access roads (19) required to support construction and operation of the project.

Contractor Ya**rds**

To support construction activities, PAPL would use a total of five contractor yards on a temporary basis. Contractor yards would temporarily impact 339.7 acres of privately owned land. Use of these yards would result in temporary (limited to the time of use for construction activities) and minor impacts as they would be restored to preconstruction conditions following construction. Contractor yards are further described in section 2.2.3.4. Table 4.8.1-3 lists the land use impacts associated with contractor yards.

4.8.1.4 Nonjurisdictional Facilities

Nonjurisdictional facilities associated with the Liquefaction Project include the rerouting of the existing SH 87, various utility lines, and pipelines. PALNG would relocate these facilities to the western boundary of the Liquefaction Project. The relocated facilities would require a new 295-foot-wide temporary and permanent right-of-way, which includes 120 feet for SH 87 and 175 feet for the various utility lines and pipelines. The relocation of these facilities would follow an existing 100-foot-wide transmission corridor (see figure 2.1.1-1). The relocated length of SH 87 would be 3.6 miles.

Relocating SH 87, the various utility lines, and pipelines to the western boundary of the Liquefaction Project site would temporarily affect 121.0 acres and permanently affect 45.2 acres (see table 4.8.1-1). Impacts from construction and operation would mainly affect wetlands and transportation/developed land. Temporary and permanent impacts on wetlands would be similar to those described for the pipeline facilities in section 4.8.1.1. All disturbed areas would be revegetated and restored in accordance with the *Environmental Plan*, except for the paved road surfaces, which would result in the conversion of wetlands to roads/transportation land.

4.8.2 Roadways and Railroads

In addition to the access roads used during construction and operation, the Projects would cross 213 roads and 6 railroads. Of these, 58 roads and 2 railroads would be crossed using the bore method, 74 roads and 2 railroads would be crossed using the HDD method, 79 roads would be crossed using the open-cut and upland methods, and 2 roads would be crossed using the push-pull method. A description of each crossing method is provided in section 2.4.3.3.

4.8.2.1 Liquefaction Project

PALNG proposes to remove the existing J.D. Murphree WMA access road and construct an alternative access road that would connect to the relocated SH 87 (see figure 2.1.1-1). The new gravel access road would impact about 0.9 acre of PEM wetland. Additionally, recreational users of the J.D. Murphree WMA, Keith Lake, and the SNWW would be temporarily restricted from using the relocated SH 87 during equipment crossings. As such, construction and operation of the Liquefaction Project would result in a temporary to short-term but minor impact on roads and railroads.

4.8.2.2 Texas Connector and Louisiana Connector Projects

Appendix O lists the roads and railroads crossings and crossing methods proposed for the Texas Connector and Louisiana Connector Projects. Project-related impacts on roads and railroads would be temporary to short term and minor. Most paved roads and railroads would be crossed by the HDD or bore method, and unimproved or gravel roads would be crossed using the open-cut method. Potential effects associated with roadway crossings include temporary disruption of traffic flow, disturbance of existing underground utilities (e.g., water and sewer lines), and hindrance of emergency vehicle access. In areas where traffic volumes are high or other circumstances (e.g., congested areas) exist, PAPL would obtain the assistance of law enforcement to ensure traffic flow and the safety of pedestrians and vehicles. PAPL would obtain the necessary permits to access, modify, and/or work within road rights-of-way in coordination with the Texas and Louisiana state and county/parish transportation departments. Construction debris and mud would be kept off paved roads at access points used by construction equipment. As such, construction and operation of the Liquefaction Project would result in a temporary to short-term but minor impact on roads and railroads. See section 4.9 for a discussion on transportation and traffic-related impacts.

4.8.3 Landowner and Easement Requirements

Pipeline operators must obtain easements from landowners to construct and operate natural gas facilities, or acquire the land on which the facilities would be located. Easements can be temporary, granting the operator the use of the land during construction (e.g., for temporary workspace, access roads, pipe/contractor yards), or permanent, granting the operator the right to operate and maintain the facilities after construction. PAPL would need to acquire long-term easements and/or special use permits to construct and operate the new project facilities. These authorizations would convey temporary and permanent rights-of-way to PAPL for construction and operation of the Texas Connector and Louisiana Connector Projects.

An easement agreement between a company and a landowner typically specifies compensation for losses resulting from construction, including losses of non-renewable and other resources, damages to property during construction, and restrictions on existing uses that would not be permitted on the permanent right-of-way after construction. The easement would give the company the right to construct, operate, and maintain the pipeline, and establish a permanent right-of-way. Landowners would be compensated for the use of their land through the easement negotiation process.

If an easement cannot be negotiated with a landowner and the pipeline projects have been certificated by FERC, then PAPL may use the right of eminent domain granted to it under section 7(h) of the NGA and the procedure set forth under the Federal Rules of Civil Procedure (Rule 71A) to obtain the areas needed for construction and operation. PAPL would still be required to compensate the landowner for the right-of-way and for any damages incurred during construction; however, the level of compensation would be determined by a court according to state or federal law. In either case, the landowner would be compensated for the use of the land. While no federal lands would be affected by the pipeline projects, it should be noted that eminent domain does not apply to lands under federal ownership or lands under tribal ownership.

4.8.4 Land Ownership

4.8.4.1 Liquefaction Project

The land portion of the Liquefaction Project site is owned entirely by an affiliate of PALNG. The Port Arthur Canal, which is where dredging would occur, is managed by the SNND. PALNG has entered into a lease agreement with the SNND for use of Dredge Disposal Areas 9A and 9B, and with the TPWD to use 1,900 acres of the J.D. Murphree WMA as a disposal site for dredge material. A lease agreement regarding Dredge Disposal Area 8 is pending.

The Liquefaction Project's facilities would be within the jurisdictions of Jefferson County and the City of Port Arthur, Texas. Jefferson County does not have any land use zoning requirements in this area; however, the City of Port Arthur has zoned a majority of the Liquefaction Project area for Industrial uses, and a small area south of the boat ramp as Agricultural (City of Port Arthur, 2017).

4.8.4.2 Texas Connector and Louisiana Connector Projects

Table 4.8.4-1 summarizes land ownership affected by the Texas Connector and Louisiana Connector Projects. Tribal lands crossed include lands held in trust by the United States for the Coushatta Tribe of Louisiana. Highway 10 is the only known federally managed land crossed by the Louisiana Connector Project.

TABLE 4.8.4-1

Summary of Land Ownership for the Texas Connector and Louisiana Connector Projects

Ownership	Crossing Length (miles) [a]	Percent of Total Projects Length
Local/State	22.6	13.3
Federal [b]	< 0.1	0.0
Private Lands	146.6	86.2
Tribal Lands (MPs 98.1 to 99.1)	0.8	0.5
Projects Total	**170.1**	**100.0**

[a] Includes laterals.
[b] Interstate Highway 10.
Note: Addends may not sum due to rounding.

4.8.4.3 Nonjurisdictional Facilities

The relocation of SH 87 and adjacent pipelines and utilities would occur on land owned by an affiliate of PALNG. Following construction, the land would be transferred to the TDOT and respective owners and operators of the pipelines and utilities, which would be responsible for the maintenance and operation of these facilities.

4.8.5 Existing Residences and Planned Developments

4.8.5.1 Liquefaction Project

The closest residence to the Liquefaction Project is about 1.3 miles away and would not be directly or indirectly affected by the project. In addition, there are two projects that are planned near the Liquefaction Project including the Golden Pass and Sabine Pass LNG Terminals with associated pipelines.

Based on PALNG's consultations with Jefferson County, and Port Arthur zoning maps, there are no planned residential or commercial developments in the project area (City of Port Arthur, 2017). Recently completed commercial developments are discussed further in section 4.13.

4.8.5.2 Texas Connector and Louisiana Connector Projects

Based on PAPL's field and civil surveys, there are 4 residences and 7 structures within 50 feet of proposed construction workspace areas associated with the Texas Connector Project, and 17 residences and 7 structures within 50 feet of construction workspace areas associated with the Louisiana Connector Project. Table 4.8.5-1 lists the locations and distances of residences and structures from the projects' centerlines and workspaces.

TABLE 4.8.5-1

Residences and Structures within 50 Feet of the Construction Work Areas Associated with the Texas Connector and Louisiana Connector Projects

Project/State/County or Parish/Structure Type	Milepost	Distance from Construction Work Area (feet)	Distance from Pipeline Centerline (feet)
TEXAS CONNECTOR PROJECT			
Southern Pipeline			
Texas/Orange County			
Residence	0.3 on FGT Lateral	16.0	51.0
Residence	0.3 on FGT Lateral	33.0	68.0
Outbuilding	0.3 on FGT Lateral	33.0	123.0
Residence	0.5 on FGT Lateral	38.0	133.0
Shed	0.5 on FGT Lateral	31.0	121.0
Northern Pipeline			
Texas/Jefferson County			
Barn [a]	17.2	0.0	54.8
Barn [a]	17.2	0.0	25.1
Texas/Orange County			
Barn	26.2	26.0	117.0
Residence	26.4	12.0	42.0
Pool	26.4	25	55
Barn	26.3	52	81
Residence	26.3	53	94
LOUISIANA CONNECTOR PROJECT			
Calcasieu Parish			
Barn/Warehouse	40.8	46	81
Residence	45.0	49	149
Barn/Warehouse [a]	42.5	0	0
Residence	46.8	50	173
Residence	52.3	49	120
Residence	56.6	9	39
Residence	56.6	44	84

TABLE 4.8.5-1 (cont'd)

Residences and Structures within 50 Feet of the Construction Work Areas Associated with the Texas Connector and Louisiana Connector Projects

Project/State/County or Parish/Structure Type	Milepost	Distance from Construction Work Area (feet)	Distance from Pipeline Centerline (feet)
Allen Parish			
Residence	89.5	47	139
Residence	89.6	31	61
Residence	90.9	32	128
Residence	97.0	31	126
Shed	97.0	5.9	92
Shed [a]	97.0	0	13
Residence	99.7	37	157
Residence	99.8	13	77
Garage	99.8	9.5	77
Residence	103.7	5	74
St. Landry Parish			
Shed [a]	120.8	0	0
Residence	120.9	50	90
Residence	120.9	0	44
Residence	120.9	45	85
Residence	120.9	42	146
Residence	123.4	0	22
Shed	123.4	14	84

[a] Structure to be removed during construction, pending landowner approval.

Structures within 50 feet of the construction work area would likely experience effects of construction and operation of the projects. In general, as the distance to the construction work area increases, the impacts on residences decrease. In residential areas, typically the greatest impacts associated with construction and operation of a pipeline are related to temporary disturbances during construction, and the presence of the permanent right-of-way, which prevents the construction of permanent structures within the right-of-way.

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

Before mobilizing any equipment, PAPL would stake the limits of disturbance and the centerline of the pipeline. Affected landowners would be notified 7 days prior to trench excavation commences.

PAPL would use special construction methods designed for working in residential areas. These special construction methods are described in section 2.4, and specific methods to be used on an individual property are shown on PAPL's site-specific RCPs (see below). PAPL would implement the following general measures to minimize construction-related impacts on all residences and other structures within 50 feet of the construction right-of-way:

- Attempt to maintain, where feasible, a minimum distance of 25 feet between any residence and the edge of the construction work area.
- Install safety fence at the edge of the construction right-of-way for 100 feet on either side of a residence.
- Fence the boundary of the construction work area to ensure that construction equipment and materials, including the spoil pile, remain within the construction work area.
- Weld and install pipeline as quickly as possible to minimize the amount of time a neighborhood is affected by construction.
- Attempt to preserve mature trees, vegetative screens, and landscaping within the construction work area, unless the trees and landscaping interfere with the installation techniques or present unsafe working conditions.
- Backfill the trench after the pipe is installed, or temporarily place steel plates over the trench.
- Restore all lawn areas and landscaping within the construction work area, excluding mature trees within the permanent pipeline easement, immediately following backfilling the trench.
- Complete final cleanup, grading, and installation of permanent erosion control devices within 10 days after backfilling the trench.

PAPL would minimize noise during non-daylight hours and within 1 mile of residences or other NSAs. Residential landscapes impacted during construction would be would be restored according to landowner agreements.

PAPL has also developed site-specific RCPs to inform affected landowners of proposed measures to minimize disruption and to maintain access to the residences within 25 feet of the construction work area (see appendix F). These site-specific construction plans include a dimensioned drawing depicting the residence in relation to the pipeline construction; workspace boundaries; the proposed permanent right-of-way; trees to be avoided; and nearby residences, structures, roads, and miscellaneous features (other utilities, sewer, etc.). We have reviewed the site-specific RCPs and find them acceptable. **However, we encourage the owners of each of these residences to provide us comments on the plan specific for their property during the draft EIS comment period.**

No known septic systems have been identified, but PAPL would work with the landowner to avoid these systems if they are encountered.

Following construction, all residential areas would be restored to preconstruction conditions to the extent possible, or as specified in written landowner agreements. Landowners would continue to have use of the right-of-way provided such use does not interfere with the easement rights granted to PAPL for construction and operation of the pipeline system. For example, no structures would be allowed on the permanent right-of-way, including houses, decks, playgrounds, tool sheds, garages, poles, guy wires, catch basins, swimming pools, trailers, leaching fields, septic tanks, or any other objects not easily removed. As shown on its site-specific RCPs and table 4.8.5-1, PAPL would remove several structures currently present over the pipeline route. PAPL would work with landowners to relocate these structures to an off-right-of-way location. Because of the increased potential for construction of the projects to disrupt these residences, and as stated earlier, we encourage the owners of these parcels to provide us comments on PAPL's proposal to relocate these structures during the draft EIS comment period.

To ensure impacts on residences and commercial areas are addressed, PALNG and PAPL would develop a grievance and resolution plan as part of its Implementation Plan. The grievance and resolution plan would identify a toll-free phone number and email address through which landowners, agencies, and the public can contact a project representative with questions, concerns, and complaints during construction, restoration, and operation of the Projects. PALNG and PAPL would provide a timeframe in which a project representative would respond. In the event PALNG's or PAPL's response is not satisfactory to the landowner, agency, or public, they would have the opportunity to contact FERC's Landowner Helpline. We conclude that implementation of PALNG's and PAPL's mitigation measures, including the construction methods in residential areas and commercial facilities, the site-specific RCPs, and grievance and resolution process, along with our recommendation to consult with landowners regarding structure removal or relocation, impacts on residential and commercial areas would be minimized or mitigated.

Based on PAPL's consultations with Orange and Jefferson Counties, and the Cities of Port Arthur and Beaumont, there are no planned residential or commercial developments in the Texas Connector Project area. One planned industrial development is a modification and expansion of the Golden Pass LNG Project. The Golden Pass LNG Project is 0.3 mile from the NGPL Meter Station along the Southern Pipeline. Although the main project was completed in 2010, it was recently approved for an expansion by the FERC. The metering station and pig launcher/receiver along the Texas Connector Project's Southern Pipeline at MP 7.6 is adjacent to the planned expansion of the Sabine Pass LNG facility in Cameron Parish. The impacts associated with the Golden Pass LNG Project expansion, Sabine Pass LNG facility, and recently completed commercial developments are discussed further in section 4.13.

Based on PAPL's consultations with the Calcasieu Parish Planning and Development Board and St. Landry Parish Public Works, there are no planned residential development projects within 0.25 mile of the Louisiana Connector Project in Calcasieu and St. Landry Parishes.

Driftwood has proposed to construct a 96-mile-long feed gas pipeline through Louisiana to deliver gas to the proposed Driftwood LNG facility on the west bank of the Calcasieu River, south of Lake Charles, Louisiana. As currently designed and proposed, the Driftwood Pipeline Project would parallel PAPL's Louisiana Connector Project between MPs 45.4 and 54.5 in Calcasieu Parish, and at MP 116 in Evangeline Parish. The impacts associated with the Driftwood Pipeline Project are discussed further in section 4.13, and an alternative taking into account the two pipelines is discussed in section 3.4.2.

4.8.5.3 Nonjurisdictional Facilities

There are no residences or commercial developments or structures near the nonjurisdictional facilities. The closest residence is about 1.3 miles from the road, pipeline, and utility corridor. Based on review of existing Jefferson County land use and zoning geographic information systems interactive maps, there are no planned residential or commercial developments within or adjacent to the relocated highway, pipelines, and utility corridor (Jefferson Central Appraisal District, 2017).

4.8.6 Recreation and Special Interest Areas

Based on consultations with local agencies and review of public databases and maps, the Projects would not cross or affect any of the following designated areas:

- National Wild and Scenic Rivers System
- National Trails System
- Wilderness Areas designated under the Wilderness Act
- State or local designated trails
- National or state forests
- National Natural Landmarks
- Public game management areas
- Nature preserves
- Golf courses or other recreational facilities

The Projects would, however, affect or be within 0.25 mile of a WMA, state-designated wild and scenic rivers, and other general recreational activities, as discussed further below.

One of the primary concerns when crossing a designated recreation or special interest area is the impact of construction on the purpose for which the area was established (e.g., the recreational activities, public access, resources the area aims to protect). Construction would alter visual aesthetics by removing existing vegetation and disturbing soils. Construction would also generate dust and noise, which could be a nuisance to recreational users. Construction could also interfere with or diminish the quality of the recreational experience by affecting wildlife movements or disturbing trails. Direct project impacts on recreational and special interest areas occurring outside of forested land (including managed tree plantations) would be minor and limited to the period of active construction, which typically would last only several days to several weeks in any one area. These impacts would be minimized by implementing PALNG's and PAPL's project-specific *Environmental Plan*.

To ensure public safety and a safe working environment for project personnel, it may be necessary to limit access to designated recreation or special interest areas during construction. These impacts would be limited to the time of active construction and would cease when construction is complete. PALNG and PAPL would work with the landowners and land-managing agency of the recreation and special interest areas to avoid, minimize, or mitigate impacts on these areas, as requested and discussed further by area below. PALNG and PAPL would attempt to maintain access to the areas during construction of the pipeline, and if necessary would compensate the landowner(s) for the value of any lost resources. PALNG and PAPL would also coordinate with land managing agencies and private landowners regarding the best way to inform the public of planned construction activities and/or to coordinate the timing of construction activities. Public notification measures could include signage on recreation area access routes, website notifications, and targeted mailings.

Following construction, most open land uses would be able to revert to their former uses. Forest land affected by the temporary construction right-of-way and ATWS areas would experience long-term impacts because of the time required to restore the woody vegetation to its preconstruction condition (at least 30 years). Further, the placement of aboveground facilities and permanent access roads, as well as forest land within the operational right-of-way, would experience permanent impacts as a result of a land use and vegetation type conversion.

The landscape of the states crossed by Projects provide ample opportunities for public enjoyment of dispersed recreation including fishing, boating, birding, wildlife viewing, photography, hiking, biking, and hunting. Seasonal hunting recreation opportunities in these areas would be temporarily affected by construction activities. For example, construction of the pipeline may affect hunting activities on private land if the hunting season is within the construction time frame. To minimize conflicts with hunting, PALNG and PAPL would notify and coordinate with landowners and managers prior to construction. Operation of the Projects would not interfere with most recreational activities.

The following sections describe specific recreational and special interest areas that would be crossed by or within 0.25 mile of the Projects. Based on the impacts identified and mitigation measures PALNG and PAPL would implement, the Projects would not result in significant or adverse impacts on recreational or special interest areas. Visual impacts on recreational and special interest areas that are designated for their scenic value are discussed in section 4.8.8.

4.8.6.1 Liquefaction Project

The Liquefaction Project area does not include developed recreational areas; however, the site may be used for hunting and fishing due to its location adjacent to the J.D. Murphree WMA and Port Arthur Canal.

J.D. Murphree WMA and Round Lake

Although it is outside the immediate Liquefaction Project boundaries, the J.D. Murphree WMA would be indirectly affected by the construction and operation liquefaction facilities, and directly affected by dredge disposal activities and relocation of the WMA access road. The J.D. Murphree WMA encompasses 24,498 acres of fresh, intermediate, and brackish water coastal marsh along the upper coast of Texas, and is owned and managed by the TPWD. The WMA includes Round Lake and portions of Keith Lake. Recreational activities on the WMA include fishing; wildlife viewing; and waterfowl, feral hog, and alligator hunting (TPWD, 2017g). The WMA also provides half-day public waterfowl hunts that attract as many as 175 hunters per day.

Round Lake, which is also within the J.D. Murphree WMA, would be surrounded by the Liquefaction Project but avoided. Round Lake is a designated No Hunt Zone (TPWD, 2017h), and is frequented by local and migratory birds, and attracts birders as discussed in section 4.6.1.3. Indirect impacts on recreationalists visiting the WMA and Round Lake during construction of the liquefaction facilities would include construction and equipment noise.

About 1,900 acres of the J.D. Murphree WMA would be used for the disposal of dredge material. The disposal area would be west of Lost Lake and the liquefaction facilities, in an area generally surrounded by Shell, Johnson, and Keith Lakes, and the ICWW. A portion of the dredge material would be used to restore 1,264 acres of degraded wetland marsh habitat within the WMA. Truck traffic and large equipment associated with the hauling and spreading of dredge material would create noise, dust, and visual intrusions for recreational users of the WMA, particularly near Lost Lake. Disposal activities may create temporary use restrictions near the disposal area and could deter recreational users from recreating nearby. All disturbed areas outside of the disposal area would be restored to previous conditions. Recreation would be permanently restricted at the disposal site.

As mentioned in section 4.8.2.1, PALNG would relocate the existing WMA access road and construct an alternative access road that would connect to the relocated SH 87. The TPWD requested PALNG avoid construction within the WMA during periods of high public use, which are typically mid-September, and November through January. If construction is unavoidable during these times, PALNG would be required to compensate TPWD for the lost recreational opportunities (TPWD, 2017i). PALNG has committed to coordinate with the TPWD to determine mitigation measures for any lost recreational opportunities.

Keith Lake

Keith Lake, which is partially within the J.D. Murphree WMA, is about 0.1 mile southwest of the liquefaction facility. Keith Lake is open for fishing year-round, and commercial crabbing is permitted (TPWD, 2017g). PALNG sold a portion of its land north of Keith Lake to Jefferson County for the construction of a boat ramp and parking area that would provide access to Keith Lake and the J.D. Murphree WMA. The boat launch ramp is less than 0.1 mile from the facility site. Recreational users in the WMA would be affected during construction from the dust and noise created by increased truck traffic and machinery. In addition, PAPL would temporarily use an existing access road (AR-S-2) to access project workspace areas. PAPL proposes to widen/regrade the road resulting in 0.8 acre of impact (see section 4.8.2). Impacts from dust and noise would be minor and temporary, lasting only the duration of construction. Boating and fishing opportunities and access to Keith Lake and the boat launch ramp would not be impacted by construction or operation.

Port Arthur Canal

Recreational boating and fishing in the Port Arthur Canal would also be affected during dredging, excavating, increased ship and barge traffic, and hauling of dredge material to accommodate the liquefaction facilities (e.g., MOF, ship berths). Dredging activities in the Port Arthur Canal could result in access restrictions in certain areas for fishing and boating. Impacts would be minor and temporary, lasting only the duration it takes for ships and barges to clear the area, and consistent with other LNG and industrial facilities along the Port Arthur Canal. Access would be permanently restricted in the immediate areas surrounding the facilities for safety. Construction, ship and barge traffic, and access restrictions would be in effect in site-specific areas but would not affect access to other areas along the canal. Project-related impacts on the canal are further discussed in sections 4.3.2 (waterbodies) and 4.9.6.1.

4.8.6.2 Texas Connector Project

The Northern Pipeline would cross the J.D. Murphree WMA at four locations between MPs 1.5 and 1.6, MPs 4.5 and 6.0, MPs 10.2 and 10.5, and MPs 11.6 and 11.7. The Southern Pipeline would cross the WMA at two locations between MPs 0.1 and 0.9 and MPs 2.4 and 2.5. To reduce impacts resulting from construction activities, PAPL would use the HDD method to cross the WMA, which would avoid the need for vegetation clearing, soil grading, and maintenance activities between the HDD entry and exit points. ATWS associated with an HDD point at MP 5.1 would temporarily affect about 2.0 acres of wetlands in the WMA. The active HDD would be visible and heard by recreational users. Recreation opportunities may be limited near construction areas; however, impacts would be minor and temporary. Where parallel to the WMA between MPs 0.0 and 1.5 along the Northern Pipeline and between MPs 0.0 and 3.1 along the Southern Pipeline, PAPL would maintain a 100-foot buffer between the construction workspace and the WMA boundary. PAPL would coordinate with the TPWD prior to construction to identify any additional site-specific restoration measures requested by the WMA. Following construction, ATWS on the WMA would be restored in accordance with PAPL's *Environmental Plan* and TPWD easement requirements. Recreational use of the WMA would be allowed to continue during project operations.

The HDD construction method would be implemented at waterbody crossings used for recreational fishing, boating, and waterfowl hunting, which would reduce noise and dust and disturbance of existing vegetation near waterbody banks. This includes the Sabine Neches Waterway, Taylor Bayou, Sabine Pass, and the waterway that provides access from the Port Arthur Canal to Keith Lake. Access for boating, fishing, and hunting would be maintained throughout construction at HDD crossings.

The South Compressor Station would be about 0.7 mile east of Lost Lake and 0.3 mile west of Round Lake. Like Round Lake, Lost Lake is a designated No Hunt Zone (TPWD, 2017h). Access to the lakes for recreation would not be restricted and aesthetic impacts from the presence of the compressor station would be minor due to similar existing industrial facilities east of the compressor station.

The NGPL Meter Station would be about 0.1 mile east of Keith Lake, which would result in similar impacts on recreation as the compressor station. All other meter stations and pig/launcher receivers would be sited in areas where recreation is not anticipated or affected.

4.8.6.3 Louisiana Connector Project

No public hunting or game management areas would be crossed by the Louisiana Connector Project. Private property managed for hunting would be crossed between MPs 65.5 and 67.2. This property is managed in cooperation with the LDWF for a variety of wild game species including deer, hogs, turkey, and pheasant. Land use at this crossing is forest and wetland, and is actively managed for pulp wood production. Pipeline construction would likely occur during the spring and summer hunting seasons. An affiliate of PAPL has constructed through the project area as recently as 2016 and, like past practices, would work with landowners and hunting clubs to avoid potential conflicts with the hunting activities. As such, pipeline construction is expected to have minor to negligible impacts on hunting opportunities.

Sabine National Wildlife Refuge

The Sabine NWR is a 125,790-acre wildlife refuge adjacent to the northeast and east shore of Sabine Lake. Sabine NWR occupies the marshes between Calcasieu and Sabine Lakes and is managed to provide habitat for migratory waterfowl and other birds, and to preserve and enhance coastal marshes for wildlife and fish (FWS, 2017). Sabine National Wildlife Refuge is 0.2 mile from the Louisiana Connector Project at MP 17.4 in Cameron Parish. During construction near this area, noise from construction activities may disturb wildlife and hunting activities; however, impacts on this area are expected to be short term and minor. Construction and operation of the pipeline facilities would have no direct impact on the refuge.

State Wild and Scenic Rivers

The System Rivers was developed for preserving, protecting, developing, reclaiming, and enhancing the wilderness qualities, scenic beauties, and ecological regimes of certain free-flowing Louisiana streams. The LDWF administers the System Rivers (Louisiana State Legislature, 2017).

The Louisiana Connector Project would cross four state-designated scenic rivers in Louisiana: Beckwith Creek, Hickory Branch, Barnes Creek, and Whiskey Chitto Creek. PAPL proposes to cross the rivers using the HDD method. We have included draft versions of the available site-specific crossing plans in appendix J.

The Louisiana Connector Project would cross Beckwith Creek at MP 64.1 in Calcasieu Parish. At this location, the state of Louisiana classifies Beckwith Creek as a scenic river from it headwaters to the west fork of the Calcasieu River in Beauregard and Calcasieu parishes (LDWF, 2017a). The HDD entry and exit points would affect silviculture and open land on both sides of the river.

The Louisiana Connector Project would cross Hickory Branch at MP 65.3 in Calcasieu Parish. At this location, Hickory Branch is classified as a scenic river from its headwaters to the West Fork of the Calcasieu River (LDWF, 2017a). The HDD entry and exit points and ATWS would affect open land and forest/woodland on both sides of the river.

The Louisiana Connector Project would cross Barnes Creek at MP 79.2 in Allen Parish. At this location, Barnes Creek is classified as a scenic river from Louisiana SH 27 to the Calcasieu River in Allen and Beauregard Parishes (LDWF, 2017a). The HDD entry and exit points would affect forest/woodland on both sides of the river.

The Louisiana Connector Project would cross Whiskey Chitto Creek at MP 91.2 in Allen Parish. At this location, Whiskey Chitto Creek is classified as a state scenic river from the boundary of Fort Polk Military Reservation (Lookout Road) to its entrance into the Calcasieu River (LDWF, 2017a). The HDD entry and exit points and ATWS would affect open land and forest/woodland on both sides of the river.

Direct impacts on each waterbody would be avoided as a result of the HDD crossing method. However, recreational users may experience temporary visual and noise impacts associated with construction personnel and equipment, as well as HDD activities, including tree removal within the HDD entry and exit points and ATWS. Also, as a result of the HDD method, tree clearing and vegetation maintenance within the permanent right-of-way on either side of the crossing would not be necessary, thus avoiding permanent visual impacts on recreational users. The ATWS associated with the HDD crossing would result in minor and temporary tree removal. In addition, as discussed in section 4.3.2.2, there is the potential during the drilling process for an inadvertent release of drilling mud. To minimize potential impacts on water quality in the event of an inadvertent release of drilling mud, PAPL would implement its HDD Plan (included within PAPL's *Environmental Plan*). Measures to prevent or control an inadvertent release of drilling mud include installing perimeter controls to contain any inadvertent release of drilling mud.

Following construction, ATWS areas would be restored to preconstruction conditions, and recreational users of the scenic river would not be affected by operations.

State Scenic Byways

State Scenic Byways crossed by the Louisiana Connector Project include the Myths and Legends Byway at MP 96.9 and the Zydeco Cajun Prairie Scenic Byway at MP 123.8.

The Louisiana Connector Project would cross U.S. Highway 165 (Myths and Legends Byway) at MP 96.9 using the HDD method. This 181-mile-long byway begins in southwestern Louisiana at the Texas state line and travels through mostly flat land originally settled by the Atakapa and Coushatta Indians. Recreational activities along the Myths and Legends Byway includes nature hiking and viewing, historic places, cultural centers, wildlife viewing, hiking, biking, fishing, and horseback and ATV riding (Louisiana Office of Tourism, 2017a). Land use on either side of the byway crossing consists of open land, residential, and forest/woodland.

The Louisiana Connector Project would cross SH 29 (Zydeco Cajun Prairie Byway) at MP 123.8 using the bore method. Recreational activities along this byway include community and historic/cultural centers, wildlife viewing, and visiting natural areas such as wilderness wetlands and prairies (Zydeco Cajun Prairie Scenic Byway Commission, 2017). Land use on either side of the byway crossing consists of agricultural land.

At each crossing, direct impacts would be avoided due to the use of the bore or HDD method; however, scenic travelers may experience temporary visual and noise impacts associated with construction personnel and equipment, as well as bore activities. Also, as a result of the bore or HDD, tree clearing and vegetation maintenance within the permanent right-of-way on either side of the crossing would not be necessary, thus avoiding permanent visual impacts on scenic travelers. Following construction, ATWS areas would be restored to preconstruction conditions, and recreational users of the scenic byways would not be affected by operations.

Port Arthur Canal

The Louisiana Connector Project would cross the Port Arthur Canal between MPs 0.2 and 0.5 by HDD. The Port Arthur Canal is primarily used for navigation, but also supports recreational boating and fishing on Keith Lake, Lost Lake, Blind Lake, and Sabine Lake. Because the canal would be crossed using the HDD method, which avoids direct impacts on the features it crosses between the entry and exit points, construction and operation of the project would not affect commercial and recreational fishing boats in the Port Arthur Canal.

Sabine Lake

The Louisiana Connector Project would cross Sabine Lake between MPs 0.7 and 17.9 using various construction methods, as described in section 2.4.3.1. Sabine Lake is a 98-square-mile lake that was formed by the Neches and Sabine Rivers. Sabine Lake, through its 5-mile-long Sabine Pass, drains about 50,000 square miles of Texas and Louisiana into the Gulf of Mexico (Texas State Historical Association, 2017). Recreational uses of the lake include sailing, boating, fishing, crabbing, and wildlife viewing (Pleasure Island Commission, 2017).

Construction of the proposed pipelines in Sabine Lake would temporarily affect commercial and recreational fishing boats near the construction work areas (further details are provided in section 4.8.1.3), including our determination of impact on Sabine Lake.

CC Road Savannas

The Nature Conservancy's CC Road Savannas conservation easements are within 0.25 mile of the Louisiana Connector Project near MP 81.5 in Allen Parish. The CC Road Savannas conservation easements encompass 1,486 acres, and include the CC Road Savanna Preserve, which is a 477-acre property that contains some of the best remaining examples of wet longleaf pine flatwood savanna in southwestern Louisiana. The conservation easements and Preserve include important native species and plant communities, and serve as a platform to demonstrate restoration and management of longleaf pine flatwood savanna. There are no developed trails within the CC Road Savannas conservation easements or the Preserve (The Nature Conservancy, 2017). Opportunities for wildlife and forest viewing are provided by the existing roadways.

Direct effects would not occur on areas within 0.25 mile of the Louisiana Connector Project and outside of the construction right-of-way. Indirect impacts from noise and visual impacts are not expected because the preserve does not provide recreational opportunities beyond viewing opportunities along existing roadways. Additionally, the presence of a permanent pipeline right-of-way would be similar to the existing visual conditions surrounding the conservation easements, which includes roads and other utility rights-of-way between MPs 79.5 and 81.5 and MPs 82.6 and 85.6. PAPL would implement the measures outlined in its project-specific *Environmental Plan* to prevent disturbance to off-site areas.

U.S. Highway 171/Louisiana's Western Corridor

The Louisiana Connector Project would cross U.S. Highway 171 (part of Louisiana's Western Corridor) at MP 70.7 using the bore method. Louisiana's Western Corridor travels from Lake Charles to Shreveport and offers travelers a self-guided tour to places such as Sam Houston Jones State Park, the Whisky Chitto, Fort Polk, Barksdale Airforce Base, Kisatche National Forest, the Toledo Bend Reservoir and the Mansfield Commemorative Area (Lake Charles Convention & Visitors Bureau, 2017).

4.8.6.4 Nonjurisdictional Facilities

Construction and relocation of SH 87, pipelines, and utilities would result in minor and temporary impacts on fishing and boating along the Port Arthur Canal, particularly at the beginning and end of the right-of-way where the right-of-way ties into the existing SH 87, which is about 0.1 mile from the canal. Access to the canal would be maintained and all disturbed areas would be restored to preconstruction conditions according to the PALNG's *Environmental Plan* or landowner requirements.

4.8.7 Contaminated Sites

Based on PALNG's and PAPL's review of federal and state regulatory databases to identify known and potential water and soil contamination, landfills, and hazardous waste sites, there are no known sources of soil or groundwater contamination within 0.25 mile of the Louisiana Connector Project. There are, however, three mapped sites within 0.25 mile of the Texas Connector and Liquefaction Projects. The three sites are discussed in more detail below:

- Site 1 is about 0.1 mile east of the proposed HPL Meter Station at MP 1.0 on the Northern Pipeline. The site was identified on the Texas Closed Landfill list and was documented as closed in 1985.
- Site 2 is about 0.2 mile southeast of MP 20.5 on the Northern Pipeline. The site was identified on the Texas Aboveground Storage Tank and the Texas Underground Storage Tank databases as being a watercraft refueling facility.
- Site 3 is about 0.1 mile northwest of the proposed KMLP Meter Station at MP 7.6 on the Southern Pipeline. The site was identified on the LDEP's air permit and NPDES discharge list.

See section 4.2.1.6 for additional details on soil contamination and EPA recommendations for the Liquefaction Project.

The Projects would also cross waterbodies that are listed under section 303(d) of the CWA for various contaminants. As discussed in section 4.3.1.1, a soil and sediment analysis would be conducted according to the EPA recommendations (see section 4.2.1.6) for the liquefaction site and all dredge materials placed on the J.D. Murphree WMA. The Texas Connector Project would cross the Taylor Bayou and Hillebrandt Bayou, which are listed under section 303(d) for the presence of dioxin, PCBs, and bacteria. Both waterbodies would be crossed using the HDD method. The Louisiana Connector Project would cross 14 waterbodies that are listed under section 303(d) for various contaminants. These waters include the Sabine-Neches Canal and Sabine Lake in Texas; and Bayou des Cannes, Nezpique Bayou, Bayou Blue, Calcasieu River, Barnes Creek, Marsh Bayou, Indian Bayou, Hickory Branch, Beckwith Creek, Little River, Houston River, and Sabine Lake in Louisiana. PAPL would cross these waterbodies using the HDD method except for Bayou Blue, Marsh Bayou, and Indian Bayou, which would be crossed using the open-cut method. Additionally, Sabine Lake would be crossed using the HDD and S-lay methods.

Should contaminated media (i.e., soil or groundwater) be encountered during construction, PALNG and PAPL would implement their respective project-specific *Unanticipated Hazardous Waste Discovery Plan*. As outlined in the plan, the contractor(s) would stop work in the area, restrict access to the site, and notify the Projects' EI and the Supervisor of Environmental, Health, and Safety Division. A qualified consultant would conduct site-specific testing to determine the extent and nature of the contamination. Depending on the results of the analysis, PALNG and PAPL would develop a site-specific plan to evaluate site avoidance, exposure minimization, and cleanup options. The plan would include methods for handling the specific waste, hauling, manifesting, disposal, and site stabilization and restoration. We reviewed PALNG's and PAPL's *Unanticipated Hazardous Waste Discovery Plans* and find them acceptable.

4.8.8 Visual Resources

"Visual resources" refers to the composite of basic terrain features, geologic features, hydrologic features, vegetation patterns, and anthropogenic features that influence the visual appeal of an area for residents or visitors. The Projects would cross federal, state, county, tribal, and privately owned lands that encompass a wide range of visual resources and landscapes. The Projects could alter these existing visual resources in several ways, including construction activity and equipment that may temporarily alter viewsheds, alteration of existing vegetation patterns during right-of-way maintenance, and permanent alterations to the viewshed at and near aboveground facilities. The significance of these visual impacts would be primarily dependent upon the quality of the current viewshed, the degree of alteration of that view, the number of potential viewers, and the perspective of the viewer.

4.8.8.1 Liquefaction Project

Construction and operation of the Liquefaction Project would result in a permanent impact on the visual landscape of the area. Construction of the liquefaction facilities would result in temporary visual impacts associated with heavy truck and equipment traffic and dredging operations. Temporary impacts would be greatest on views from SH 87 and SH 82, the J.D. Murphree WMA, Pleasure Island, and the Port Arthur Canal. Impacts would be minor based on being consistent with the existing industrial land use in the area and impacts would last only the duration of construction, which is expected to be 5 years.

The tops of the three LNG storage tanks would be about 256 feet above grade, which would create a strong vertical visual contrast across a relatively flat existing landscape. The ship berths, offloading facilities, and utility buildings would permanently alter the existing viewshed. The storage tanks and liquefaction facilities would not be screened and would also result in long-term and moderate visual impacts on views from the eastern edge of the J.D. Murphree WMA. Impacts on views for those traveling on SH 87 and SH 82, and those visiting Pleasure Island or the Port Arthur Canal would be relatively minor due to existing industrial facilities surrounding and northeast of the project area.

4.8.8.2 Texas Connector and Louisiana Connector Projects

The Texas Connector and Louisiana Connector Projects do not cross wilderness areas designated by the Wilderness Act, National Wild and Scenic Rivers, or National Scenic byways. The Louisiana Connector would, however, cross state scenic rivers and byways, as discussed below. Existing visual conditions in the pipeline projects areas include flat, open, and brackish water marsh lands, patches of trees, short grasses, open fields, waterbodies, vertical buildings and structures, and utility corridors.

Pipeline Facilities

Visual impacts associated with construction and operation of the rights-of-way and ATWS would include the disturbance or removal of existing vegetation and individual trees along the rights-of-way and the presence of construction vehicles and equipment. Visual impacts would be greatest from the residences within 50 feet of the rights-of-way, where the pipeline route crosses existing roads, and forested areas that could be seen by passing motorists. The clearing of trees in forested areas to accommodate the construction right-of-way and ATWS would result in long-term visual impacts due to the time it takes for trees to become reestablished.

PAPL would collocate the pipelines and laterals with existing utility rights-of-way along 113.8 miles, which would reduce the extent of new disturbance and visual impacts. Visual impacts would also be reduced by using the HDD and push-pull construction method at several roadway, waterbody, and wetland crossings, which minimizes the removal of vegetation and visual contrasts across the landscape. The pipeline facilities would not create strong visual contrasts across the landscape due to previous ground disturbance associated with existing utility rights-of-way. The presence of a permanent pipeline right-of-way would be similar to the existing visual conditions in the project area, which includes roads and other utility rights-of-way and commercial and industrial facilities. Apart from forest land, which would not be reestablished within the 50-foot-wide permanent right-of-way, PAPL would restore all disturbed areas to preconstruction conditions according to its *Environmental Plan* or landowner requirements.

State Scenic Rivers

The LDWF Scenic Rivers System was developed for preserving, protecting, developing, reclaiming, and enhancing the wilderness qualities, scenic beauties, and ecological regimes of certain free-flowing Louisiana streams. Certain activities are prohibited on designated Natural and Scenic Rivers, including channelization, clearing and snagging, channel realignment, reservoir construction, and the commercial cutting of trees within 100 feet of the ordinary low water mark. Scenic River Permits are required for all activities on or near System Rivers that may impact the ecological integrity, scenic beauty, or wilderness qualities of those rivers (LDWF, 2017a). Table 4.8.8-1 lists the designated state scenic rivers crossed by the Louisiana Connector Project.

TABLE 4.8.8-1

Designated State Scenic Rivers Crossed by the Louisiana Connector Project

Waterbody Name	Milepost	Scenic Conditions	Proposed Crossing Method
Beckwith Creek	64.1	Dense forest/woodland along each bank.	HDD
Hickory Branch	65.3	Dense forest/woodland along each bank.	HDD
Barnes Creek	79.2	Dense silvicultural land along each bank.	HDD
Whiskey Chitto Creek	91.2	Dense forest/woodland along each bank, with areas of open land along the existing utility right-of-way and the eastern bank.	HDD

During construction, recreational users may experience temporary visual impacts associated with personnel, equipment, and HDD activities. As a result of using the HDD crossing method, direct impacts such as in-stream work and vegetation clearing adjacent to state scenic waterbodies would be avoided, and recreational uses of the state scenic rivers would not be affected by operations. Because the HDD method would be used to cross the rivers, tree clearing would not be required within 100 feet of the ordinary low water mark. Tree clearing would be necessary within the ATWS areas associated with the HDD entry and exit sites, which are typically a few hundred feet away from the feature crossing. Following pipeline installation, all disturbed areas would be seeded and revegetated as soon as possible to reduce visual impacts from construction in accordance with PAPL's *Environmental Plan*.

Scenic Byways

The National Scenic Byways Program is part of the DOT's FHA, which designates roads as National Scenic Byways or All-American Roads based on their archaeological, cultural, historic, natural, recreational, and scenic qualities. As part of the National Scenic Byways Program, the Louisiana Scenic Byways Program was created to identify a distinctive collection of roads and their stories to recognize, educate, preserve, and enhance the visitor experience, and to promote sustainable economic and tourism development opportunities. The Louisiana Byways Program is managed by the Louisiana Office of Tourism (Louisiana Office of Tourism, 2017b). State Scenic Byways crossed by the Louisiana Connector Project include the Myths and Legends Byway at MP 96.9, and the Zydeco Cajun Prairie Scenic Byway at MP 123.8.

PAPL would cross the scenic byways using the bore and HDD methods, which would reduce impacts on the surface of the roadbed. The boring and HDD equipment, tree clearing for ATWS, and construction personnel may result in short- to long-term impacts on the viewshed for those traveling along the byways. Visual impacts would be minimal, localized, and intermittent, lasting only for the time it takes a traveler to cross the byway and for construction to occur (typically a few weeks at any given location). If trees are cleared adjacent to the road, the impact would be temporary in areas of temporary workspace, but permanent in areas that are maintained for the life of the project. All disturbed areas would be restored to original conditions according to PAPL's *Environmental Plan*, with the exception of permanently maintained areas which would be restored, but as a maintained right-of-way as discussed in section ZZZZ.

Aboveground Facilities

Compressor Stations

The North and South Compressor Stations associated with the Texas Connector Project would consist of maintenance and control buildings, utility systems, above- and below-ground piping, lighting structures, wire fencing, and other mechanical and electrical systems. Visual characteristics at the North Compressor Station are flat, consisting of open land to the west and north, and a small area of trees and open land to the east. Mansfield Ferry Road and four residences are to the south of the site. The closest residence is about 100 feet east of the proposed compressor station site, with some natural screening provided by trees. The greatest visual impacts would be for those residences south of the compressor station and for motorists traveling on Mansfield Ferry Road. The South Compressor Station would be about 0.7 mile east of Lost Lake and 0.3 mile west of Round Lake, and would result in permanent visual impacts for those visiting the lakes and traversing relocated SH 87. Impacts would be permanent but minor due to similar visual contrasts from existing industrial facilities near the compressor station.

The Louisiana Connector Project Compressor Station would be west of Lyles, in Allen Parish, near the eastern end of the pipeline at MP 96.3, and consist of maintenance and control buildings, utility systems, above- and below-ground piping, lighting structures, wire fencing, and other mechanical and electrical systems. Visual characteristics at the proposed compressor station site mainly consist of densely forested silviculture land (pine plantation). The compressor station site is bound by Green Oak Cemetery Road on the south, an existing utility right-of-way on the north, an existing unimproved road on the east, and silviculture land on the west (and Contractor Yard LY-ALL-01). The compressor station would be 0.3 mile from the Myths and Legends Scenic Byway (U.S. Highway 165). The closest residence is about 500 feet east of the compressor station site. The area between the residence and compressor station is densely forested, and would provide some screening. Compressor Station buildings would be between 12 and 35 feet tall.

As mentioned in section 4.8.1, land within the compressor station site would be permanently converted to industrial/commercial land use. Lighting would be directed toward the facilities to minimize glare on surrounding areas. The greatest visual impacts would be for motorists traveling on Green Oak Cemetery Road. Visual impacts would be minimized due to the forested area that would remain between the compressor station and the residence, and retention of some forested areas within the compressor station site boundary. Motorists traveling north on the Myths and Legends Scenic Byway may be able to see portions of the compressor station; however, because the area between the compressor station site and the byway is densely forested, and local topography is relatively flat, visual impacts would not be significant.

Meter Stations

The NGPL Meter Station would be about 0.1 mile from Keith Lake and about 0.5 mile from an existing industrial facility, which would create a permanent but minor visual impact for those visiting the lake. Impacts would be minor due to similar industrial structures east of the meter station. The HPL Meter Station would require the clearing of an upland forest area, which would result in permanent but minor visual impacts due to previously cleared areas to the north and west. The TETCO Meter Station would be about 0.1 south and east of two residences and west of several buildings, structures, and open land. Visual impacts from residences would be permanent but minor as the views would be screened by existing trees and vegetation. The FGT Meter Station would be less than 0.1 mile west of an existing cleared area with buildings and structures and 0.1 mile south of South Main Street. The meter station would be consistent with existing visual conditions and impacts would be minor for motorists traveling on South Main Street. The GTS/CIPCO and KMLP Meter Stations would be adjacent to industrial facilities, which would be consistent with existing visual conditions and result in minor visual impacts.

The CGT Meter Station (MP 130.9) would be 0.1 mile east of a residence. Based on PAPL's noise analysis for the meter stations, the CGT Meter Station requires noise mitigation. PAPL has committed to implementing noise mitigation measures to reach a 55-decible day-night equivalent level at all NSAs located within 0.5 mile of the CGT Meter Station. Land use surrounding the CGT Meter Station is agricultural, and because PAPL would not enclose or paint the structure to blend in with the surroundings, the meter station would be visible to motorists traveling on nearby roads and the residence. Noise impacts and mitigation are discussed further in section 4.11.

Mainline Valves and Pig Launchers/Receivers

Only a small portion of valve equipment would extend above the ground; however, these areas would be fenced and gated. Therefore, the valves may have visual impacts when located near roads and houses, if without landscape or vegetation screening. Valves near roadways may be visible to motorists. However, given their small size, it is unlikely that impacts on motorists' view would be significant.

The mainline valve at MP 15.3 along the Northern Pipeline would be south of Knauth Road and west of Herbert Road within the permanent right-of-way near a previously cleared area. Only a small portion of valve equipment would extend above the ground; however, the area would be fenced and gated. Valves near roadways may be visible to motorists; however, given their small size, it is unlikely that impacts on motorists' view would be significant.

Pig launchers and receivers would generally be installed within the footprint of the compressor stations or M&R stations. These structures are smaller and less visible than the other aboveground facilities and would have minor visual impact.

Access Roads

PALNG and PAPL propose to construct temporary and permanent access roads to access project workspaces. Construction of temporary access roads would result in similar impacts on visual resources as those described for the pipeline facilities. Most temporary access roads would be along existing roads and rights-of-way in areas that have been previously disturbed. PAPL would limit the removal of trees and vegetation to only that required to safely travel along the roads. When construction of the right-of-way is complete, all temporary roads would be restored to original contours and disturbed areas would be reseeded according to project-specific *Environmental Plans* or landowner requirements. Visual impacts from access roads would be temporary and insignificant. New access roads in forested areas associated with operation of the project would represent a permanent visual impact. Visual impacts would be similar to those described in section 4.8.2 for pipeline facilities in forested areas**.**

A potential for visual impact would be realized for visitors of the J.D. Murphree WMA and nearby lakes, including users of the Keith Lake boat ramp, during construction of the new access roads at MP 2.9 and MP 3.7 along the South Pipeline, which are adjacent to these features. When construction of the right-of-way is complete, all temporary roads would be restored to original contours and disturbed areas would be reseeded according to PAPL's *Environmental Plan*.

Contractor Yards

PAPL would require ten contractor yards to store project equipment, vehicles, and machinery during construction. PAPL is proposing to use previously disturbed, developed, or open lands to reduce the extent of clearing and grading required for these sites. Summaries of land use types affected by contractor yards are provided in tables 4.8.1-2 and 4.8.1-3.

Contractor yards may initially create minor visual impacts in localized areas from clearing, grading, and filling. Impacts on visual resources would be the greatest on contractor yards where tree clearing is required, and where residences are near with minimal screening. Following construction, all contractor yards would be revegetated and restored to preconstruction conditions in accordance with PAPL's *Environmental Plan* or landowner requirements. This would eliminate visual impacts as vegetation becomes established.

4.8.8.3 Nonjurisdictional Facilities

Construction associated with relocating SH 87, pipelines, and utilities would result in a similar range of impacts as the construction of pipeline facilities. Visual resources in the area have been previously altered by tree clearing to support operation of existing electric powerlines and utility rights-of-way and construction and operation of roads and industrial facilities. While construction and operation of the nonjurisdictional facilities would contribute to additional visual impacts, they would be consistent with surrounding conditions and not significant.

4.8.9 Coastal Zone Management

The CZMA is intended to "preserve, protect, develop, and where possible, to restore or enhance" the nation's coastal zone (16 U.S.C. 1452, section 303 [1] and [2]). To participate in the CZMP, a state/commonwealth is required to prepare a management plan for approval by the U.S. Department of Commerce, NOAA, Office for Coastal Management (OCM). Once the OCM approves a plan, the state/commonwealth program gains "Federal Consistency" or jurisdiction. This means that federal actions (including actions requiring federally issued licenses or permits) that take place within a state's/commonwealth's coastal zone must be found to be consistent with state/commonwealth coastal policies before the federal action can take place.

As listed in section 1.5, PAPL is required to file documentation verifying it has received all applicable authorizations required under federal law. The FERC would not approve construction until all federal authorizations, including a consistency determination with the CZMA, have been granted.

4.8.9.1 Liquefaction Project

Based on a review of the TCMP's Coastal Zone Maps, all liquefaction facilities and components occur within the Texas Coastal Zone Management Area administered by the TGLO. The inland boundary of the CZMA mostly follows Interstate 10 north of Port Arthur, and the offshore boundary is about 10.4 miles off the coast of the Gulf of Mexico. The liquefaction facilities would be sited along the Port Arthur Canal, about 1.6 miles west of the inland CZMA boundary in Jefferson County.

The TGLO reviews federal actions to ensure consistency with the TCMP (TGLO, 2017). A consistency determination is performed through both the CWA by the USACE section 404 process and the Texas RRC through the section 401 Water Quality Certification process. PALNG submitted its application and request for consistency review as part of its USACE section 404/10 permit application on November 28, 2016, and submitted a revised application on November 13, 2017. PALNG would continue to coordinate with the TGLO and USACE regarding the coastal zone management consistency review and determination for the Liquefaction Project.

To ensure the project is consistent with the CZMA, **we recommend that:**

- **<u>Prior to construction of the Liquefaction Project</u>, PALNG should file with the Secretary documentation of concurrence from the USACE and TGLO that the Liquefaction Project is consistent with the CZMA.**

4.8.9.2 Texas Connector and Louisiana Connector Projects

Along the Texas Connector Project, the entire Northern Pipeline and associated aboveground facilities and a portion of the Southern Pipeline between MPs 0.0 and 6.4 fall within the Texas CZMA. In addition, about 1.2 miles of the Southern Pipeline and associated aboveground facilities between MPs 6.4 and 7.6 fall within the Louisiana Cameron Parish CZMA.

Along the Louisiana Connector Project, the pipeline and associated ATWS would fall within the CZMA between MPs 0.0 and 16.7 in Texas. In Louisiana, the pipeline and associated ATWS would fall within the CZMA between MPs 16.7 and 42.3.

In Texas, the CZMA is administered by the TGLO. In Louisiana, the CZMA is administered by the OCM of the LDNR. The OCM regulates development activities and manages resources within the coastal zone to determine compliance with the Coastal Resources Program (LDNR, 2017b).

For the Texas Connector Project, PAPL submitted its application and request for consistency review as part of its USACE section 404/10 permit application on February 6, 2017. For the Louisiana Connector Project, PAPL submitted its application and request for consistency review as part of its USACE section 404/10 permit application on October 13, 2017. PAPL states it will continue to coordinate with the USACE, TGLO, and Louisiana Office of Coastal Management regarding the coastal zone management consistency review and determination for the Texas Connector and Louisiana Connector Projects.

To ensure the Texas Connector and Louisiana Connector Projects are consistent with the CZMA, **we recommend that:**

- **<u>Prior to construction of the Texas Connector and Louisiana Connector Projects</u>, PAPL should file with the Secretary documentation of concurrence from the USACE, TGLO, and Louisiana Office of Coastal Management that the Texas Connector Project and Louisiana Connector Project are consistent with the CZMA.**

4.8.9.3 Nonjurisdictional Facilities

The nonjurisdictional facilities would be within the Texas Coastal Zone Management Area and similar to the liquefaction facilities, PALNG would coordinate with the USACE and TGLO regarding the coastal zone management consistency review and determination for the Liquefaction Project.

4.9 SOCIOECONOMICS

Construction and operation activities could impact socioeconomic conditions in the Projects area. Some potential effects are related to the number of construction workers that would work on the Projects and their impact on population, public services, and temporary housing during construction. Other potential effects include alteration of population levels or local demographics, increased employment opportunities, increased demand for housing and public services, tourism and transportation impacts, and an increase in government revenue associated with sales and payroll taxes. Potential impacts related to construction include increased road and marine traffic and disruption of normal traffic patterns. Increased property tax revenue, increased job opportunities, and increased income associated with local construction employment are potential effects of the Projects.

The socioeconomic study area considered for the analysis of the Liquefaction Project and the nonjurisdictional facilities includes Jefferson and Orange Counties, Texas as well as the communities of Beaumont, Groves, Nederland, Port Arthur, and Port Neches, all of which are in Jefferson County. The socioeconomic study area considered for the analysis of the Texas Connector Project includes Jefferson and Orange Counties, Texas; Cameron Parish, Louisiana; and the communities of Beaumont, Groves, Nederland, Port Arthur, and Port Neches, all of which are in Jefferson County. The socioeconomic study area considered for the analysis of the Louisiana Connector Project includes Allen, Beauregard, Calcasieu, Cameron, Evangeline, and St. Landry Parishes, Louisiana; Jefferson and Orange Counties, Texas; and the communities of Port Arthur, Texas and Sulphur, Lake Charles, Kinder, and Eunice, Louisiana.

For certain resources such as population and housing, we considered the combined impacts of the Projects on a study area defined as Cameron Parish, Louisiana and Orange and Jefferson Counties, Texas. Combined impacts were considered during overlapping peak construction phases where each project's peak workforce would be working in the study area, therefore creating an increase in the study area's population that would then create impacts on population and housing resources. Nonjurisdictional facilities were not considered in our combined impacts analysis, as construction of these facilities are scheduled to conclude prior to or following the influx of the Projects' peak workforce.

4.9.1 Population

4.9.1.1 Liquefaction Project

In 2016, the combined population of Jefferson and Orange Counties totaled 339,643. The population of the five largest communities in proximity to the Liquefaction Project (which represents over 65 percent of the population of the study area) ranges in population from 12,809 in Port Neches to 118,299 in Beaumont. Table 4.9.1-1 presents existing population levels and trends for counties and communities in the Liquefaction Project study area.

TABLE 4.9.1-1

Existing Population Levels and Trends for the Liquefaction Project Socioeconomic Study Area

Location	2000 Population [a]	2010 Population [b]	2016 Population Estimate [c]	Population Density (persons/sq. mi) (2010) [b]	Population Change 2000 - 2016	Population Change 2010 - 2016
UNITED STATES	281,421,906	308,745,538	323,127,513	87.4	14.8	4.7
TEXAS	20,851,820	25,145,561	27,862,596	96.3	33.6	10.8
Jefferson County	252,051	252,273	254,679	287.9	1.0	1.0
Orange County	84,966	81,837	84,964	245.3	0.0	3.8
City of Beaumont	113,866	118,296	118,299	1,428.7	3.9	-0.0

TABLE 4.9.1-1 (cont'd)

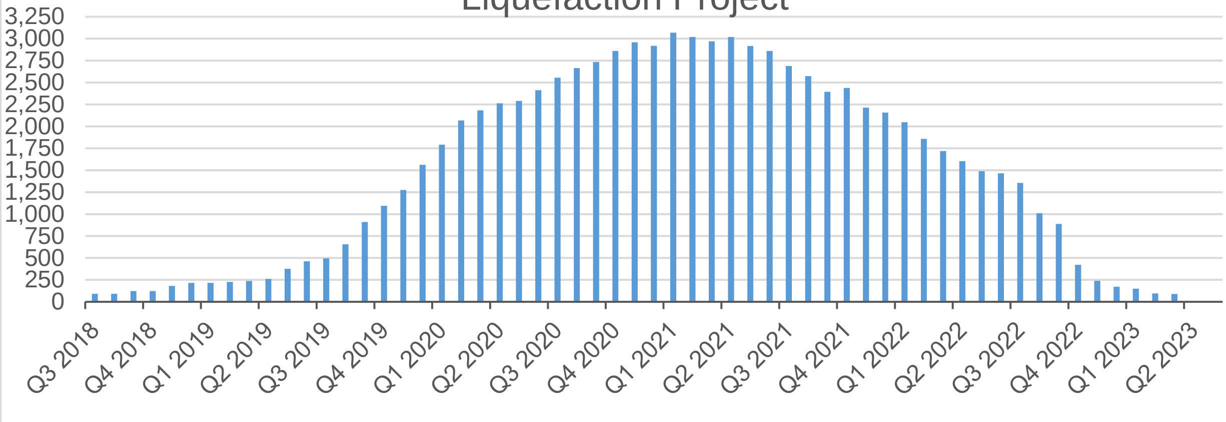
Existing Population Levels and Trends for the Liquefaction Project Socioeconomic Study Area

Location	2000 Population [a]	2010 Population [b]	2016 Population Estimate [c]	Population Density (persons/sq. mi) (2010) [b]	Population Change 2000 - 2016	Population Change 2010 - 2016
City of Groves	15,733	16,144	15,758	3,120.5	0.2	-2.4
City of Nederland	17,422	17,547	17,294	3,073.9	-0.7	-1.4
City of Port Arthur	57,755	53,818	55,427	699.8	-4.0	3.0
City of Port Neches	13,601	13,040	12,809	1,511.0	-5.8	-1.8

[a] Source: U.S. Census Bureau, 2000.
[b] Source: U.S. Census Bureau, 2010.
[c] Source: U.S. Census Bureau, 2016.

Construction of the Liquefaction Project would take place over a 60-month period. Figure 4.9.1-1 shows the estimated monthly construction workforce for the Liquefaction Project and assumes a third quarter of 2018 start date for demonstration purposes; however, construction work would begin only after the receipt of all applicable permits and authorizations. The spikes in construction workforce would shift to the start date/year realized if the project is approved.

Figure 4.9.1-1: Monthly Workforce Projections for the Liquefaction Project



Population impacts resulting from the Liquefaction Project are expected to last about 3 years. These impacts are considered temporary given they would last only for the duration of construction. Given the existing populations of the counties, parish, and cities in the study area, the impacts are expected to be minor. The effect on the population would be equal to the total number of non-local construction workers (i.e., workers living outside a 150-mile radius of the project location) plus any family members accompanying them. PALNG estimates the peak construction workforce, to occur in month 32, would be about 3,000 workers. PALNG estimates that up to 20 percent of the construction workforce could be hired locally (i.e., from Jefferson and Orange Counties in Texas and Cameron Parish, Louisiana), 20 percent would commute daily from outside the project area (i.e., the Beaumont-Port Arthur Metropolitan Statistical Area), and 60 percent would be non-local (i.e., traveling more than 150 miles), relocating to the area for the length of their employment. Therefore, a maximum of 1,800 workers would relocate to the area. If each of the non-local workers brought their families, the resulting population influx would be a maximum of 4,554 people[30] relocating to the study area. Although it is unlikely that all workers would relocate with families, this addition would represent a 2 and 6 percent increase in the population of Jefferson and Orange Counties, respectively.

After construction, 200 permanent jobs would be created at the liquefaction facility. This would be a small increase for the population of Jefferson County, and PALNG anticipates that 70 percent (140 persons) of the permanent employees would be hired locally.

4.9.1.2 Texas Connector and Louisiana Connector Projects

Texas Connector Project

In 2016, the total county/parish population in the Texas Connector Project study area is 346,525. The population of the five largest communities in proximity to the Texas Connector Project range in population from 12,809 in Port Neches to 118,299 in Beaumont. These five communities represent over 63 percent of the population of the study area. Table 4.9.1-2 presents existing population levels and trends for the counties, parish, and communities in the Texas Connector Project study area.

TABLE 4.9.1-2

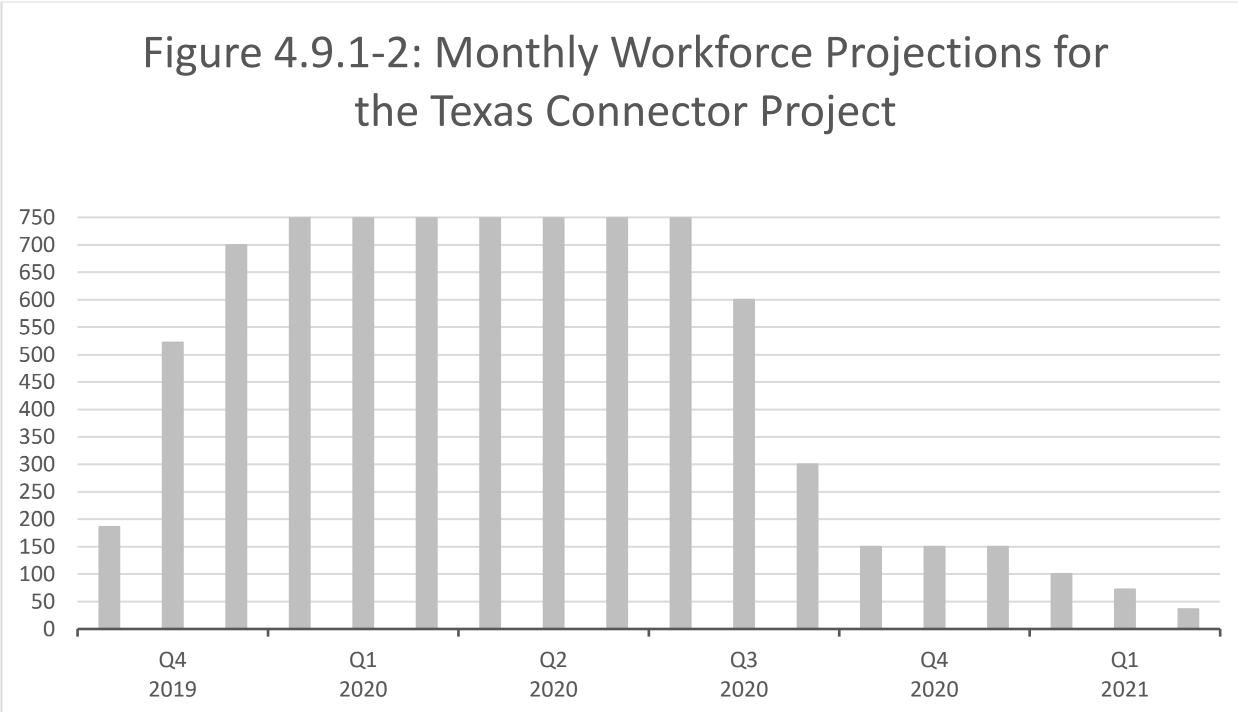
Existing Population Levels and Trends for the Texas Connector Project Socioeconomic Study Area

Location	2000 Population [a]	2010 Population [b]	2016 Population Estimate [c]	Population Density (persons/sq. mi) (2010) [b]	Population Change 2000 - 2016	Population Change 2010 - 2016
UNITED STATES	281,421,906	308,745,538	323,127,513	87.4	14.8	4.7
TEXAS	20,851,820	25,145,561	27,862,596	96.3	33.6	10.8
Jefferson County	252,051	252,273	254,679	287.9	1.0	1.0
Orange County	84,966	81,837	84,964	245.3	0.0	3.8
City of Beaumont	113,866	118,296	118,299	1,428.7	3.9	-0.0
City of Groves	15,733	16,144	15,758	3,120.5	0.2	-2.4
City of Nederland	17,422	17,547	17,294	3,073.9	-0.7	-1.4
City of Port Arthur	57,755	53,818	55,427	699.8	-4.0	3.0
City of Port Neches	13,601	13,040	12,809	1,511.0	-5.8	-1.8
LOUISIANA	4,468,976	4,533,372	4,681,666	104.9	4.8	3.3
Cameron Parish	9,991	6,839	6,882	5.3	-31.1	0.6

[a] Source: U.S. Census Bureau, 2000.
[b] Source: U.S. Census Bureau, 2010.
[c] Source: U.S. Census Bureau, 2016.

Construction of the Texas Connector Project would take place over an 18-month period. Figure 4.9.1-2 shows the estimated monthly construction workforce for the Texas Connector Project. While it assumes a fourth quarter of 2019 start date for demonstration purposes, construction work would begin only after the receipt of all applicable permits and authorizations. The spikes in construction workforce would shift to the start date/year realized if the project is approved.

30 This estimate was calculated assuming an average household size of 2.53 persons based on the average household size in Jefferson County (U.S. Census, 2016).



The Northern and Southern Pipelines, lateral pipelines, and associated facilities (i.e., compressor and meter stations, MLV, and pig launchers and receivers) would be constructed at the same time and PAPL estimates the average monthly construction workforce for the project would be 623 workers who would be dispersed along the length of the proposed pipeline routes. PAPL estimates that about 30 workers (4.38 percent) would be hired locally and the remaining 593 workers would be non-local, relocating to the area for the length of their employment.

Population impacts resulting from the Texas Connector Project are expected to be temporary and, given the increase relative to the existing populations of the counties, parish, and cities in the study area, minor. The effect on the population would be equal to the total number of non-local construction workers (i.e., outside of Jefferson and Orange Counties in Texas and Cameron Parish, Louisiana) plus any family members accompanying them. Pipeline construction is mobile and of a short duration, and most non-local workers would not travel with their families to study area, thus minimizing temporary impacts on the local populations. PAPL estimates the average monthly construction workforce would be 623 workers and the peak construction workforce, to occur in months 4 through 10, would be about 750 workers. PAPL estimates that 4.8 percent of the construction workforce could be hired locally (i.e., from Jefferson and Orange counties in Texas and Cameron Parish, Louisiana), and the remaining 95 percent would be non-local, relocating to the area for the length of their employment. Therefore, an average of 593 and a maximum of 714 workers would relocate to the area. If each of the non-local workers brought their families, the resulting population influx would be on average 1,500 and a maximum of 1,806 people[31] relocating to the study area. Although it is unlikely that all workers would relocate with families, this addition would represent an average of a 0.4 percent and a maximum of 0.5 percent increase in the population of Jefferson and Orange Counties and Cameron Parish. Any temporary increase in population would be distributed throughout the study area and would not have a permanent impact on any one population.

31 This estimate was calculated assuming an average household size of 2.53 persons based on the average household size in Jefferson County (U.S. Census, 2016).

After construction, 20 permanent employees would be employed during operations of the pipeline and associated facilities. This would be a minor increase for the population of the study area, and PAPL anticipates that about 20 percent (four persons) of the permanent employees would be hired locally.

Louisiana Connector Project

In 2016, the total population of the counties and parish in the Louisiana Connector Project study area was 727,329. The population of the largest communities in proximity to the Louisiana Connector Project range in population from 2,436 in Kinder to 76,848 in Lake Charles. These communities represent about 23 percent of the population of the study area. Table 4.9.1-3 presents existing population levels and trends for the parishes, counties, and communities in the Louisiana Connector Project study area.

TABLE 4.9.1-3

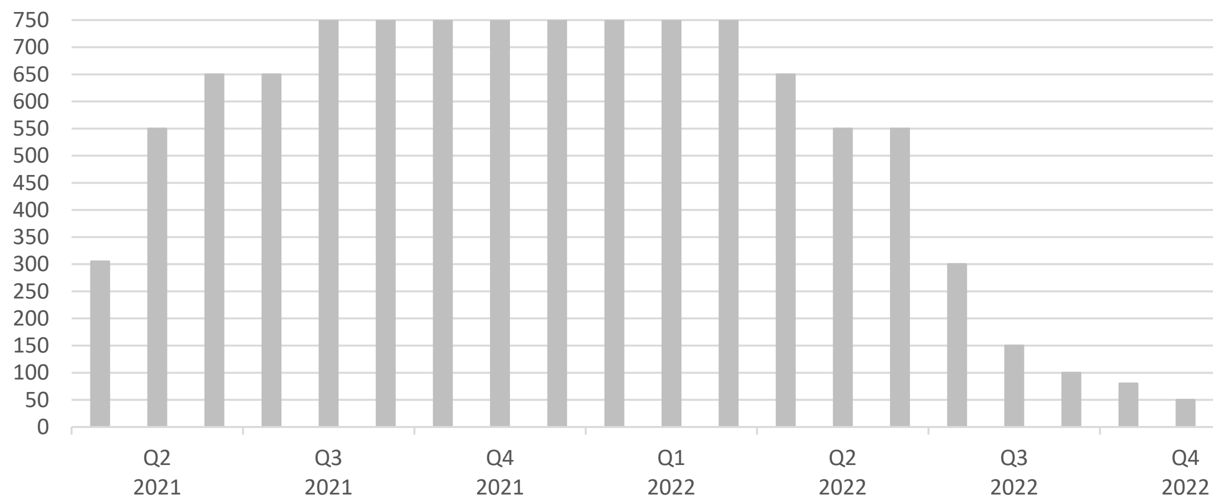
Existing Population Levels and Trends for the Louisiana Connector Project Socioeconomic Study Area

Location	2000 Population [a]	2010 Population [b]	2016 Population Estimate [c]	Population Density (persons/sq. mi) (2010) [b]	Population Change 2000 - 2016	Population Change 2010 - 2016
UNITED STATES	**281,421,906**	**308,745,538**	**323,127,513**	**87.4**	**14.8**	**4.7**
TEXAS	**20,851,820**	**25,145,561**	**27,862,596**	**96.3**	**33.6**	**10.8**
Jefferson County	252,051	252,273	254,679	287.9	1.0	1.0
Orange County	84,966	81,837	84,964	245.3	0.0	3.8
City of Port Arthur, Texas	57,755	53,818	55,427	374.3	-4.0	3.0
LOUISIANA	**4,468,976**	**4,533,372**	**4,681,666**	**104.9**	**4.8**	**3.3**
Allen Parish	25,440	25,764	25,684	33.8	1.0	-0.3
Beauregard Parish	32,986	35,654	36,927	30.8	11.9	3.6
Calcasieu Parish	183,577	192,768	200,601	181.2	9.3	4.1
Cameron Parish	9,991	6,839	6,882	5.3	-31.1	0.6
Evangeline Parish	34,434	33,984	33,709	51.3	-2.1	-0.8
St. Landry Parish	87,700	83,384	83,883	90.3	-4.4	0.6
City of Sulphur, Louisiana	20,512	20,410	20,272	2,010.8	-1.2	-0.7
City of Lake Charles, Louisiana	71,757	71,993	76,848	1,603.4	7.0	6.7
City of Kinder, Louisiana	2,148	2,477	2,436	448.3	13.4	-1.7
City of Eunice, Louisiana	11,499	10,398	10,279	2,023.4	-10.6	-1.1

[a] U.S. Census Bureau, 2000.
[b] U.S. Census Bureau, 2010.
[c] U.S. Census Bureau, 2016.

Construction of the Louisiana Connector Project would take place over a 17-month period for the pipeline portion of the project and a 21-month period for the construction of the compressor station. Figure 4.9.1-3 shows the estimated monthly construction workforce for the Louisiana Connector Project. While it assumes a second quarter of 2021 start date for demonstration purposes, construction work would begin only after the receipt of all applicable permits and authorizations. The spikes in construction workforce would shift to the start date/year realized if the project is approved.

Figure 4.9.1-3: Monthly Workforce Projections for the Louisiana Connector Project



The pipeline and compressor stations would be constructed simultaneously, and PAPL estimates the average monthly construction workforce for the project would be 600 workers who would be dispersed along the length of the pipeline route, and that 150 workers would be required for construction at the compressor station locations. PAPL estimates that 150 to 300 workers (about 20 to 40 percent of the total workforce, estimated at 750 workers during peak construction) would be hired locally (i.e., from within the study area parishes and counties), and the remaining 450 to 600 workers would be non-local, relocating to the area for the length of their employment.

Population impacts resulting from the Louisiana Connector Project are expected to be temporary and, given the increase relative to the existing populations of the parishes, counties, and communities in the study area, minor. The effect on the population would be equal to the total number of non-local construction workers plus any family members accompanying them. Pipeline construction is mobile and of a short duration, and in our experience most non-local workers would not travel with their families to study area, thus minimizing temporary impacts on the local populations. PAPL estimates the average monthly construction workforce would be 600 workers and the peak construction workforce, to occur in months 5 through 12, would be about 750 workers. PAPL estimates that between 20 and 40 percent of the construction workforce could be hired locally and the remaining 60 to 80 percent would be non-local, relocating to the area for the length of their employment. Therefore, an average of between 360 (off-peak) and 480 (peak) workers, and a maximum of between 450 (off-peak) and 600 (peak) workers, would relocate to the area. If each of the non-local workers brought their families, the resulting population influx would be on average between 954 (off-peak) and 1,272 (peak) people and a maximum of 1,193 (off-peak) and 1,590 (peak) people[32] relocating to the study area. Although it is unlikely that all workers would relocate with families, this addition would represent an average of between 0.1 and 0.2 percent and a maximum of a 0.3 percent increase in the population of the study area. Any temporary increase in population would be distributed throughout the study area and would not have a permanent impact on any one population.

32 This estimate was calculated assuming an average household size of 2.65 persons based on the average household size in the study area.

After construction, ten permanent employees would be employed during operations of the pipeline and associated facilities. This would be a minor increase for the population of the study area, and PAPL anticipates that about 20 to 40 percent (two to four persons) of the permanent employees would be hired locally.

4.9.1.3 Nonjurisdictional Facilities

Relocation of SH 87, pipelines, and utilities is estimated to take place over a 20-month period. PALNG estimates 150 construction workers would be needed for the duration of the relocation activities. PALNG estimates that about 50 percent of the construction workforce (75 workers) would be hired locally (i.e., from within the project study area). Population impacts resulting from the SH 87, pipeline, and utility relocation are expected to be temporary and, given the increase relative to the existing populations of the counties and cities in the study area, minor. Any temporary increase in population would be distributed throughout the study area and would not have a permanent impact on any one population. Following the relocation activities, personnel from TDOT and the respective pipeline and utility owner and operator would permanently maintain these facilities.

4.9.1.4 Combined Projects Impacts on Population

Assuming all permits and authorizations are received when anticipated, the Projects are expected to have their peak workforce requirements at roughly the same time, from the fourth quarter of 2019 through the first quarter of 2022. At the peak, anticipated for the third quarter of 2020, a combined workforce of over 3,230 workers would be needed. The could represent a population increase of less than 1 percent to the entire study area. Where the Projects would overlap the greatest geographically, in Cameron Parish and Orange and Jefferson Counties, this would be an increase of 1 percent to the population. Based on the populations of the counties/parishes and cities study area, in the event some construction workers and families do temporarily relocate to the area, the increase in population would not be significant. In addition, any temporary increase in population would be distributed throughout the study area and would not have a permanent impact on any one population.

4.9.2 Economy and Employment

4.9.2.1 Liquefaction Project

Table 4.9.2-1 provides select employment and income statistics for the Liquefaction Project study area.

TABLE 4.9.2-1

Existing Economic Conditions for the Liquefaction Project Study Area

Location	Per Capita Income (U.S. Dollars)	Civilian Labor Force	Top Three Industries [a]	Unemployment Rate
UNITED STATES	$28,930	158,897,824	R, P, M	8.3
TEXAS	$26,999	13,006,330	E, R, P	7.0
Jefferson County	$24,154	113,186	E, M, R	8.8
Orange County	$25,489	38,866	E, M, R	8.4
City of Beaumont	$24,803	54,963	E, R, M	8.5
City of Groves	$24,650	7,428	E, M, C	11.7
City of Nederland	$32,295	9,114	E, M, P	6.1

TABLE 4.9.2-1 (cont'd) **Existing Economic Conditions for the Liquefaction Project Study Area**				
Location	Per Capita Income (U.S. Dollars)	Civilian Labor Force	Top Three Industries [a]	Unemployment Rate
City of Port Arthur	$18,464	23,855	E, C, M	11.5
City of Port Neches	$30,905	6,433	E, M, R	6.4

Source: U.S. Census Bureau, 2016.
[a] Industries are defined under the 2012 North American Industry Classification System (NAICS) and abbreviated as follows: **C** = Construction; **E** = Educational, Health and Social Services; **M** = Manufacturing; **P** = Professional, Scientific, Management, Administrative, and Waste Management Services; **R** = Retail Trade.

The top three industries in the Liquefaction Project study area are educational, health and social services; manufacturing; and retail trade. The total civilian workforce in Jefferson and Orange Counties is 152,052. The civilian workforce in the five largest communities in proximity to the Liquefaction Project ranges from 6,433 in Port Neches to 54,963 in Beaumont. Over 66 percent of the civilian workforce in the study area resides in the five communities identified (U.S. Census Bureau, 2016).

At $24,154 and $25,489, respectively, both Jefferson and Orange Counties have per capita incomes below the average for the State of Texas. The per capita incomes of the communities in the study area range from $18,464 in Port Arthur to $32,295 in Nederland. Additionally, the unemployment rates in both Jefferson and Orange Counties, at 8.8 and 8.4, respectively, are below the state rate. Unemployment rates in the communities in the study area range from 6.1 in Nederland to 11.7 in Groves.

Tourism opportunities in the Liquefaction Project study area include federal, state, and local special interest areas discussed in section 4.8.6 as well as tourist attractions and general recreation areas located throughout the study area. Tourists drawn to the project area experience opportunities such as fishing, hunting, kayaking, beaches, and golfing. Examples of tourist activities in the study area include Walter Umphrey State Park, J.D. Murphree WMA, Sabine Pass Battleground State Historical Park, and the Texas Point National Wildlife Refuge. While visits to the recreational and special interest areas in the study area occur year-round, the peak tourism season typically occurs in the spring. Travel-related spending supports local economies in the study area, and there are businesses in and around the study area that are dependent on year-round as well as seasonal tourists.

Travel- and tourism-related spending in the Liquefaction Project study area totaled about $597 million in 2016, and 7,130 jobs in the study area were attributed to travel-generated employment. Table 4.9.2-2 provides an overview of the economic impacts of travel-related spending in the counties in the Liquefaction Project study area.

TABLE 4.9.2-2 **Tourism Economy in the Liquefaction Project Study Area**				
Location	Travel and Tourism Spending ($ millions) (2016)	Tourism-Supporting Jobs (2016)	Job Earnings ($ millions) (2016)	Local/State Tax Revenue ($ millions)
TEXAS				
Jefferson County	489.1	5,970	125.2	8.3/28.4
Orange County	108.0	1,160	27.6	1.45/6.6

Sources: Dean Runyan Associates, 2017; University of New Orleans, 2017

The influx of construction workers would be limited to the time of construction. The demand for temporary housing by non-local workers is not expected to exceed the available number of hotels, motels, and campground units in the study area, but accommodations in the study area could experience some minor limited availability, particularly during planned construction periods that overlap with the peak tourism season in the project area. Section 4.9.4 discusses impacts on housing (including hotel/motel/campground rentals).

Construction of the Liquefaction Project would add temporary employment opportunities to the study area and the greater region. This would result in a minor, temporary decrease in the unemployment rate in the Liquefaction Project study area.

In addition to direct hires, it is reasonable to expect that construction of the Liquefaction Project would result in several temporary, indirect jobs as purchases for goods and services would increase along with the influx of the construction workforce to the project area. Indirect employment, including hiring additional staff in the retail and service industries to accommodate the increase in demand for food, clothing, lodging, gasoline, and entertainment, would have a temporary stimulating effect on local economies. These indirect jobs would represent a temporary, minor increase in employment opportunities in the study area.

Payroll taxes would be collected from workers employed in the construction of the Liquefaction Project, resulting in additional beneficial, short-term effects. PALNG estimates that payroll spending would be $783 million during the construction phase (of which, $156 million would go to the local construction workforce) and $36 million annually during the operational phase. PALNG estimates that during construction $369 million would be spent locally on the purchase of material goods and services, and operations would produce an estimated annual regional expenditure of $200 million. The increase in economic activity resulting from spending during construction would result in a temporary, positive economic impact in the Liquefaction Project study area.

Operation of the Liquefaction Project would add 200 permanent jobs. These jobs would create more employment opportunities and result in indirect economic benefits to the study area as the workers spend their salaries in the community, producing permanent, minor economic benefits to the local economy and employment in the project area.

4.9.2.2 Texas Connector and Louisiana Connector Projects

Texas Connector Project

Table 4.9.2-3 provides select employment and income statistics for the Texas Connector Project study area.

TABLE 4.9.2-3

Existing Economic Conditions for the Texas Connector Project Study Area

Location	Per Capita Income (U.S. Dollars)	Civilian Labor Force	Top Three Industries [a]	Unemployment Rate
UNITED STATES	$28,930	158,897,824	R, P, M	8.3
TEXAS	$26,999	13,006,330	E, R, P	7.0
Jefferson County	$24,154	113,186	E, M, R	8.8
Orange County	$25,489	38,866	E, M, R	8.4
City of Beaumont	$24,803	54,963	E, R, M	8.5
City of Groves	$24,650	7,428	E, M, C	11.7
City of Nederland	$32,295	9,114	E, M, P	6.1

TABLE 4.9.2-3 (cont'd)

Existing Economic Conditions for the Texas Connector Project Study Area

Location	Per Capita Income (U.S. Dollars)	Civilian Labor Force	Top Three Industries [a]	Unemployment Rate
City of Port Arthur	$18,464	23,855	E, C, M	11.5
City of Port Neches	$30,905	6,433	E, M, R	6.4
LOUISIANA	$24,981	2,194,199	E, R, A	8.1
Cameron Parish	$29,679	3,283	E, Ag, R	6.3

[a] Industries are defined under the 2012 NAICS and abbreviated as follows: **A** = Arts, Entertainment, and Recreation, and Accommodation and Food services; **Ag** = Agriculture, Forestry, Fishing, and Hunting, and Mining; **C** = Construction; **E** = Educational, Health and Social Services; **M** = Manufacturing; **P** = Professional, Scientific, Management, Administrative, and Waste Management Services; **R** = Retail Trade.

Source: U.S. Census Bureau, 2016.

The top three industries in the Texas Connector Project study area are the same as those identified in the Liquefaction Project study area – educational, health and social services; manufacturing; and retail trade. The total civilian workforce in Texas Connector Project study area is 155,335. The civilian workforce in the five largest communities in proximity to the Texas Connector Project ranges from 6,433 in Port Neches to 54,963 in Beaumont. Over 65 percent of the civilian workforce in the study area resides in the five communities identified in table 4.9.2-3.

The economic characteristics of the Texas Connector Project study area are the same as the Liquefaction Project study area, apart from the addition of Cameron Parish. Cameron Parish has a per capita income of $29,679, which is higher than that of the State of Louisiana. Further, the unemployment rate in Cameron Parish, 6.3 percent, is almost 2 percent lower than the unemployment rate for the state.

Tourism opportunities in the Texas Connector Project study area include federal, state, and local special interest areas discussed in section 4.8.6 as well as tourist attractions and general recreation areas located throughout the study area. Examples of tourist activities in the study area include festivals such as Mardi Gras; Big Thicket National Preserve; Sea Rim State Park; Atchafalaya National Heritage Area; Cameron Prairie National Wildlife Refuge; the Sabine Lake National Wildlife Reserve in Cameron Parish, Louisiana, which attracts 300,000 visitors annually to participate in hiking, fishing, boating, camping, and hunting activities (FWS, 2016c); the Creole Nature Trail in Cameron and Calcasieu Parishes, Louisiana; and miles of scenic U.S. Byways (Lake Charles Convention & Visitors Bureau, 2017). While visits to the recreational and special interest areas in the study area occur year-round, the peak tourism season typically occurs in the spring. Tourists drawn to the project area experience opportunities such as fishing, hunting, kayaking, beaches, and golfing. Travel-related spending supports local economies in the study area, and there are businesses in and around the study area that are dependent on year-round as well as seasonal tourists.

Travel- and tourism-related spending in the Texas Connector Project study area totaled about $599.5 million in 2016, and 7,160 jobs in the study area were attributed to travel-generated employment. Table 4.9.2-4 provides an overview of the economic impacts of travel-related spending in the counties and parishes in the Texas Connector Project study area.

TABLE 4.9.2-4 **Tourism Economy in the Louisiana Connector Project Study Area**				
Location	Travel and Tourism Spending ($ millions) (2016)	Tourism-Supporting Jobs (2016)	Job Earnings ($ millions) (2016)	Local/State Tax Revenue ($ millions)
TEXAS				
Jefferson County	489.1	5,970	125.2	8.3/28.4
Orange County	108.0	1,160	27.6	1.45/6.6
LOUISIANA				
Cameron Parish	2.4	30	0.9	<0.1/0.2

Sources: Dean Runyan Associates, 2017; University of New Orleans, 2017

The influx of construction workers would be limited to the time of construction and dispersed across the Texas Connector Project study area throughout the construction period. The demand for temporary housing by non-local workers is not expected to exceed the available number of hotels, motels, and campground units in the study area, but accommodations in the study area could experience some minor limited availability, particularly during planned construction periods that overlap with the peak tourism season in the project area. Section 4.9.4 discusses impacts on housing (including hotel/motel/campground rentals).

Construction of the Texas Connector Project would add a small number (about 30) of temporary employment opportunities to the study area. This would result in a minor, temporary decrease in the unemployment rate in the Texas Connector Project study area. The impact of indirect jobs in the study area would be the same as discussed for the Liquefaction Project.

Payroll taxes would be collected from workers employed in the construction of the Texas Connector Project, resulting in additional beneficial, short-term effects. PAPL estimates that payroll spending would be $89.8 million during the construction phase (of which, it is anticipated that $17.9 million would go to the local construction workforce) and operation would produce an estimated total annual payroll of $48 million. PAPL estimates that during construction, $18 million would be spent locally on the purchase of material goods and services and an estimated annual regional expenditure of $2.7 million during operation. The increase in economic activity resulting from spending during construction would result in a temporary, positive economic impact in the Texas Connector Project study area.

Operation of the Texas Connector Project would add 20 permanent jobs. These jobs would add more employment opportunities and would result in indirect economic benefits to the study area as the workers spend their salaries in the community, producing permanent, minor economic benefits to the local economy and employment in the Texas Connector Project area.

Louisiana Connector Project

Table 4.9.2-5 provides select employment and income statistics for the Louisiana Connector Project study area.

TABLE 4.9.2-5

Existing Economic Conditions for the Louisiana Connector Project Study Area

Location	Per Capita Income (U.S. Dollars)	Civilian Labor Force	Top Three Industries [a]	Unemployment Rate
UNITED STATES	$28,930	158,897,824	R, P, M	8.3
TEXAS	$26,999	13,006,330	E, R, P	7.0
Jefferson County	$24,154	113,186	E, M, R	8.8
Orange County	$25,489	38,866	E, M, R	8.4
City of Port Arthur	$18,464	23,855	E, M, C	11.5
LOUISIANA	$24,981	2,194,199	E, R, A	8.1
Allen Parish	$19,868	9,073	E, A, Pu	8.9
Beauregard Parish	$22,961	15,155	E, R, M	5.7
Calcasieu Parish	$25,005	94,684	E, A, R	8.3
Cameron Parish	$29,679	3,283	E, Ag, R	6.3
Evangeline Parish	$18,484	12,254	E, R, Ag	10.4
St. Landry Parish	$19,156	33,190	E, R, C	6.1
City of Sulphur, Louisiana	$22,724	8,901	M, R, C	8.6
City of Lake Charles	$23,932	36,664	E, R, A	9.5
City of Kinder	$16,979	1,062	A, E, Pu	7.4
City of Eunice	$17,486	4,412	E, R, O	7.0

Source: U.S. Census Bureau, 2016.

[a] Industries are defined under the 2012 NAICS and abbreviated as follows: **A** = Arts, Entertainment, and Recreation, and Accommodation and Food services; **Ag** = Agriculture, Forestry, Fishing, and Hunting, and Mining; **C** = Construction; **E** = Educational, Health and Social Services; **M** = Manufacturing; **O** = Other Services, except Public Administration; **P** = Professional, Scientific, Management, Administrative, and Waste Management Services; **Pu** = Public Administration; **R** = Retail Trade.

The top three industries in the Louisiana Connector Project study area are the same as those identified in the Liquefaction and Texas Connector Projects study areas – educational, health and social services; manufacturing; and retail trade. The total civilian workforce in Louisiana Connector Project study area is 319,691. The civilian workforce in the communities in proximity to the Louisiana Connector Project ranges from 1,062 in Kinder to 36,664 in Lake Charles. Over 23 percent of the civilian workforce in the study area resides in the communities identified in table 4.9.2-5.

The per capita incomes of the parishes in the study area range from $18,484 in Evangeline Parish to $29,679 in Cameron Parish. Two of the six parishes in the study area (Calcasieu and Cameron) have per capita incomes above the average for the State of Louisiana. Unemployment rates in the parishes in the study area range from 5.7 in Beauregard to 10.4 in Evangeline. Three of the six parishes in the study area (Allen, Calcasieu, and Evangeline) have unemployment rates above the state rate. At $24,154 and $25,489, respectively, both Jefferson and Orange Counties have per capita incomes below the average for the State of Texas. Additionally, the unemployment rates in both Jefferson and Orange Counties, at 8.8 and 8.4, respectively, are below the state rate.

Tourism opportunities in the Louisiana Connector Project study area are similar to those described for the Texas Connector Project and includes the Coushatta Casino Resort. Travel- and tourism-related spending in the Louisiana Connector Project study area totaled about $1.3 billion in 2016, and 17,830 jobs in the study area were attributed to travel-generated employment. Table 4.9.2-6 provides an overview of the economic impacts of travel-related spending in the counties and parishes in the Louisiana Connector Project study area. Impacts on tourism from the Louisiana Connector Project would be similar to those described above for the Texas Connector Project.

TABLE 4.9.2-6

Tourism Economy in the Louisiana Connector Project Study Area

Location	Travel and Tourism Spending ($ millions) (2016)	Tourism-Supporting Jobs (2016)	Job Earnings ($ millions) (2016)	Local/State Tax Revenue ($ millions)
TEXAS				
Jefferson County	489.1	5,970	125.2	8.3/28.4
Orange County	108.0	1,160	27.6	1.45/6.6
LOUISIANA				
Allen Parish	11.0	160	4.2	0.4/1.0
Beauregard Parish	25.4	360	9.7	0.9/2.3
Calcasieu Parish	645.8	9,140	247.2	23.3/59.4
Cameron Parish	2.4	30	0.9	<0.1/0.2
Evangeline Parish	5.1	70	1.9	0.2/0.5
St. Landry Parish	66.1	940	25.3	2.4/6.1

Sources: Dean Runyan Associates, 2017; University of New Orleans, 2017

The Louisiana Connector Project would impact farms and businesses focused on rice, crawfish fields, and silviculture. According to the USDA's Louisiana Crop Production Report (2016), rice is the fourth largest crop in the state with about 435,000 acres dedicated to the resource. While the project would affect these areas, PAPL would compensate landowners for loss of crops or timber during construction and for subsequent years as agreed upon with the landowner. In addition, the project would cross Sabine Lake, which is used for both recreational and commercial fishing. Of the 90,000-acre lake, the project would affect less than 1 percent of the total area.

Construction of the Louisiana Connector Project would add a small number (between 150 and 300) of temporary employment opportunities to the study area. This would result in a minor, temporary decrease in the unemployment rate in the Louisiana Connector Project study area.

Payroll taxes would be collected from workers employed in the construction of the Louisiana Connector Project, resulting in additional beneficial, short-term effects. PAPL estimates that payroll spending would be $108 million during the construction phase (of which, it is anticipated that $22 million would go to the local construction workforce) and estimated $1.2 million annually during operation. PAPL estimates that during construction, $116 million would be spent locally on the purchase of material goods and services of a total of $224 million in expenditures on goods and services during construction. The increase in economic activity resulting from spending during construction would result in a temporary, positive economic impact in the Louisiana Connector Project study area.

Operation of the Louisiana Connector Project would add 10 permanent jobs. These jobs would add more employment opportunities and would result in indirect economic benefits to the study area as the workers spend their salaries in the community, producing permanent, minor economic benefits to the local economy and employment in the Louisiana Connector Project area.

4.9.2.3 Nonjurisdictional Facilities

The SH 87, pipelines, and utilities relocation would add 75 temporary local construction jobs to the study area during the 20-month construction period. This would result in a minor, temporary decrease in the unemployment rate in the study area. Similar to the Projects, it is reasonable to expect that the construction of the nonjurisdictional facilities would result in a few temporary, indirect jobs as purchases for goods and services would increase along with the influx of the construction workforce to the project area. The increase in economic activity resulting from spending during construction of the nonjurisdictional facilities would result in a temporary, positive economic impact in the study area.

4.9.2.4 Combined Projects Impacts on Economy and Employment

The Projects are expected to have a temporary, minor, and beneficial impact on the economy and employment during construction based on the creation of over 4,300 jobs, local expenditures estimated to be over $500 million, and payroll taxes associated with these positions estimated to be about $908 million. Operation of the Projects would create 230 new, permanent jobs. In addition to direct hires, it is reasonable to expect that construction of the Projects would result in many temporary, indirect jobs as purchases for goods and services would increase along with the influx of the construction workforce to the Projects area. Indirect employment, including hiring additional staff in the retail and service industries to accommodate the increase in demand for food, clothing, lodging, gasoline, and entertainment, would have a temporary stimulating effect on local economies. These indirect jobs would represent a temporary, minor, and beneficial increase in employment opportunities in the Projects area.

4.9.3 Local Taxes and Government Revenue

PALNG estimates that $369 million would be spent on direct local expenditures during construction of the Liquefaction Project. The estimated $783 million in payroll would increase the federal government's income tax revenues.

PAPL estimates that $18 million would be spent on direct local expenditures during construction of the Texas Connector Project. The estimated $89.8 million in payroll would increase the federal government's income tax revenues.

PAPL estimates that $116 million would be spent on direct local expenditures during construction of the Louisiana Connector Project. The estimated $108 million in payroll would increase the federal government's income tax revenues.

This would generate increased federal, state, and local tax revenue in counties and parishes where the Projects would be located. Expenditures on goods and services by construction workers and their families would also generate increased tax revenues. This increase in tax revenue would be a minor, temporary, and positive impact on tax revenue in the study area.

Operation of the Liquefaction, Texas Connector, and Louisiana Connector Projects would result in a minor, long-term increase in sales tax revenue from expenditures made locally on materials, goods, and services. PALNG expects that $24 million would be spent annually on local purchases from project operations. PAPL expects that $2.7 million and $250,000 would be spent annually on local purchases during operation of the Texas Connector and Louisiana Connector Projects, respectively.

4.9.4 Housing

4.9.4.1 Liquefaction Project

Housing statistics for the Liquefaction Project study area are listed in table 4.9.4-1. The study area has 88 hotels, motels, and RV parks along with over 42,000 rental housing units. Of the 42,000 rental housing units in the study area, 78 percent are in the five largest communities in proximity to the Liquefaction Project.

TABLE 4.9.4-1

Available Housing in the Liquefaction Project Study Area

Location	Total Housing Units [a]	Owner Occupied [a]	Renter Occupied [a]	Median Gross Rent ($) [a]	Rental Vacancy Rate (%) [a]	Vacant Housing Units	Hotels and Motels [b, d]	Campgrounds /RV Parks [c, d]
UNITED STATES	133,351,840	74,712,091	42,214,214	$928	6.4	16,425,535	--	--
TEXAS	10,305,607	5,693,770	3,455,426	$882	7.8	1,156,411	--	--
Jefferson County	106,857	58,939	34,556	$761	9.8	13,362	50	20
Orange County	35,952	24,507	7,547	$748	7.8	3,898	15	3
City of Beaumont	52,822	26,365	19,828	$765	10.8	6,629	--	--
City of Groves	6,830	4,554	1,698	$810	3.9	578	--	--
City of Nederland	7,910	5,415	1,781	$862	6.8	714	--	--
City of Port Arthur	23,912	11,637	8,169	$704	10.2	4,106	--	--
City of Port Neches	5,414	3,753	1,241	$878	12.0	420	--	--

[a] U.S. Census Bureau, 2016.
[b] Yellow Pages, 2017.
[c] Beaumont Convention & Visitors Bureau, 2017.
[d] City hotel, motel, campground, and RV park data for communities are accounted for in the county totals.
Note: Inventory of hotels, motels, and campgrounds was collected at county-level only.

The availability of housing in the study area may fluctuate during local and seasonal events as well as due to demand on housing from other industries. The rental vacancy rates in Jefferson and Orange Counties are 9.8 and 7.8, respectively. The rental vacancy rates in the five communities identified range from a low of 3.9 percent in Groves to a high of 12 percent in Port Neches.

PALNG estimates that about 60 percent of the workforce would be non-local. That equates to 1,800 non-local workers at peak construction placing demand on local temporary housing in the Liquefaction Project study area. Using a conservative estimate of 25 units per hotel/motel or campground, of which there are 88, we estimate that there are at least 2,200 rooms/sites available in the study area. Given the rental vacancy rates in the counties and communities in the study area) and number of hotel/motel rooms available in study area, the increased demand caused by the influx of the non-local construction workforce may cause a shortage in temporary housing availability in the Project area.

The influx of non-local construction workers to the study area would result in a minor, temporary increase in the demand for rental housing and/or hotel/motel rooms and campground sites. The Liquefaction Project could have a short-term positive impact on the area rental industry through increased demand and higher rates of occupancy; however, no significant impacts on local housing markets are expected. Increased demand in the study area could benefit the proprietors of the local motels, hotels, and other rental units through increased revenue. While the project could increase competition (and cost) for short-term housing and could decrease housing availability for local renters or residents, the demand for temporary housing by non-local workers is not expected to exceed the available number of hotels, motels, and campground units in the study area.

The increase in demand for short-term housing from non-local construction workers during the construction of the Liquefaction Project would be temporary and minor. In addition, we conclude the estimated 60 non-local employees needed during operations would not have a noticeable impact on housing resources in the study area.

4.9.4.2 Texas Connector and Louisiana Connector Projects

Texas Connector Project

Housing statistics for the Texas Connector Project study area are listed in table 4.9.4-2. At least 92 hotels, motels, and campgrounds along with over 42,300 rental housing units are within the study area. Of the 42,300 rental housing units in the study area, 77 percent are in the five largest communities in proximity to the Pipeline Project.

TABLE 4.9.4-2

Available Housing in the Texas Connector Project Study Area

Location	Total Housing Units [a]	Owner Occupied [a]	Renter Occupied [a]	Median Gross Rent ($) [a]	Rental Vacancy Rate (%) [a]	Vacant Housing Units	Hotels and Motels [b, e]	Campgrounds/ RV Parks [c, d, e]
UNITED STATES	133,351,840	74,712,091	42,214,214	$928	6.4	16,425,535	--	--
TEXAS	10,305,607	5,693,770	3,455,426	$882	7.8	1,156,411	--	--
Jefferson County	106,857	58,939	34,556	$761	9.8	13,362	50	20
Orange County	35,952	24,507	7,547	$748	7.8	3,898	15	3
City of Beaumont	52,822	26,365	19,828	$765	10.8	6,629	--	--
City of Groves	6,830	4,554	1,698	$810	3.9	578	--	--
City of Nederland	7,910	5,415	1,781	$862	6.8	714	--	--
City of Port Arthur	23,912	11,637	8,169	$704	10.2	4,106	--	--
City of Port Neches	5,414	3,753	1,241	$878	12.0	420	--	--
LOUISIANA	1,999,855	1,136,709	591,210	$788	8.1	271,936	--	--
Cameron Parish	3,524	2,369	239	$727	13.1	916	2	2

[a] U.S. Census Bureau, 2016.
[b] Yellow Pages, 2017.
[c] Cameron Parish Tourist Commission, 2017.
[d] Beaumont Convention & Visitors Bureau, 2017.
[e] City hotel, motel, campground, and RV park data for communities are accounted for in the county and parish totals.
Note: Inventory of hotels, motels, and campgrounds was collected at parish- and county-level only.

The availability of housing in the study area may fluctuate during local and seasonal events as well as due to demand on housing from other industries. The rental vacancy rates in the Texas Connector Project study area are the same as that of the Liquefaction Project study area apart from Cameron Parish with a rental vacancy rate of 13.1.

PAPL estimates that about 95 percent of the workforce needed for the Texas Connector Project would be non-local. That equates to 714 non-local workers at peak construction placing demand on local temporary housing in the study area. Using a conservative estimate of 25 units per hotel/motel or campground, of which there are 92, we estimate that there are at least 2,300 rooms/sites available in the study area. Given the rental vacancy rates in the parish, counties, and communities in the study area and number of hotel/motel rooms available in study area, there are sufficient vacant housing units to meet the increase in demand caused by the influx of the non-local construction workforce.

The influx of non-local construction workers to the study area would result in a minor, temporary increase in the demand for rental housing and/or hotel/motel rooms and campground sites. The Texas Connector Project could have a short-term positive impact on the area rental industry through increased demand and higher rates of occupancy; however, no significant impacts on local housing markets are expected. Increased demand in the study area could benefit the proprietors of the local motels, hotels, and other rental units through increased revenue. While the project could increase competition (and cost) for short-term housing and could decrease housing availability for local renters or residents, the demand for temporary housing by non-local workers is not expected to exceed the available number of hotels, motels, and campground units in the study area.

The increase in demand for short-term housing from non-local construction workers during the construction of the Texas Connector Project would be temporary and minor. In addition, the estimated 16 non-local employees needed during operations would not have a noticeable impact on housing resources in the study area.

Louisiana Connector Project

Housing statistics for the Louisiana Connector Project study area are listed in table 4.9.4-3. At least 175 hotels, motels, and campgrounds along with over 84,503 rental housing units are within the study area.

TABLE 4.9.4-3

Available Housing in the Louisiana Connector Project Study Area

Location	Total Housing Units [a]	Owner Occupied [a]	Renter Occupied [a]	Median Gross Rent ($) [a]	Rental Vacancy Rate (%) [a]	Vacant Housing Units	Hotels and Motels [b, c, d]	Campgrounds/ RV Parks [d, d, f, g]
UNITED STATES	133,351,840	74,712,091	42,214,214	$928	6.4	16,425,535	--	--
TEXAS	10,305,607	5,693,770	3,455,426	$882	7.8	1,156,411	--	--
Jefferson County	106,857	58,939	34,556	$761	9.8	13,362	50	20
Orange County	35,952	24,507	7,547	$748	7.8	3,898	15	3
City of Port Arthur	23,912	11,637	8,169	$704	10.2	4,106	--	--
LOUISIANA	1,999,855	1,136,709	591,210	$788	8.1	271,936	--	--
Allen Parish	9,781	5,983	2,044	$522	6.6	1,754	22	4
Beauregard Parish	15,201	10,050	3,102	$669	6.3	2,049	10	3
Calcasieu Parish	84,954	51,678	23,647	$758	9.0	9,629	85	7
Cameron Parish	3,524	2,369	239	$727	13.1	916	2	2
Evangeline Parish	14,815	7,895	4,059	$539	7.3	2,861	4	1
St. Landry Parish	36,047	21,374	9,309	$593	9.2	5,364	0	0
City of Sulphur	9,053	5,484	2,615	$744	10.5	701	--	--
City of Lake Charles	32,469	16,325	12,615	$753	10.9	4,407	--	--
City of Kinder	1,137	544	466	$642	11.2	119	--	--
City of Eunice	4,578	2,242	1,904	$601	9.4	549	--	--

[a] U.S. Census Bureau, 2000, 2010, 2016; City-Data.com, 2015.
[b] Yellow Pages, 2017.
[c] HotelMotels.info, 2017
[d] Local hotel, motel, campground, and RV park data for communities are accounted for in the county and parish totals.
[e] Cameron Parish Tourist Commission, 2017.
[f] Beaumont Convention & Visitors Bureau, 2017.
[g] Louisiana Trip Planner, 2017
Note: Inventory of hotels, motels, and campgrounds was collected at parish- and county-level only.

The availability of housing in the study area may fluctuate during local and seasonal events as well as due to demand on housing from other industries. The rental vacancy rates in the parishes in the Louisiana

Connector Project area range from a low of 6.3 percent in Beauregard to a high of 13.1 percent in Cameron. The rental vacancy rates in Jefferson and Orange Counties are 9.8 and 7.8, respectively.

PAPL estimates that about 60 to 80 percent of the workforce needed for the Louisiana Connector Project would be non-local. That equates to 450 to 600 non-local workers at peak construction placing demand on local temporary housing in the Louisiana Connector Project study area. Using a conservative estimate of 25 units per hotel/motel or campground, of which there are 228 dispersed throughout the project area, we estimate that there are at least 5,700 rooms/sites available in the study area. Given the rental vacancy rates in the parishes, counties, and communities in the study area and number of hotel/motel rooms available in study area, there are sufficient vacant housing units to meet the increase in demand caused by the influx of the non-local construction workforce.

The influx of non-local construction workers to the study area would result in a minor, temporary increase in the demand for rental housing and/or hotel/motel rooms and campground sites. The Louisiana Connector Project could have a short-term positive impact on the area rental industry through increased demand and higher rates of occupancy; however, no significant impacts on local housing markets are expected. Increased demand in the study area could benefit the proprietors of the local motels, hotels, and other rental units through increased revenue. While the project could increase competition (and cost) for short-term housing and could decrease housing availability for local renters or residents, the demand for temporary housing by non-local workers is not expected to exceed the available number of hotels, motels, and campground units in the study area.

The increase in demand for short-term housing from non-local construction workers during the construction of the Louisiana Connector Project would be temporary and minor. In addition, the estimated 8 non-local employees needed during operations would not have a noticeable impact on housing resources in the study area.

4.9.4.3 Nonjurisdictional Facilities

PALNG estimates that about 50 percent of the workforce for construction of the nonjurisdictional facilities would be non-local. That equates to 75 non-local workers for the 20-month construction period placing demand on local temporary housing in the study area. Similar to the Liquefaction Project, there are sufficient vacant housing units to meet the increase in demand caused by the influx of the non-local construction workforce. The influx of non-local construction workers to the study area would result in a minor, temporary increase in the demand for rental housing and/or hotel/motel rooms and campground sites.

4.9.4.4 Combined Projects Impacts on Housing

The influx of non-local construction workers to the Projects study area would result in a minor to moderate, temporary increase in the demand for rental housing and/or hotel/motel rooms and campground sites. The Projects could have a short-term positive impact on the area rental industry through increased demand and higher rates of occupancy; however, no significant impacts on local housing markets are expected. Increased demand in the study area could benefit the proprietors of the local motels, hotels, and other rental units through increased revenue; however, it could increase competition (and cost) for short-term housing and could decrease housing availability for tourists, recreationalists, and local renters or residents. While some construction activity would be conducted during the peak tourism season (discussed in section 4.9.2), sufficient temporary housing is still likely to be available for tourists; however, it may be more difficult to find (particularly on short notice) and/or more expensive to secure. Based on the large number of accommodations in the Projects study area and surrounding areas, rental housing accommodations along with hotels, motels, and campgrounds, would be sufficient to house the non-local construction workforce without significantly impacting or displacing tourists or local renters and residents.

4.9.5 Public Services

4.9.5.1 Liquefaction Project

Public services in the Liquefaction Project study area are summarized in table 4.9.5-1.

TABLE 4.9.5-1

Public Services Available in Liquefaction Project Study Area [a]

Location	Fire Departments	Nearest Distance to Mainline/ Facility (miles)	Police/Sheriff Departments	Nearest Distance to Mainline/ Facility (miles)	Hospitals	Nearest Distance to Mainline/ Facility (miles)
TEXAS						
Beaumont	12	21	1	21	4	21
Groves	1	11	1	11	1	10
Nederland	1	13	1	13	1	11
Sabine Pass	1	5	0	N/A	0	N/A
Port Arthur	7	5	1	5	2	8
Port Neches	1	13	1	13	0	N/A

N/A – not applicable

[a] Sources:
U.S. Bureau of Justice Statistics 2008 *Census of State and Local Law Enforcement Agencies*
https://apps.usfa.fema.gov/registry/summary
https://fire-departments.org
http://co.jefferson.tx.us/
http://www.co.orange.tx.us/
http://portarthurfd.com/about.php
http://www.parishofcameron.net
https://tea.texas.gov
http://www.countyoffice.org/police-department/

The project area is included within the Sabine Neches Chiefs Association, a mutual aid group serving the South East Texas community whose emergency assistance plan provides the community or member plant in need of assistance with equipment, manpower, area mobilization, and communications (Sabine Neches Chiefs Association, 2018). PALNG would develop an Emergency Response Plan (ERP) in coordination with local emergency response officials, and the facility would have a first responder group that supports local services to respond to incidents at the liquefaction terminal, thus reducing the need for local public service assistance. Based on the total number and location of police departments, mutual aid programs, and PALNG's ERP, the project would have a minor impact on the daily public service infrastructure in the vicinity of the Liquefaction Project.

PALNG anticipates that 200 permanent jobs would be created at the liquefaction facility, of which 60 are expected to be non-local hires that relocate to the Project area with their families. The addition of 60 families, or 152 people, would represent a negligible increase in the local population. In addition, as mentioned above, PALNG would implement an ERP developed in coordination with local officials in the event of an emergency during project operations. Therefore, we conclude that operations of the Liquefaction Project would have a negligible, long-term impact on the availability of public services.

4.9.5.2 Texas Connector and Louisiana Connector Projects

Texas Connector Project

Public services in the Texas Connector Project study area are summarized in table 4.9.5-2.

TABLE 4.9.5-2

Public Services Available in the Texas Connector Project Study Area [a]

Location	Fire Departments	Nearest Distance to Mainline/ Facility (miles)	Police/Sheriff Departments	Nearest Distance to Mainline/ Facility (miles)	Hospitals	Nearest Distance to Mainline/ Facility (miles)
TEXAS						
Beaumont	12	21	1	21	4	21
Groves	1	11	1	11	1	10
Nederland	1	13	1	13	1	11
Sabine Pass	1	5	0	N/A	0	N/A
Port Arthur	7	5	1	5	2	8
Port Neches	1	13	1	13	0	N/A
LOUISIANA						
Cameron Parish	1	10	5	Varies	1	30

[a] Sources:
U.S. Bureau of Justice Statistics 2008 *Census of State and Local Law Enforcement Agencies*
https://apps.usfa.fema.gov/registry/summary
https://fire-departments.org
http://co.jefferson.tx.us/
http://www.co.orange.tx.us/
http://portarthurfd.com/about.php
http://www.parishofcameron.net
https://tea.texas.gov
http://www.countyoffice.org/police-department/

Based on the total number and location of police, fire departments, and hospitals in the study area, there appears to be adequate public service infrastructure in the vicinity of the Texas Connector Project to accommodate the temporary needs of the non-local construction workforce and long-term needs of non-local operations workers, while not compromising services to residents. Therefore, we conclude that construction of the Texas Connector Project would have little or no short-term impact on the availability of local community facilities and services such as police, fire, and medical due to the short duration of the small influx of the non-local construction workforce relative to the current population of the study area.

PAPL anticipates that 20 permanent jobs would be created for operation of the pipeline and aboveground facilities, of which 16 are expected to be non-local hires that relocate to the project area with their families. The addition of 16 families (or 40 people) would represent a negligible increase in the local population. Therefore, we conclude that operations of the Texas Connector Project would have a negligible, long-term impact on the availability of public services.

Louisiana Connector Project

Public services in the Louisiana Connector Project study area are summarized in table 4.9.5-3.

TABLE 4.9.5-3

Public Services Available in the Louisiana Connector Project Study Area [a]

Location	Fire Departments	Nearest Distance to Mainline/ Facility (miles)	Police/Sheriff Departments	Nearest Distance to Mainline/ Facility (miles)	Hospitals	Nearest Distance to Mainline/ Facility (miles)
TEXAS						
City of Port Arthur	1	5	1	4	1	6
LOUISIANA						
City of Sulphur	1	<1	1	1	1	2
City of Lake Charles	1	8	2	12	3	9
City of Kinder	1	3	1	3	1	2
City of Eunice	1	2	1	2	1	2

[a] Sources:
LDE, 2017
USACOPS, 2017a, 2017b, 2017c, 2017d, 2017e, 2017f, 2017g
Beauregard Parish Police Jury, 2017
Calcasieu Parish Policy Jury, 2017
Cameron Parish Police Jury, 2017
County Office, 2017
USA Fire & Rescue, 2017
AHD, 2017a, 2017b
TDSHS, 2016
AdvancED, 2015

Based on the total number and location of police departments, fire departments, and hospitals in the study area, there appears to be adequate public service infrastructure in the vicinity of the Louisiana Connector Project to accommodate the temporary needs of the non-local construction workforce and long-term needs of non-local operations workers, while not compromising services to residents. Therefore, we conclude that construction of the Louisiana Connector Project would have little or no short-term impact on the availability of local community facilities and services such as police, fire, and medical due to the short duration of the small influx of the non-local construction workforce relative to the current population of the study area.

PAPL anticipates that 10 permanent jobs would be created for operation of the pipeline and aboveground facilities, of which 6 to 8 are expected to be non-local hires that relocate to the project area with their families. The addition of 6 to 8 families (or 15 to 20 people) would represent a negligible increase in the local population. Therefore, operations of the Louisiana Connector Project would have a negligible, long-term impact on the availability of public services.

4.9.5.3 Nonjurisdictional Facilities

PALNG estimates 75 non-local construction workers would be hired for the duration of the activities associated with the relocation of SH 87, pipelines, and utilities. Any temporary increase in population would be distributed throughout the study area and would not have a permanent impact on any one population. Based on the total number and location of public services throughout the study area, there appears to be adequate public service infrastructure in the vicinity to accommodate the temporary needs of the non-local construction workforce while not compromising services to residents.

4.9.5.4 Combined Projects Impacts on Public Services

Assuming all applicable permits and authorizations are received when anticipated, the Projects are expected to have their peak workforce requirements at roughly the same time, from the fourth quarter of 2019 through the first quarter of 2022. At the peak, anticipated for the third quarter of 2020, a combined workforce of over 3,230 workers would be needed. This would be an increase of 1 percent to the population of Cameron Parish and Orange and Jefferson Counties, where the Projects would overlap the most geographically. Based on the total number and location of public services, there appears to be adequate public service infrastructure near the Projects to accommodate the temporary needs of the non-local construction workforce and long-term needs of non-local operations, while not compromising services to residents. In addition, any temporary increase in population would be distributed throughout the study area and would not have a permanent impact on public services in any one location.

4.9.6 Transportation and Traffic

4.9.6.1 Liquefaction Project

Roadway Transportation

Highway access to the Liquefaction Project would be provided via SH 87 with traffic to the site passing through the Premcor Refinery and the intersection of SH 87 and SH 82. Construction vehicles and equipment accessing the project site may result in temporary impacts on local traffic. PALNG estimates that during peak construction just over 3,000 workers would be traveling to the project site via personal vehicle or bus. The liquefaction facility site would have 500 parking spaces available and, therefore, it is estimated that about 650 workers[33] would commute directly to the site daily. An estimated 48 buses would transport the remaining 2,350 workers to and from the site from an offsite parking lot. PALNG has identified four potential parking areas near the project site where workers would park and meet shuttle buses to then be transported to the site. In total, it is estimated that vehicles and buses would make trips two times per day during peak travel times at peak construction associated with the movement of the construction workforce to and from the project site.

Ground-based deliveries would occur throughout the 60-month construction period. At the peak of material and equipment delivery (month 11), PALNG estimates 6,900 deliveries per month to the project site. On average, 2,562 material deliveries per month would be made to the site throughout the construction period. When possible, ground-based deliveries would be made during off-peak hours to minimize congestion and impacts on roadways in the Liquefaction Project study area.

During operation of the project, PALNG estimates 30 trucks or tanker trucks would transport commodities (e.g., liquid nitrogen, condensate product, etc.) to or from the facility per week. An additional tanker truck of diesel fuel would come to and from the facility on a bi-weekly basis.

AECOM, on behalf of PALNG, conducted a traffic impact analysis focusing on impacts on the intersection of SH 87 and SH 82 due to traffic associated with the construction and operation of the Liquefaction Project. The analysis found the intersection of SH 87 and SH 82 to currently be operating at

33 This assumes the 500 parking spaces would be utilized by 500 construction worker vehicles at a vehicle occupancy rate of 1.3.

a level of service[34] (LOS) B. An intersection with a LOS B indicates there is stable traffic flow with a high degree of freedom to select speed and operating conditions but with some influence from other users. The traffic analysis found the intersection of SH 87 and SH 82 remained at a LOS B after considering the workforce and ground-based delivery traffic projected to occur at the project site during construction and operation (LDWF, 2016). Because the LOS on the roads in the project study area would remain at current acceptable levels of service, the impacts on the roadways would be minor and temporary.

To minimize and mitigate potential impacts on transportation, PALNG would develop a Transportation Plan as part of its project-specific Implementation Plan. We agree that a transportation plan outlining the measures PALNG would adopt to manage vehicle traffic during construction of the project considering peak travel times and emergency services would mitigate for project-related impacts. Therefore, **we recommend that:**

- **<u>Prior to construction of the Liquefaction Project</u>, PALNG should file with the Secretary its Transportation Plan for the Liquefaction Project, for review and written approval by the Director of OEP. The plan should include personnel training; permitting requirements; consultations conducted with local and state agencies; and how access to/from the work site by personnel, equipment, and materials would be managed on a daily basis throughout construction.**

Marine Transportation

As described in section 2.1.1, PALNG would construct a MOF along the western shore of the Port Arthur Canal and north of the liquefaction facility to support the transfer of construction materials delivered by barge. Marine traffic would access the MOF along the SNWW, which is already used for over 125 million tons of cargo shipments annually (SNND, 2017b).

During construction, PALNG estimates between 100 and 200 deliveries would be needed per month during the first 25 months of construction, or three to six barges per day. These trips would not cause significant impact when compared to the total amount of traffic in the SNWW.

In addition to commercial barge traffic, there is also traffic associated with commercial offshore fishing vessels. Commercial fishing traffic in the SNWW is minor (USACE, 2011). Recreational fishing also occurs along the SNWW. The impacts of construction on marine traffic in the SNWW would be minor and temporary to short-term, concentrated during the first 25 months of project construction.

As a result of measures and methods described in this section, construction activities related to the Liquefaction Project would result in minor and temporary to short-term impacts on transportation infrastructure lasting the duration of project construction. During operation of the project, PALNG estimates 180 transits of LNG vessels per year from the liquefaction facility. The impacts of operation of the Liquefaction Project on marine traffic in the SNWW would be minor and permanent.

4.9.6.2 Texas Connector and Louisiana Connector Projects

The Texas Connector Project is primarily easily accessible via local roads and highways in the study area, namely U.S. Highway 96 and SH 73. The Louisiana Connector Project is primarily easily accessible via local roads and highways in the study area, namely Interstate Highway 10 and SH 27, 171, and 165 in Louisiana, and SH 87 in Texas. The Projects may temporarily impact transportation and traffic

34 LOS, as defined by the Federal Highway Administration, is a measure of a road's operating conditions and reflects the relative ease of traffic flow on a scale of A to F, with a free-flowing intersection or roadway being rated LOS A and highly congested conditions rated LOS F (Federal Highway Administration, 2017).

across and within roadways during construction due to an increase in vehicle traffic associated with the commuting of the construction workforce to the project area and the movement of construction vehicles and delivery of equipment and materials to the construction work areas.

PAPL estimates a total of 3,120 vehicles trips per week for the Texas Connector Project along the length of the pipeline route during the 12-month construction period. Of this number, 600 heavy truck trips and 2,520 commuter trips are anticipated. PAPL estimates a total of 626 vehicles trips per week for the Louisiana Connector Project along the length of the pipeline route during the 21-month construction period. Of this number, 91 heavy truck trips and 535 commuter trips are anticipated. Construction activities in the Project study areas would result in temporary effects on local transportation infrastructure and vehicle traffic, including disruptions from increased transportation of construction materials, equipment and workforce; disruptions from construction of pipeline facilities at or across existing roads; and damage to local roads caused by heavy machinery.

The Texas Connector and Louisiana Connector Projects would cross the paved or roads and railroads via bore, resulting in little to no disruption to traffic or road impacts. Lightly traveled and unimproved rural dirt roads would be crossed using the open-cut method, usually requiring temporary road closures and/or detours. Where detours are infeasible, one road lane would be left open to maintain traffic flow. Most open-cut crossings would be resurfaced after a few days of completion. Traffic control measures would be employed as necessary to ensure safety of local traffic. Additionally, PAPL would schedule work within roadways to avoid commuter traffic and impacts on school bus routes, to the extent practicable.

Based on the small number of new, locally based permanent employees associated with the Texas Connector and Louisiana Connector Projects, the additional operations workforce would result in a negligible impact on the local transportation infrastructure and traffic. During project operations, the number and types of vehicles and equipment necessary to attend to maintenance activities would be dependent on the type of activity but would be significantly less than pipeline construction.

Specific to the Louisiana Connector Project, water routes would also be used to access portions of the upland right-of-way and Sabine Lake construction. Based on PAPL’s alignment sheets for the project, the ICWW would be used to provide equipment and materials access to portions of the construction right-of-way between approximate MPs 26 and 34.

Vessels used to access Sabine Lake would consist of digging and backfill barges, pipelaying barges, pipe transportation barges, HDD barges, and tug boats. More specifically, PAPL states that construction across Sabine Lake is estimated to require:

- two digging barges;
- two backfill barges;
- two barges to transport pipe segments from the contractor yard to the pipelay barges with a total of one combined trip per day; and
- nine other construction support vessels including tug boats, port-o-let, and crew boat.

Sabine Lake is regularly accessed by similar types of activities and the project would impact a relatively small percentage (less than 1 percent) of the entire lake area. Project-related impacts would primarily affect barges and smaller recreational vessels. To mitigate for potential impacts on other vessels in Sabine Lake, PAPL stated that the pipeline would be installed using barges mobilized with tug boats.

This procedure would minimize impacts resulting from construction operations. Furthermore, although not specified, it is likely that PAPL would conduct lake construction similar to other projects in the area by, for example, providing project-specific details to the USCG such as the timing of, and areas in which, water-based construction would occur, as well as the types of vessels that would be used. PAPL would post notifications in the local newspapers prior to and during construction, including maps outlining construction corridors to be avoided; erect signs about the project at boat launch facilities used to access Sabine Lake; and place warning signs to construction vessels indicating safe distances to be maintained. In addition, PAPL would place PVC poles displaying warning signs along the right-of-way boundary and install safety lighting to illuminate the work area. PAPL would also be required to comply with all navigation rules and regulations in the project vicinity.

As a result of measures and methods described in this section, we conclude that construction and operation activities related to the Texas Connector and Louisiana Connector Projects would result in minor and temporary to short-term impacts on transportation infrastructure and traffic.

4.9.6.3 Nonjurisdictional Facilities

Construction of the nonjurisdictional facilities may temporarily impact transportation and traffic across and within roadways during construction due to an increase in vehicle traffic associated with the commuting of the construction workforce to the project area and the movement of construction vehicles and delivery of equipment and materials to the construction work areas. Traffic control measures, such as flagmen and signs, would be employed as necessary to ensure safety of local traffic. Additionally, the current SH 87 would remain open until the relocated SH 87 is completed.

As a result of measures and methods described in this section, construction activities related to the nonjurisdictional facilities would result in minor and temporary to short-term impacts on transportation infrastructure.

4.9.6.4 Combined Projects Impacts on Transportation and Traffic

Construction activities in the Projects study area would result in temporary effects on local transportation infrastructure and vehicle traffic, including disruptions from increased transportation of construction equipment, materials, and workforce; disruptions from construction of pipeline facilities at or across existing roads; and damage to local roads caused by heavy machinery and materials. To minimize and mitigate potential impacts, PALNG would prepare a transportation plan for managing vehicle traffic during construction of the Liquefaction Project, which would mitigate for impacts considering peak travel times and emergency services. To further minimize and mitigate potential impacts, PALNG and PAPL would limit construction activities to between 7:00 a.m. and 10:00 p.m. Therefore, workers would travel to and from the site earlier and later in the day, outside of peak traffic hours, thus minimizing their contribution to traffic congestion. Operation of the Projects would require a total 230 personnel, which would not significantly increase the number of vehicles already accessing the Projects area. As a result of measures and methods described in this section, construction and operation activities related to the Projects would result in minor and temporary to short-term impacts on transportation infrastructure and traffic.

4.9.7 Property Values

4.9.7.1 Liquefaction Project

Potential impacts on the value of a tract of land depends on many factors, including size, the values of adjacent properties, presence of other industrial facilities or pipelines, the current value of the land, and the extent of development and other aspects of current land use.

The proposed location for the Liquefaction Project is about 4 miles south of the city of Port Arthur, an active port and the location of a large portion of the nation's oil refining capacity. The closest residential areas are 4 miles north in Port Arthur and 6 miles southeast in Sabine Pass. Given the proximity of the Liquefaction Project to residential areas and the historical presence of industry in the area, it is unlikely that there would be any adverse effects on property values of nearby residences.

4.9.7.2 Texas Connector and Louisiana Connector Projects

The effect that a pipeline easement may have on property value is a damage-related issue that would be negotiated between the parties during the easement acquisition process, which is designed to provide fair compensation to the landowner for the right to use the property for pipeline construction and operation. Appraisal methods used to value land are typically based on objective characteristics of the property and any improvements. The impact a pipeline could have on a property's value would depend on many factors including the size of the tract, the values of adjacent properties, the presence of other utilities, the current value of the land, and the current land use. Subjective valuation is generally not considered in appraisals. A potential purchaser of property may decide to purchase land based on his or her planned use. An industrial user might find the pipeline (i.e., a potential source of energy for an industrial plant) preferable; a farmer looking for land for grazing or cropland may or may not find it objectionable. If the presence of a pipeline renders a planned use infeasible, it is possible that a potential purchaser would decide not to purchase the property; however, each potential purchaser has different criteria and differing capabilities to purchase land.

Property taxes for a piece of property are generally based on the actual use of the land. Construction of the pipeline would not change the general use of the land but would preclude construction of aboveground structures on the permanent right-of-way. If a landowner believes that the presence of a pipeline easement impacts the value of his or her land, resulting in an overpayment of property taxes, he or she could appeal the issue of the assessment and subsequent property taxation to the local property tax agency.

4.9.8 Environmental Justice

For projects with major aboveground facilities, FERC regulations (18 CFR 380.12[g][1]) direct us to consider the impacts on human health or the environment of the local populations, including impacts that would be disproportionately high and adverse for minority and low-income populations. Additionally, during project scoping, we received comments requesting that the EIS identify the impacts of the Projects on minority and low-income populations (see section 1.3.1).

The EPA's Environmental Justice Policies (which are directed, in part, by Executive Order 12898: *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations*) focus on enhancing opportunities for residents to participate in decision making. The EPA (2011) states that Environmental Justice involves meaningful involvement so that: "1) potentially affected community residents have an appropriate opportunity to participate in decisions about a proposed activity that would affect their environment and/or health; 2) the public's contributions can influence the regulatory agency's decision; 3) the concerns of all participants involved would be considered in the decision-making process; and 4) the decision-makers seek out and facilitate the involvement of those potentially affected." CEQ also has called on federal agencies to actively scrutinize a number of important issues with respect to environmental justice (CEQ, 1997).

As part of our NEPA review, we have evaluated potential environmental justice impacts related to the Projects taking into account the following:

- The racial and economic composition of affected communities.
- Public participation strategies, including community or tribal participation in the process.

All public documents, notices, and meetings for the Projects were made available to the public during our review of the Projects. PALNG and PAPL met with many different stakeholders during the initial development of the Projects. These efforts involved open houses with the affected communities and local authorities. PALNG and PAPL also established, and are maintaining, a project website to share project information with the public.

PALNG and PAPL also used the FERC's Pre-filing Process (see section 1.3). One of the major goals of this process is to increase public awareness and encourage public input regarding every aspect of the Projects (e.g., design, siting, routing, environmental concerns and impacts) before an application is filed. As part of this process, FERC staff participated in PALNG's and PAPL's open houses and hosted FERC scoping sessions to receive input from the public about the Projects. Interested parties have had, and will continue to be given, opportunities to participate in the NEPA review process. To date, this included the opportunity to participate in the public scoping meetings within the project area to identify concerns and issues that should be covered in the EIS, and the opportunity to submit written comments about the Projects to the FERC. Stakeholders will also have the opportunity to review this draft EIS and provide comments directly to the FERC staff in person (during scheduled comment sessions) or in writing via mail or internet.

Based on published EPA guidance concerning environmental justice reviews (2011), we used a three-step approach to conduct our review of the Projects. These steps are to:

1. determine the existence of minority and low-income populations;
2. determine if resource impacts are high and adverse; and
3. determine if the impacts fall disproportionately on environmental justice populations.

For the purposes of this review, a low-income population exists when the percentage of all persons living below the poverty level is more than the percentage for the state where the census tract is located. Also, for the purpose of this review, minority population exists when:

1. the total racial minorities in a U.S. Census Bureau-defined census tract (U.S. Census Bureau, 2016) are more than 50 percent of the tract's population;
2. the percentage of a racial minority in a census tract is "meaningfully greater"[35] than in the comparison group;
3. the total ethnic minorities in a census tract are more than 50 percent of the tract's population; and
4. the percentage of ethnic minorities in a census tract is meaningfully greater than in the comparison group.

35 "Meaningfully greater" is defined in this analysis when minority or ethnic populations are at least 10 percentage points more than in the comparison group, which was the county/parish in which the census tract was located.

Racial and ethnic minorities include: African American/Black, Native American or Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, two or more races, and other races; and the Hispanic or Latino ethnicity.

4.9.8.1 Liquefaction Project

Two unique census tracts are within a 0.5-mile radius of the Liquefaction Project. In Texas and Louisiana, minorities comprise 25.2 and 37.2 percent of the total population respectively. The percentage of minorities in the census tracts within 0.5 miles of the Liquefaction Project are 5.4 to 7.8 percent. Neither of the two census tracts within 0.5 mile of the Liquefaction Project have a minority population greater than the minority population of their respective county or parish (41.8 percent in Jefferson County and 37.2 percent in Cameron Parish).

To restate, for this analysis, a low-income population exists when the percent of all persons living below the poverty level is greater than the percent of persons below poverty level for the state where the census tract is located. Neither census tract within 0.5 mile of the Liquefaction Project has a low-income population meaningfully greater than that of the respective state.

Neither of the census tracts identified within 0.5 mile of the Liquefaction Project has an identified environmental justice community. Therefore, construction and operation of the Liquefaction Project would not have a disproportionately high adverse effect on minority or low-income populations.

4.9.8.2 Texas Connector and Louisiana Connector Projects

Texas Connector Project

Eight unique census tracts are within a 0.5-mile radius of the centerline of the pipeline and within a radius around each compressor station that extends to the nearest NSA. Of these, one tract, Census Tract 113.02 in Cameron County, Texas qualifies as a minority population for Black/African-American based on the definitions above and is considered meaningfully greater than that of the state levels. As such, this tract is considered an environmental justice community.

The Texas Connector Project would result in negligible to minor negative impacts and minor positive impacts on socioeconomic characteristics and economies in the project area. As discussed throughout this EIS, potentially adverse environmental effects associated with the project would be minimized or mitigated, as applicable. Although the racial composition of one census tract traversed by the project show some deviations from state-level statistics, there is no evidence that the project would cause a disproportionate share of adverse environmental or socioeconomic impacts on any racial, ethnic, or socioeconomic group.

Louisiana Connector Project

Twenty-two (22) unique census tracts are within a 0.5-mile radius of the centerline of the pipeline (116, 51, 203, 224, 9607, 27, 23, 32, 34, 22.01, 29, 28, 33, 9702.01, 9505, 9504, 9501, 9607, 9608, 9503, 9508, 9505) and within a radius around each compressor station that extends to the nearest NSA (9505). Of these, one tract, Census Tract 51 in Jefferson County, Texas qualifies as a minority and low-income population based on the definitions above and is considered meaningfully greater than that of the state levels (see table 4.9.8-1). Census Tract 203 in Orange County, Texas; and Louisiana Census Tracts 28 in Calcasieu Parish; 9501 in Allen Parish; 9607 and 9608 in St. Landry Parish; and 9503 and 9508 in Evangeline Parish have poverty levels above that of the state level (see table 4.9.8-1). As such, these tracts are considered environmental justice communities.

TABLE 4.9.8-1

Race, Ethnicity, and Poverty Data by Census Tract for the Louisiana Connector Project

State/ Census Tract, County or Parish	White	Black/ African-American	American Indian or Alaskan Native	Asian	Native Hawaiian/ Pacific Islander	Some Other Race	Two or More Races	Hispanic (any Race)	Total Minority	Below Poverty Level
TEXAS	70.4%	11.9%	0.7%	3.8%	0.1%	10.5%	2.7%	37.6%	54.7%	15.5%
Census Tract 51, Jefferson County, Texas	8.3%	**89.1%**	0.0%	0.1%	0.0%	1.4%	1.2%	2.9%	**92.7%**	**33.1%**
Census Tract 203, Orange County, Texas	83.7%	10.5%	0.4%	0.7%	0.0%	3.0%	1.7%	6.7%	19.7%	**32.4%**
LOUISIANA	62.6%	32.0%	0.7%	1.6%	<0.1%	1.5%	1.6%	4.3%	39.7%	19.1%
Census Tract 28, Calcasieu Parish, Louisiana	89.7%	6.3%	0.4%	0.3%	0.2%	0.8%	2.2%	3.7%	12.7%	**29.8%**
Census Tract 9501, Allen Parish, Louisiana	95.4%	2.1%	1.2%	0.1%	0.1%	0.3%	0.8%	1.0%	5.2%	**19.5%**
Census Tract 9607, St. Landry Parish, Louisiana	58.7%	37.1%	0.5%	0.1%	0.0%	2.0%	1.7%	2.1%	42.2%	**21.0%**
Census Tract 9608, St. Landry Parish, Louisiana	75.7%	21.0%	0.4%	0.3%	0.0%	0.9%	1.7%	0.9%	24.8%	**20.7%**
Census Tract 9503, Evangeline Parish, Louisiana	78.1%	14.9%	0.4%	0.5%	0.0%	4.6%	1.6%	8.1%	25.6%	**19.9%**
Census Tract 9508, Evangeline Parish, Louisiana	65.9%	32.2%	0.2%	0.1%	0.0%	0.6%	1.1%	1.5%	34.7%	**24.3%**

Similar to the Texas Connector Project, the Louisiana Connector Project would result in negligible to minor negative impacts and minor positive impacts on socioeconomic characteristics and economies in the project area. Potentially adverse environmental effects associated with the project would be minimized or mitigated, as applicable. Although the racial and economic composition of the counties and parishes traversed by the project and census tracts within 0.5 mile of the project show some deviations from state-level statistics, there is no evidence that the project would cause a disproportionate share of adverse environmental or socioeconomic impacts on any racial, ethnic, or socioeconomic group.

4.9.8.3 Combined Projects Impacts on Environmental Justice

The primary project-related health issue would be the risk associated with an unanticipated failure at the liquefaction terminal, pipelines, or compressor stations. Section 4.12 discusses the localized risks to public safety that could result from a pipeline failure and describes how applicable safety regulations and standards would minimize the potential for these risks. Because the Projects generally would be in and traverse sparsely populated areas, the number of persons who would be at risk of injury due to a failure would be low; and there is no evidence that such risk would be disproportionately borne by any racial, ethnic, or socioeconomic group. Therefore, construction and operation of the Projects would not have a disproportionately high adverse effect on minority or low-income populations.

4.10 CULTURAL RESOURCES

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

Construction and operation of the Projects could potentially affect historic properties (i.e., cultural resources listed or eligible for listing on the NRHP). Historic properties could include prehistoric or historic archaeological sites, districts, buildings, structures, and objects, as well as locations with traditional value to Native Americans or other groups. Such historic properties generally must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and must meet one or more of the criteria specified in 36 CFR 60.4. Direct effects could include destruction or damage to all, or a portion, of an historic property. Indirect effects could include the introduction of visual, atmospheric, or audible elements that affect the setting or character of a historic property.

4.10.1 Cultural Resources Surveys

4.10.1.1 Liquefaction Project

PALNG contacted the Texas State Historic Preservation Office (SHPO) on May 19, 2015, regarding the need for cultural resources investigations on about 2,900 acres of property owned by PALNG, which includes the proposed liquefaction facility. PALNG recommended that the entire 2,900-acre area, which also includes the nonjurisdictional SH 87 and pipeline and utility relocation corridors, was previously disturbed and that no cultural resource survey be required. On June 2, 2015, the Texas SHPO concurred that no historic properties would be affected by the Liquefaction Project within the 2,900-acre property. We concur.

PALNG contacted the Texas SHPO regarding the turning basin within the SNWW, Dredge Disposal Areas 9A and 9B, and a dredge disposal area within the J.D. Murphree WMA. The Texas SHPO responded on August 24, 2017, that no historic properties would be affected. We concur.

PALNG has not yet provided information to or comments from the Texas SHPO concerning proposed Dredge Disposal Area 8.

4.10.1.2 Texas Connector and Louisiana Connector Projects

Texas Connector Project

PAPL surveyed a 300-foot-wide corridor along 39.5 miles of the Northern and Southern Pipelines and six laterals, with expansions of the corridor, as needed, for crossing waterbodies or manmade features. PAPL also surveyed a 100-foot-wide corridor centered on proposed access roads; three contractor yards; and the entire footprint of the proposed compressor stations, meter stations, and MLV sites. The area examined for historic aboveground architectural resources includes those areas within 164 feet of the proposed pipeline Project's facilities. PAPL provided the resulting Phase I Cultural Resources Survey reports to the FERC and Texas and Louisiana SHPOs, for their respective states.

<u>Texas</u>

Cultural resources surveys for archaeological and architectural resources have been completed for 83.3 percent of the Northern Pipeline and 50.6 percent of the Southern Pipeline in Texas. Surveys were completed for the North Compressor Station, three contractor yards, and the HPL, FGT, and GTS/CIPCO Meter Stations. The historic aboveground survey resulted in the identification of one cemetery and five historic standing structures that have been assessed as not eligible for the NRHP. The structures represent residential dwellings dating from the early- to mid-twentieth century. The Granger Family Cemetery was identified within the Northern Pipeline survey corridor; however, it is not within the permanent easement or construction workspace and would be avoided and preserved in place. No new archaeological resources have been identified to date; however, three previously recorded sites (41JF84, 41JF91, and 41OR89) have not been assessed for NRHP eligibility as they extend into parcels where landowners have denied survey permission or the sites were submerged at time of survey.

In a letter dated September 16, 2016, the Texas SHPO concurred with the Phase I Cultural Resources Survey report's NRHP assessment of not eligible for the identified five historic architecture resources, and requested PAPL maintain a 25-foot buffer zone between the Granger Family Cemetery and the construction workspace to prohibit inadvertent encroachment on this property. The Texas SHPO also requested surveys be completed for the three previously recorded sites (41JF84, 41JF91, and 41OR89) that have not been assessed for NRHP eligibility. PAPL provided a plan to avoid the Granger Family Cemetery that included a 25-foot fenced buffer on the eastern and western property boundaries. In a letter dated July 28, 2017, the Texas SHPO requested mechanical scraping of the proposed buffer area to confirm cemetery boundaries. PAPL has not yet provided results of the additional investigations to FERC or Texas SHPO.

The proposed South Compressor Station, two access roads, and 1.8 miles of the Northern Pipeline are situated within the 2,900-acre Liquefaction Project property. As discussed in section 4.10.1.1, this area was reviewed by the Texas SHPO and it was determined that no historic properties would be affected by the project.

PAPL provided a Phase I report summarizing the survey results for portions of the Southern Pipeline that only cross the J.D. Murphree WMA. No archaeological sites or architectural resources were identified during survey of the J.D. Murphree WMA. On September 13, 2016, the Texas SHPO concurred with the Phase I report's recommendations that no historic properties within the areas surveyed would be affected by the Texas Connector Project. We concur also.

PAPL would survey the remaining Northern Pipeline, laterals, TETCO and NGPL Meter Stations, and access roads, and submit the results of surveys in future survey reports.

Louisiana

Cultural resources surveys for archaeological or architectural resources have been completed for 92.5 percent of the Southern Pipeline in Louisiana; no cultural resources were identified. On September 12, 2016, the Louisiana SHPO concurred with the Phase I's recommendations that no historic properties within the areas surveyed would be impacted by the Texas Connector Project.

PAPL would survey the remaining Southern Pipeline, KMLP Lateral, and KMLP Meter Station, and submit the results of surveys in future survey reports.

Louisiana Connector Project

PAPL surveyed a corridor ranging from 225 to 325 feet wide along 131 miles of the Louisiana Connector Project's pipeline, with expansions of the corridor as needed for crossing waterbodies or manmade features. Of this, 113.3 miles would be constructed on land and 17.6 miles would extend across Sabine Lake. PAPL also surveyed a 32.8-foot-wide corridor centered on 125 proposed access roads; 5 contractor yards; 1 compressor station site, 8 interconnects and 1 meter station; 9 MLV sites; and 4 pig launcher/receiver facilities. The area examined for historic aboveground architectural resources included those areas within 164 feet of the proposed project's facilities. PAPL provided the resulting Phase I Cultural Resources Survey report to the FERC and Louisiana SHPO.

Texas

The Centana and PALNG Meter Stations, the HDD entry pad, and temporary workspace are within the 2,900-acre Liquefaction Project property. As discussed in section 4.10.1.1, this area was reviewed by the Texas SHPO and it was determined that no historic properties would be affected by the project. PAPL recommended that no survey was required for the remaining onshore land in Texas. On May 15, 2017, the Texas SHPO concurred that no cultural resources surveys would be required for the terrestrial portion of the Project in Texas. We concur also.

PAPL completed a submerged cultural resources survey of a 1-mile, 600-foot-wide corridor along the offshore portion of the Louisiana Connector Project across Sabine Lake in Texas, and provided the resulting report to the FERC and Texas SHPO. A total of 61 magnetic anomalies and 44 side scan sonar contacts were identified. Analysis resulted in the recommendation that no submerged cultural resources nor relic geomorphic features with the potential for archaeological deposits were present. PAPL has not yet provided the Texas SHPO's comments on the submerged cultural resources survey report.

Louisiana

PAPL completed 58 percent of the terrestrial cultural resources surveys for the Louisiana Connector Project corridor, compressor station, access roads, contractor yard, valve sites, and ATWS. A total of 2,366.5 acres was surveyed. Two newly recorded archaeological sites, nine historic architectural properties, and four cemeteries were identified. The two newly recorded sites, consisting of an historic artifact scatter (16AL51) and an abandoned railroad grade (16BE108), have been assessed as not eligible for the NRHP. In addition, seven previously recorded resources (16AL1, 16AL48, 16AL49, 16CM23, 16CU28, 16CU31, and 16EV13) had been identified as within or immediately adjacent to the pipeline survey corridor or associated facilities. Of these, no artifacts or evidence of intact cultural deposits were recovered at sites 16AL1, 16AL48, 16CU31, and 16EV13 within the construction area, and have been assessed as not eligible for the NRHP. PAPL has not assessed sites 16AL49, 16CM23, and 16CU28 for NRHP eligibility as they extend into parcels in which the landowners have denied survey permission; PAPL would complete surveys at these sites once access becomes available. In a letter dated December 14, 2017, the Louisiana SHPO concurred.

The historic architectural properties represent three farmstead complexes, four residential buildings, and two collapsed structures. PAPL recommended that eight of these historic architectural properties were not eligible for the NRHP, and one (#49-00011) would require further evaluation. PAPL confirmed that Resource #49-00011 would be avoided by the project. PAPL recommended that the four historic/modern Euro-American cemeteries would not be directly affected by Project activities as all three would be avoided by the construction workspace. Due to proximity of the pipeline corridor to the Creel and Green Oak Cemeteries, PAPL would institute a 50-foot buffer zone (e.g., install exclusion fencing) to prohibit inadvertent encroachment on these properties; the Cemetiere de Colteau is situated along an access road and no encroachment is anticipated, while the Kinder McRill Memorial Cemetery is located south of the pipeline construction corridor and would not be affected. In its December 14, 2017 letter, the Louisiana SHPO concurred with these recommendations.

PAPL would survey the remaining pipeline corridor, contractor yard LY-CAl-01, ANR and TGP Meter Stations, and 50 access roads, and submit the results of surveys in future survey reports.

PAPL completed a submerged cultural resources survey of 17.6-mile, 600-foot-wide corridor along the offshore portion of the Louisiana Connector Project across Sabine Lake in Louisiana, and provided the resulting report to the FERC and Louisiana SHPO. A total of 157 magnetic anomalies and 32 side scan sonar contacts were identified. Analysis resulted in the recommendation that no submerged cultural resources nor relic geomorphic features with the potential for archaeological deposits were present. In a letter dated December 15, 2017, the Louisiana SHPO concurred that no historic properties would be impacted by this portion of the Project. We concur also.

4.10.2 Unanticipated Discovery Plan

PALNG and PAPL provided a plan for Texas and Louisiana to the FERC and SHPOs, which would be implemented if cultural resources or human remains are encountered during construction of the Projects. The plan also provides for the notification of Native American tribes in the event of any discovery. We requested revisions to the plan. PAPL provided a revised plan which we find acceptable. In a letter dated December 15, 2017, the Louisiana SHPO concurred with the plan. The Texas SHPO has not commented on the plan.

4.10.3 Native American Consultation

4.10.3.1 Liquefaction Project and Texas Connector Project

On June 24, 2015, we sent our NOI for the Projects to eight federally recognized Native American tribes, including Alabama-Coushatta Tribe of Texas; Choctaw Nation of Oklahoma; Coushatta Tribe of Louisiana; Jena Band of Choctaw Indians; Kickapoo Traditional Tribe of Texas; Mississippi Band of Choctaw Indians; Tonkawa Tribe of Oklahoma; and Tunica-Biloxi Indian Tribe of Louisiana. On November 10, 2015, we sent follow-up letters to these same tribes. The Choctaw Nation of Oklahoma requested initiation of consultation with FERC and a copy of the technical report on August 8, 2015. PAPL submitted the Phase I report to the tribe on March 17, 2017. No further responses have been received to date.

In addition, PALNG and PAPL or its contractor, AECOM, separately contacted the tribes that might attach cultural or religious significance to cultural resources in the Projects' area, as summarized below.

In a letter dated April 28, 2015, PALNG contacted three federally recognized Native American tribes and offered an opportunity to identify traditional properties or provide comments about the Liquefaction Project, including the Alabama-Coushatta Tribe of Texas; Kickapoo Traditional Tribe of Texas; and Tonkawa Tribe of Oklahoma. No responses have been received to date.

In a letter dated March 31, 2015, PAPL contacted eight Native American tribes and offered an opportunity to identify traditional properties or provide comments about the Texas Connector Project, including the Alabama-Coushatta Tribe of Texas; Choctaw Nation of Oklahoma; Coushatta Tribe of Louisiana; Jena Band of Choctaw Indians; Kickapoo Traditional Tribe of Texas; Mississippi Band of Choctaw Indians; Tonkawa Tribe of Oklahoma; and Tunica-Biloxi Indian Tribe of Louisiana.

The Choctaw Nation of Oklahoma requested shapefiles from PAPL on the Louisiana portion of the Texas Connector Project, which were provided on May 21, 2015. On June 22, 2015, the tribe requested a copy of the technical report from PAPL to enable an evaluation of the Project and its potential impacts on archaeological and human remains. As mentioned above, the Phase I report was submitted by PAPL to the tribe on March 17, 2017. No additional responses from Native American tribes has been received.

4.10.3.2 Louisiana Connector Project

On May 25, 2017, we sent our NOI for the Project to ten federally recognized Native American tribes, including Alabama-Coushatta Tribe of Texas; Apache Tribe of Oklahoma; Chitimacha Tribe of Louisiana; Choctaw Nation of Oklahoma; Coushatta Tribe of Louisiana; Jena Band of Choctaw Indians; Jicarilla Apache Nation; Mescalero Apache Tribe; Mississippi Band of Choctaw Indians; and Tunica-Biloxi Indian Tribe of Louisiana. On October 5, 2017, we sent follow-up letters to these same tribes. On November 20, 2017, the Choctaw Nation of Oklahoma requested that PAPL provide the tribe with shapefiles of the Louisiana Connector Project and copies of cultural resources survey reports. In a June 21, 2018 letter, the Coushatta Tribe of Louisiana requested government-to-government consultation and a meeting. No other responses have been received to date.

We attended a meeting on June 13, 2017, hosted by the Coushatta Tribe of Louisiana and PAPL to discuss the status of cultural resources surveys and to offer the Tribe an opportunity to identify traditional properties or provide comments about the Louisiana Connector Project. The Coushatta Tribe of Louisiana requested a traditional cultural properties survey be performed.

PAPL separately contacted seven tribes on May 19, 2017, that might attach cultural or religious significance to cultural resources in the Project area, including the Alabama-Coushatta Tribe of Texas; Chitimacha Tribe of Louisiana; Choctaw Nation of Oklahoma; Coushatta Tribe of Louisiana; Jena Band of Choctaw Indians; Mississippi Band of Choctaw Indians; and Tunica-Biloxi Indian Tribe of Louisiana. The Choctaw Nation of Oklahoma, in an email dated June 26, 2017, requested shapefiles and a copy of the technical report from PAPL on the Louisiana Connector Project to enable an evaluation of the Project and its potential impacts on archaeological and human remains, which was provided on September 12, 2017. Follow-up letters were submitted to six tribes (Alabama-Coushatta Tribe of Texas; Chitimacha Tribe of Louisiana; Coushatta Tribe of Louisiana; Jena Band of Choctaw Indians; Mississippi Band of Choctaw Indians; and Tunica-Biloxi Indian Tribe of Louisiana) on July 19, 2017. On August 5, 2017, PAPL sent an email to the Coushatta Tribe of Louisiana requesting an opportunity to discuss the traditional cultural properties survey process. The tribe responded on the same day and indicated the Project would be discussed further with tribal leadership. PAPL indicated that it employed Coushatta tribal members to participate in surveys on tribal lands, and that it was willing to employ monitors on Coushatta tribal lands. No additional responses have been received.

In addition, we communicated with the Coushatta Tribe of Louisiana in June and August 2018, and have arranged to meet with the tribe in October 2018.

4.10.4 Compliance with Section 106 of the NHPA

4.10.4.1 Liquefaction Project

The process of complying with section 106 of the NHPA has not been completed for the Liquefaction Project. To ensure that the FERC's responsibilities under the NHPA and its implementing regulations are met, **we recommend that**:

- **PALNG should <u>not begin</u> construction of facilities and/or use of staging, storage, or temporary work areas and new or to-be-improved access roads associated with the Liquefaction Project <u>until</u>:**

  a. PALNG files with the Secretary the outstanding information for Dredge Disposal Area 8 and the Texas SHPO's comments on the information;

b. **PALNG files any required survey report and the Texas SHPO's comments on the report;**

c. **the ACHP is afforded an opportunity to comment on the undertaking if historic properties would be adversely affected; and**

d. **the FERC staff reviews and the Director of OEP approves any cultural resources report, and notifies PALNG in writing that construction may proceed.**

All material filed with the Commission that contains <u>location, character, and ownership information</u> about cultural resources must have the cover and any relevant pages therein clearly labeled in bold lettering "<u>CUI//PRIV- DO NOT RELEASE</u>."

4.10.4.2 Texas Connector and Louisiana Connector Projects

The process of complying with section 106 of the NHPA has not been completed for the Texas Connector and Louisiana Connector Projects. PAPL has not completed cultural resources surveys and NRHP evaluations, and consultation with the Texas and Louisiana SHPOs is not yet complete.

To ensure that the FERC's responsibilities under the NHPA and its implementing regulations are met for the Texas Connector and Louisiana Connector Projects, **we recommend that:**

- **PAPL should <u>not begin</u> construction of facilities and/or use of staging, storage, or temporary work areas and new or to-be-improved access roads associated with the Texas Connector and Louisiana Connector Projects <u>until</u>:**

  a. **PAPL files with the Secretary all outstanding survey reports, evaluation reports, special studies, and any required avoidance/treatment plans, and the Texas and Louisiana SHPOs' comments (as applicable) on these;**

  b. **the ACHP is afforded an opportunity to comment if historic properties would be adversely affected; and**

  c. **the FERC staff reviews and the Director of OEP approves the cultural resources reports, studies, and plans, and notifies PAPL in writing that treatment plans/mitigation measures (including archaeological data recovery) may be implemented and/or construction may proceed.**

All materials filed with the Commission containing <u>location, character, and ownership</u> information about cultural resources must have the cover and any relevant pages therein clearly labeled in bold lettering "<u>CUI//PRIV – DO NOT RELEASE</u>."

4.11 AIR QUALITY AND NOISE

4.11.1 Air Quality

Temporary air emissions would be generated during project construction, which would occur over a period of 5 years and across two states; however, most air emissions associated with the Projects would result from the long-term operation of the new liquefaction facilities and compressor stations. Construction and operation air emissions and mitigation measures are discussed in section 4.11.1.3.

4.11.1.1 Existing Air Quality

Regional Climate

The regional climate in the Projects area is a modified marine climate influenced by a predominant onshore flow of tropical marine air from the Gulf of Mexico (TWDB, 1983). During onshore flow events, the area experiences a subtropical, humid climate. In summer, sea breezes help to moderate temperatures. General climate conditions are comparable across the Projects area, which includes Jefferson and Orange Counties, Texas and Cameron, Calcasieu, Beauregard, Allen, Evangeline, and St. Landry Parishes, Louisiana.

Based on 1981 to 2010 climate data from the NOAA, temperatures at the Port Arthur SE Regional Airport in Port Arthur, Texas usually range from a monthly maximum average of 92.2 °F in August to a minimum monthly average of 43.2 °F in January. Mean annual precipitation falling at the Port Arthur SE Regional Airport is 60.5 inches, while monthly average precipitation ranges from a minimum of 3.2 inches in April to a maximum of 7.1 inches in June. Recorded temperatures and rainfall are similar at the Lake Charles Regional Airport in Calcasieu Parish, Louisiana and the Lafayette Regional Airport in Lafayette Parish, Louisiana. Severe weather, including thunderstorms, tornadoes, and hurricanes, occur occasionally in the area. The average annual snowfall is less than 0.1 inch. Winds in the area are generally from the south, with average wind speeds around 15 mph. Wind direction can vary by season: during spring (February through May) winds are from the south through southeast; in summer (June through August) winds are mainly from the south and frequently from the southeast and southwest; during fall (September through November) winds are from the south counterclockwise through north; and in winter (December through January) winds are predominantly from the north and frequently from the south-southeast and north-northeast (TCEQ, 2017).

Ambient Air Quality Standards

Ambient air quality is protected by federal and state regulations. The EPA has established National Ambient Air Quality Standards (NAAQS) for "criteria pollutants" to protect human health and welfare.[36] These criteria pollutants are ground-level ozone, carbon monoxide (CO), nitrogen oxides (NO_X), sulfur dioxide (SO_2), fine particulate matter (i.e., inhalable particulate matter [PM] with an aerodynamic diameter less than or equal to 10 microns [PM_{10}] and less than or equal to 2.5 microns [$PM_{2.5}$]), and airborne lead. Ozone is not emitted into the atmosphere from an emissions source but develops as a result of a chemical reaction between NO_X and volatile organic compounds (VOC) in the presence of sunlight; therefore, NO_X and VOCs are often referred to as ozone precursors and are regulated to control the potential for ozone formation. The NAAQS include primary standards that are designed to protect human health, including the health of "sensitive" individuals such as children, the elderly, and those with chronic respiratory problems. The NAAQS also include secondary standards designed to protect public welfare, including visibility, vegetation, animal species, economic interests, and other concerns not related to human health.

36 NAAQS are available at: https://www.epa.gov/criteria-air-pollutants/naaqs-table

The LDEQ and the TCEQ have adopted the NAAQS. The TCEQ has also established 30-minute average property line standards for SO_2 and H_2S in 30 Texas Administrative Code (TAC) 112.

Hazardous air pollutants (HAP), also known as toxic air pollutants or air toxics, are specific pollutants that are known or suspected to cause cancer (carcinogens) or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. There are no national air quality standards for HAPs but their emissions are limited through permit thresholds and technology standards.

The EPA now defines air pollution to include the mix of six long-lived and directly emitted greenhouse gases (GHG), finding that the presence of the following GHGs in the atmosphere may endanger public health and welfare through climate change: CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. As with any fossil-fuel fired project or activity, the Projects would contribute GHG emissions. The principle GHGs that would be produced by the Projects are CO_2, CH_4, and N_2O. No fluorinated gases would be emitted by the Projects. GHG emissions are quantified and regulated in units of carbon dioxide equivalents (CO_2e). The CO_2e takes into account the global warming potential (GWP) of each GHG. The GWP is a ratio relative to CO_2 of a particular GHG's ability to absorb solar radiation as well 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.[37] In compliance with EPA's definition of air pollution to include GHGs, we have provided estimates of GHG emissions for construction and operation, as discussed throughout this section. Impacts from GHG emissions (i.e., climate change) are discussed in more detail in section 4.13.2.3.

Existing Air Quality and Attainment Status

Air quality control regions (AQCR) are areas established by the EPA and local agencies for air quality planning purposes, which are managed through State Implementation Plans that describe how the NAAQS would be achieved and maintained. The AQCRs are intra- and interstate regions, such as large metropolitan areas, where improvement of the air quality in one portion of the AQCR requires emission reductions throughout the AQCR. Each AQCR or smaller portion within an AQCR (such as a county or multiple counties) is designated, based on compliance with the NAAQS, as "attainment," "unclassifiable," "maintenance," or "nonattainment" on a pollutant-by-pollutant basis. Areas in compliance, or below the NAAQS, are designated as attainment, while areas not in compliance, or above the NAAQS, are designated as nonattainment. Areas that were previously designated as nonattainment and have since demonstrated compliance with the NAAQS are designated as maintenance for a period of time (normally 20 years after the effective date of attainment); this time period assumes that the area remains in compliance with the standard. Maintenance areas may be subject to more stringent regulatory requirements similar to nonattainment areas to ensure continued attainment of the NAAQS. Areas without sufficient data available are designated as unclassifiable and are treated as attainment areas.

To maintain a status of attainment, measures must be taken to track emissions data for all criteria pollutants. The TCEQ has established a maximum allowable emission level of 100 tons per year (tpy) for VOCs and NO_X, which are precursors for ozone, on projects within areas classified as maintenance. According to 40 CFR 93.153(b)(1), conformity determination thresholds for VOC and NO_X for marginal nonattainment are 100 tpy. See related discussion under General Conformity in section 4.11.1.2.

The Projects would be constructed in the Southern Louisiana-Southeast Texas Interstate AQCR 106. Jefferson and Orange Counties, Texas are within the Beaumont-Port Arthur area. As of November 19, 2010, the area is classified as attainment for all criteria pollutants. Construction emissions from the

37 These GWPs are based on a 100-year time period. We have selected their use over other published GWPs for other timeframes because these are the GWPs that the EPA has established for reporting of GHG emissions and air permitting requirements. This allows for a consistent comparison with these regulatory requirements.

Project could occur within the Houston-Galveston-Brazoria (HGB) area, which is classified as a marginal nonattainment area for the 2008 8-hour ozone standard (EPA, 2017). The remainder of the counties and parishes in AQCR 106 are classified as unclassifiable/attainment. See table 4.11.1-1 below for more details.

TABLE 4.11.1-1

Project Components and NAAQS Attainment Status by County

Project Components	County/Parish, State	AQCR	Attainment Status
Liquefaction Project, South Compressor Station, NGPL meter station, GTS Meter Station, PALNG meter station, Centana meter station, three mainline valves, Louisiana Connector Pipeline, and Texas Connector Pipeline	Jefferson County, TX	106 – Southern Louisiana-Southeast Texas Interstate	Attainment
North Compressor Station, FGT Meter Station, HPL Meter Station, TETCO meter station, FGT meter station, mainline valve, Louisiana Connector Pipeline, and Texas Connector Pipeline	Orange County, TX		Attainment
KMLP Meter Station, one mainline valve, Louisiana Connector Pipeline, and Texas Connector Pipeline	Cameron Parish, LA		Attainment
Three mainline valves and Louisiana Connector Pipeline	Calcasieu Parish, LA		Attainment
One mainline valve and Louisiana Connector Pipeline	Beauregard Parish, LA		Attainment
Louisiana Connector Project's compressor station, TETCO Meter Station, TGP Meter Station, three mainline valves, and Louisiana Connector Pipeline	Allen Parish, LA		Attainment
Egan Meter Station, Pine Prairie Meter station, TGT Meter Station, ANR Meter Station, one mainline valve, and Louisiana Connector Pipeline	Evangeline Parish, LA		Attainment
TGP Meter Station and Louisiana Connector Pipeline	St. Landry Parish, LA		Attainment
Delivery and transport of some construction materials	Chambers, TX Liberty, TX Harris, TX	HGB	Marginal nonattainment area for the 2008 8-hour ozone standard

The EPA as well as state and local agencies have established a network of ambient air quality monitoring stations to measure and track the background concentrations of criteria pollutants across the United States. To characterize the existing ambient air quality for the Projects, available data were gathered from air quality monitoring stations that are nearest to the Projects sources of operational emissions. The most recent validated data from these monitoring sites are presented in table 4.11.1-2, which compares the monitored data with the appropriate NAAQS standard for each criteria pollutant. All monitored data are below the NAAQS. Note that the Texas Connector Project's South Compressor Station is proposed to be constructed and operated in the Liquefaction Project's site boundaries and, as such, air quality impacts associated with the South Compressor Station are included with the Liquefaction Project.

TABLE 4.11.1-2

Ambient Air Quality Concentrations Representative of the Projects Areas

Facility/Pollutant	Averaging Period	Rank	2014	2015	2016	3-year average	Units	Monitor Number [a]	NAAQS
LIQUEFACTION PROJECT									
SO_2	1-Hour	99%	150.1	166.4	191.5	169.4	µg/m^3	482450011	196
PM_{10}	24-Hour	2nd	91	69	80	80	µg/m^3	482011039	150
$PM_{2.5}$	24-Hour	98%	20.1	29.7	17.6	22.5	µg/m^3	482450021	35
$PM_{2.5}$	Annual	Mean	8.7	10.7	7.8	9.1	µg/m^3	482450021	12
NO_2	Annual	Average	13.5	13.2	12.0	12.9	ppb	482450628	53
NO_2	1-Hour	98%	32.6	29.4	27.5	29.8	ppb	482450628	100
CO	8-Hour	2nd	0.4	0.5	0.4	0.4	ppm	482451035	9
CO	1-Hour	2nd	0.6	0.7	0.6	0.6	ppm	482451035	35
O_3	8-Hour	4th	0.067	0.074	0.063	0.1	ppm	482451035	0.070
TEXAS CONNECTOR PROJECT NORTH COMPRESSOR STATION									
SO_2	1-Hour	99%	16	16.6	12	14.9	ppb	482450009	75
PM_{10}	24-Hour	2nd	80.5	66	42	62.8	µg/m^3	220550007	150
$PM_{2.5}$	24-Hour	98%	15	15	18	16.0	µg/m^3	220190009	35
$PM_{2.5}$	Annual	Mean	6.9	7.3	7.6	7.3	µg/m^3	220190009	12
NO_2	Annual	Maximum	4.75	4.7	4.35	4.6	ppb	483611001	53
NO_2	1-Hour	98%	44	37	40	40.3	ppb	483611001	100
CO	8-Hour	2nd	0.4	0.5	0.4	0.4	ppm	482451035	9
CO	1-Hour	2nd	0.6	0.7	0.6	0.6	ppm	482451035	35
O_3	8-Hour	4th	0.067	0.074	0.063	0.1	ppm	482451035	0.070
LOUISIANA CONNECTOR PROJECT COMPRESSOR STATION									
SO_2	1-Hour	99%	33	33	34	33.3	ppb	220190008	75
PM_{10}	24-Hour	2nd	80.5	66	42	62.8	µg/m^3	220550007	150
$PM_{2.5}$	24-Hour	98%	15	15	18	16	µg/m^3	220190009	35
$PM_{2.5}$	Annual	Mean	6.9	7.3	7.6	7.3	µg/m^3	220190009	12
NO_2	Annual	Maximum	5.09	6.32	6.38	5.93	ppb	220190008	53
NO_2	1-Hour	98%	30	37	40	35.7	ppb	220190008	100
CO	8-Hour	2nd	1.3	1.2	1.1	1.2	ppm	220330009	9
CO	1-Hour	2nd	4.9	2.1	2.1	3.0	ppm	220330009	35
O_3	8-Hour	4th	0.067	0.072	0.065	0.068	ppm	220190002	0.070

[a] 220330009 – 1061-A Leesville Ave, Baton Rouge, LA
220190008 – 2646 John Stine Road, Westlake, LA
220550007 – 700 Cajundome, Lafayette, LA
220190009 – 2284 Paul Bellow Road, Vinton, LA
220190002 – Highway 27 and Highway 108, Carlyss, LA
482450009 - 1086 Vermont Avenue; Beaumont, TX
483611001 - 2700 Austin Ave; West Orange, TX
482451035 - 1800 N. 18th Street; Nederland, TX
482450011 – West 800 El Vista Rd, Port Arthur, TX
482011039 – 4514 ½ Durant St, Deer Park, TX
482450021 – 2200 Jefferson Dr., Port Arthur, TX
482450628 – 2210 Eastex Freeway, Beaumont, TX
482451035 – 1800 N. 18th Street, Nederland, TX

ppb = parts per billion
µg/m^3 = microgram per cubic meter
ppm = parts per million
O_3 = ozone

4.11.1.2 Regulatory Requirements for Air Quality

The CAA is the basic federal statute governing air pollution in the United States. We have summarized the applicable requirements below.

General Conformity

The General Conformity Rule was developed to ensure that federal actions in nonattainment and maintenance areas do not impede states' attainment of the NAAQS. A conformity determination must be conducted by the lead federal agency if a federal action's construction and operation activities are likely to result in generating direct and indirect emissions that would exceed the conformity applicability threshold level of the pollutant(s) for which an air basin is designated as nonattainment or maintenance. Conforming activities or actions should not, through additional air pollutant emissions:

- cause or contribute to new violations of the NAAQS in any area;
- increase the frequency or severity of any existing violation of any NAAQS; or
- delay timely attainment of any NAAQS or interim emission reductions.

The General Conformity Rule entails both an applicability analysis and a subsequent conformity determination, if applicable. According to the conformity regulations, emissions from sources that are subject to any Nonattainment New Source Review (NNSR) or PSD permitting/licensing (major or minor) are exempt and are deemed to have conformed. A General Conformity Determination must be completed when the total direct and indirect emissions of a project would equal or exceed the specified pollutant thresholds on a calendar year basis for each nonattainment or maintenance area.

As discussed previously and presented in table 4.11.1-1, the Project area is in attainment; therefore, general conformity requirements do not apply. However, general conformity could potentially apply to the HGB area associated with the Liquefaction Project, which is classified as a marginal nonattainment area for ozone. All non-permitted emissions that would occur within the HGB area were considered in the general conformity applicability analysis. Table 4.11.1-3 provides the results of the general conformity applicability review for the Liquefaction Project.

TABLE 4.11.1-3

General Conformity Applicability Analysis for Construction Emissions Associated Project [a]

Source Category	NO_X (tpy)	VOC (tpy)
Nonroad Equipment	--	< 45.7
Onroad Vehicles	40.22[b]	< 7.6
Construction Fugitive Dust	--	--
Roadway Fugitive Dust	--	--
Tug Boats	31.15	< 1.71
Construction Totals	**71.37**	**< 55.0**
General Conformity Threshold	**100**	**100**

N/A = Not Applicable

[a] Construction is anticipated to take place over a 5-year period. Non-permitted emissions were calculated for each of the five construction years. Values reported here are the maximum annual emissions occurring in the HGB 8-hour ozone nonattainment area. For NO_x, the maximum emissions occur in Construction Year 1. For VOC, maximum emissions occur in Construction Year 2.

[b] On-road emissions include emissions from 20 percent of the expected commuter vehicles. PAPL does not expect any truck deliveries to pass through the HGB nonattainment area for the Texas Connector and Louisiana Connector Projects.

Based on the results, the emissions that would occur in nonattainment or maintenance areas would not exceed the general conformity applicability thresholds for any criteria pollutant in a single calendar year. Therefore, general conformity does not apply to the Liquefaction Project.

New Source Review/Prevention of Significant Deterioration

New Source Review (NSR) is a pre-construction permitting program designed to protect air quality when air pollutant emissions are increased either through the modification of existing sources or through the construction of a new source of air pollution. In areas with good air quality, NSR ensures that the new emissions do not degrade the air quality, which is achieved through the implementation of the PSD permitting program or state minor permit programs. In addition, NSR ensures that any large, new, or modified industrial source uses air pollution control technology. Air permitting of stationary sources has been delegated to each state. Based on the operating emissions, an NSR permit would be required for the Liquefaction Project's facilities but not for the Texas Connector and Louisiana Connector Projects' compressor stations. Once a facility is subject to PSD, the following requirements apply:

- Installation of Best Available Control Technology (BACT).
- Air quality monitoring and modeling analyses to ensure that a project's incremental increase of emissions would not cause or contribute to a violation of any NAAQS or PSD air quality increment.
- Notification to the federal land manager of nearby Class I areas and modeling if applicable.
- A growth, soil, and vegetation, and visibility analysis.
- Public comment on the permit.

BACT is an emissions limitation that is based on the maximum degree of control that can be achieved. It is a case-by-case decision that considers energy, environmental, and economic impact. BACT can be add-on control equipment or modification of 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. As part of the Liquefaction Project PSD application, Port Arthur completed a BACT assessment for NO_X, CO, VOC, PM, PM_{10}, $PM_{2.5}$, SO_2, and GHGs, the results of which were incorporated into subsequent facility emission calculations.

The air quality monitoring and modeling analysis involves an assessment of existing air quality, which may include ambient monitoring data and air quality dispersion modeling results, as well as predictions, using dispersion modeling, of ambient concentrations that would result from the proposed Projects and any associated future growth. There are no Class I areas (designated under the CAA to receive special protection) within 62 miles of the Liquefaction Project; therefore, an additional PSD Class I analysis is not required.

Most states, including Texas and Louisiana, have been delegated authority by the EPA to implement federal air quality regulations. PALNG submitted an air quality application to TCEQ for the Liquefaction Project's facilities in accordance with federal and state requirements, including the NSR/PSD requirements listed above. Each state permitting agency is responsible for determining the facilities applicable under each permit. On February 17, 2016, TCEQ issued permits 131769, PSDTX1456, and GHGPSDTX134, granting PALNG authorization to construct and operate the liquefaction facilities.

New Source Performance Standards

The EPA promulgates New Source Performance Standards (NSPS) that establish emission limits and fuel, monitoring, notification, reporting, and recordkeeping requirements for new or significantly modified stationary source types or categories.

Subpart A (*General Provisions*) would apply generally to the Project. The auxiliary boilers at the liquefaction facilities would be subject to NSPS Subpart Db (*Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units)*, which sets emission standards for NO_X, PM, and SO_2. The liquid condensate tanks at the liquefaction facilities would be subject to Subpart Kb (*Standards of Performance for Volatile Organic Liquid Storage Vessels (including Petroleum Liquid Storage Vessels)*, which sets emission standards for VOC. Subpart VVa, *Standards of Performance for Equipment Leaks of VOC in the Synthetic Organic Chemicals Manufacturing Industry*, sets VOC emission limits and leak detection requirements and would apply to the closed vent system at the liquefaction facilities. The deethanizer and debutanizer columns at the liquefaction facilities would be subject to Subpart NNN, *Standards of performance for VOC Emissions from Synthetic Organic Chemical Manufacturing Industry Distillation Operations*, which sets emissions standards for VOC. The standby generators and firewater pump engines associated with the Liquefaction Project and the standby generators at the Texas Connector Project's North Compressor Station and the Louisiana Connector Project's compressor station would be subject to Subpart IIII (*Standards of Performance for Stationary Compression Ignition Internal Combustion Engines [CI ICE])*, which sets emission standards, reporting and recordkeeping requirements, and requirements for fuel, compliance, and testing. Subpart KKKK, *Standards of Performance for Stationary Combustion Turbines*, regulates emissions of NO_X and SO_2 and would apply to the power generation combustion turbines associated with the Liquefaction Project, the Texas Connector Project's North Compressor Station, and the Louisiana Connector Project's compressor station. Subpart OOOOa, *Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution*, establishes emission standards and compliance schedules for the control of VOCs and SO_2, which would apply to the collection of fugitive emissions components at the Texas Connector Project's North and South Compressor Stations and the Louisiana Connector Project's compressor station.

For the Liquefaction Project, PALNG would comply with Subparts A, Db, Kb, VV, NNN, IIII, and KKKK, including the applicable emission limits and monitoring, reporting, and testing requirements of those subparts. For the Texas Connector and Louisiana Connector Projects, PAPL would comply with Subparts A, IIII, KKKK, and OOOOa, including the applicable emission limits and monitoring, reporting, and testing requirements of those subparts.

National Emissions Standards for Hazardous Air Pollutants

The CAA Amendments established a list of 189 HAPs, resulting in the promulgation of National Emission Standards for Hazardous Air Pollutants for Source Categories (NESHAPs). NESHAPs regulate HAP emissions from stationary sources by setting emission limits, monitoring, testing, recordkeeping, and notification requirements. Subpart A (*General Provisions)* would apply generally to the Projects. PALNG and PAPL would comply with the requirements of Subpart A. Subpart ZZZZ (*National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*) would apply to the emergency fire pump engine and emergency electrical power generators associated with the Liquefaction Project and the emergency electrical power generators at the Texas Connector Project's North Compressor Station and the Louisiana Connector Project's compressor station. PALNG and PAPL would be subject to all applicable Subpart ZZZZ monitoring, recordkeeping, and reporting requirements, and/or would comply with NESHAPs Subpart ZZZZ by complying with NSPS Subpart IIII requirements.

Title V Operating Permit

Title V is an operating permit program run by each state. Because the potential to emit at the new liquefaction facilities, Texas Connector Project's North Compressor Station, and Louisiana Connector Project's compressor station would be above the Title V thresholds, the three facilities would be subject to Title V permitting requirements. PALNG was issued permit numbers 131769, PSDTX1456, and GHGPSHTX134 on February 17, 2016. PAPL proposes to submit an air permit application for the Texas Connector's North Compressor Station six months before the start of construction. PAPL submitted a permit application to LDEQ on September 22, 2017, for the Louisiana Connector's compressor station. This permit was issued on March 29, 2018.

The minimal emissions from the electric-driven South Compressor Station (associated with the Texas Connector Project) and each meter station would not be subject to Title V permitting requirements.

Greenhouse Gas Reporting Rule

The EPA established the final Mandatory Greenhouse Gas Reporting Rule, requiring the reporting of operational GHG emissions from applicable sources that emit greater than or equal to 25,000 metric tons of CO_2e in 1 year. Recent additions to the Reporting Rule effective for calendar year 2016 require reporting of GHG emissions generated during operation of natural gas pipeline transmission systems, including blowdown emissions, equipment leaks, and vent emissions at compressor stations, as well as blowdown emissions between compressor stations. The applicability of the reporting rule would apply to PALNG's and PAPL's entire system.

Although the rule does not apply to construction emissions, we have provided GHG construction emission estimates as CO_2e for accounting and disclosure purposes in section 4.11.1.3 and tables 4.11.1-3, 4.11.1-4, and 4.11.1-5. Operational GHG emission estimates for the Projects are presented as CO_2e in section 4.11.1.3. Based on the emission estimates presented, actual GHG emissions from operation of the Liquefaction Project, Texas Connector Project's North and South Compressor Stations, and Louisiana Connector Project's compressor station, which are each considered as a separate stationary source, have the potential to exceed the 25,000-metric tpy reporting threshold for the Mandatory Reporting Rule. Therefore, if the actual operational emissions from the Liquefaction Project and the compressor stations, or the PAPL system are greater than 25,000 metric tpy, PALNG and/or PAPL would be required to report GHG emissions.

State Air Quality Requirements

PALNG and PAPL would be required to obtain air quality permits from the applicable air permitting authority for the Liquefaction Project, the Texas Connector Project's North Compressor Station, and the Louisiana Connector Project's compressor station. Air quality rules in Texas and Louisiana are outlined in the TAC and the Louisiana Administrative Code (LAC), respectively. State air quality regulations that would establish emission limits or other restrictions that may be in addition to those required under federal regulations are summarized below.

In addition to PSD and NNSR permitting requirements, Texas administers its own operating permitting requirements. Specific types of processes are permitted under the Permit By Rule (PBR) within Chapter 106 of the TAC. The Texas Connector Project's North Compressor Station would be regulated under PBR 106.352(l) for Oil and Gas Handling Production Facilities and PBR 106.512 for Stationary Engines and Turbines. A concrete batch plant would operate during the first two years of construction of the Liquefaction Project. PALNG would be required to apply for and receive a Standard Permit for Concrete Batch Plants, as regulated under Texas Health and Safety Code Sec. 382.05199. As of the issuance of this draft EIS, the final design of the proposed meter stations associated with the Texas Connector and Louisiana Connector Projects has not been completed. Calculations of operational emissions are based on a standard template subject to minor changes during final design. PAPL commits to complying with all state regulations applicable to the meter stations.

Louisiana administers its own operating permitting program under LAC Title 33 Part III Chapter 5. The Louisiana Connector Project's compressor station would be required to secure a Title V operating permit prior to construction. PAPL submitted a Title V air permit application to the LDEQ on September 22, 2017.

The Projects' Texas facilities would also be subject to Texas state regulations codified in TAC Title 30, Part I including, but not limited to, the following:

- Chapter 101 – General Rules
- Chapter 111 – Control of Air Pollution from Visible Emissions and Particulate Matter
- Chapter 112 – Control of Air Pollution from Sulfur Compounds
- Chapter 113 – Control of Air Pollution From Toxic Materials
- Chapter 114 – Control of Air Pollution From Motor Vehicles
- Chapter 115 – Control of Air Pollution From Volatile Organic Compounds
- Chapter 116 – Control of Air Pollution by Permits For New Construction or Modification
- Chapter 117 – Control of Air Pollution From Nitrogen Compounds
- Chapter 118 – Control of Air Pollution Episodes
- Chapter 122 – Federal Operating Permits

The Projects' Louisiana facilities would be subject to Louisiana state regulations codified in LAC Title 33, Part 3 including, but not limited to, the following:

- LAC 33:III:1103 – (Impairment of Visibility on Public Roads Prohibited) prevents emissions from passing onto roads and causing an impairment of visibility
- LAC 33:III:1109.C – (Control of Air Pollution from Outdoor Burning) establishes requirements and exceptions for open burning
- LAC 33:III:1305 – (Control of Fugitive Emission of Particulate Matter [PM])
- LAC 33:III:1311 and 1313 – (Emission Limits [PM])
- LAC 33:III:2111 – Pumps and Compressors
- LAC 33:III:2113 – Housekeeping

4.11.1.3 Air Quality Impacts and Mitigation

Construction Emissions

Construction of the Projects would result in temporary increases of pollutant emissions from the use of diesel- and gas-fueled equipment, blowdown and purging activities, and surface coating and abrasive blasting operations, as well as temporary increases in fugitive dust emissions from earth/roadway surface disturbance. The first two construction years at the Liquefaction Project would also include emissions from the temporary concrete batch plant. PALNG has committed to acquiring and abiding by the Texas concrete batch plant permit[38], which has specific emission requirement.

Indirect emissions would be generated from vehicles associated with construction workers traveling to and from work sites. The volume of fugitive dust generated would be dependent upon the area disturbed and the type of construction activity, along with the soil's silt and moisture content, wind speed, and the nature of vehicular/equipment traffic. Construction of the Liquefaction Project would take over 5 years, while the Texas Connector and Louisiana Connector Projects would be constructed over 2 and 3 years, respectively. Construction at aboveground facilities and the use of construction support areas would take place over several months at specific locations, while pipeline construction at any given location would generally last from 6 to 10 weeks.

Construction emissions for the Projects are presented in tables 4.11.1-4 through 4.11.1-6.[39] The following assumptions and protocols were used in the emissions estimates:

- For both the Texas Connector Project and Louisiana Connector Project, combustion emissions from on-road vehicles (e.g., delivery and material removal vehicles) and non-road construction equipment operation were estimated using the EPA Motor Vehicle Emission Simulator model, which estimates emissions for on-road and non-road vehicles and equipment based on the anticipated types of non-road equipment and their associated levels of use. For the Liquefaction Project and Texas Connector Project, fugitive particulate emissions of PM_{10} and $PM_{2.5}$ were calculated using the EPA AP-42 recommended emission factors for heavy construction equipment, combined with estimates of the extent and duration of active surface disturbance during construction

- For the Louisiana Connector Project, fugitive particulate emissions of PM_{10} and $PM_{2.5}$ were calculated using factors from the *WRAP Fugitive Dust Handbook.*

- For all the Projects, GHG emissions were estimated from non-road construction equipment using factors from the *2016 Climate Registry Default Emission Factors*. HAP emissions from non-road construction equipment were estimated using EPA AP-42 factors.

- Specific to the Liquefaction Project, tug boats would be used to transport barges carrying construction materials to Liquefaction Project site. Criteria emissions from tug boats were estimated using emission factors for Tier 2 engines from the EPA's *Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories*, while GHG emissions were calculated using 40 CFR 98.

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38 TCEQ standard permit for concrete batch plants: https://www.tceq.texas.gov/permitting/air/newsourcereview/mechanical/cbp.html

39 Detailed emission calculations were provided in PALNG's application for the Liquefaction Project and PAPL's application for the Texas Connector Project (formerly referred to as the Port Arthur Pipeline Project), each filed with FERC on November 29, 2016; PAPL's application for the Louisiana Connector Project, filed with FERC on October 16, 2017; and PALNG's and PAPL's responses to our data requests and supplemental filings.

TABLE.4.11.1-4

Estimated Construction Emissions from the Liquefaction Project

Source [a]	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	HAPs	CO_2
	(total tons during 5 years of construction activities)							
Construction Equipment	712.20	8,097.70	178.60	32.60	31.80	0.97	2.05	105,332.00
Concrete Batch Plant	9.86	8.92	0.74	3.28	1.80	0.02	--	--
Delivery of Construction Supplies [b]	178.37	131.15	7.08	8.20	7.96	8.58	TBD[c]	18,170.00
Commuting Construction Workers and Onroad Delivery Vehicles	320.70	448.80	48.70	18.00	17.30	0.63	5.37	51,641.00
Fugitive Dust from Material Transfers and Road Traffic	--	--	--	4,620.00	863.50	--	--	--
Liquefaction Project Totals	**1,221.10**	**8,686.6**	**235.12**	**4,682.10**	**922.36**	**10.20**	**7.42**	**175,143**

[a] Construction emissions from the SH 87 relocation are included in the emission calculations for all sources.
[b] Delivery of supplies by barges supported by tug boats.
[c] Emissions will be provided with final EIS.

TABLE.4.11.1-5

Estimated Construction Emissions from the Texas Connector Project

Source	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	HAPs	CO_2
	(total tons during 2 years of construction activities)							
Emissions from Construction Equipment								
Texas Connector Compressor Stations	17.91	9.31	1.87	1.36	1.33	0.03	9.54E-02	2,463
Texas Connector Meter Stations	1.80	1.20	0.24	0.18	0.18	0.00	9.45E-03	246
Texas Connector Pipeline Spread	68.28	19.59	4.66	3.76	3.65	0.08	3.19E-01	9,029
Tailpipe Emissions from Commuting Construction Workers and Onroad Delivery Vehicles								
Texas Connector Compressor Stations	3.46	12.65	0.86	0.42	0.38	0.02	1.5.E-01	1499
Texas Connector Meter Stations	0.67	1.96	0.16	0.05	0.06	0.00	2.40E-02	236
Texas Connector Pipeline Spread	31.217	37.42	4.70	3.30	4.30	0.07	7.14E-01	7,486
Estimated Fugitive Emissions of Particulate Matter from Material Transfers and Road Traffic								
Texas Connector Compressor Stations, Meter Stations, and Pipeline	--	--	--	287.32	43.11	--	--	--
Texas Connector Project Totals	**123.34**	**82.13**	**12.49**	**296.39**	**53.01**	**0.2**	**1.16**	**20,959**

TABLE.4.11.1-6

Estimated Construction Emissions from the Louisiana Connector Project

Source	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	HAPs	CO_2
	(total tons during 3 years of construction activities)							
Emissions from Construction Equipment								
Louisiana Connector Compressor Station	1.83	6.80	0.39	0.11	0.11	0.01	1.00E-02	566
Louisiana Connector Meter Stations	13.96	7.09	1.44	0.68	0.68	0.02	1.30E-02	621
Louisiana Connector Pipeline Spread	45.75	33.07	5.90	2.56	2.56	0.12	3.90E-01	18,739
Tailpipe Emissions from Commuting Construction Workers and Onroad Delivery Vehicles								
Louisiana Connector Compressor Station	0.58	0.47	0.02	0.02	0.02	0.00	3.12E-03	181
Louisiana Connector Meter Stations and Pipeline Spread	2.50	1.48	0.11	0.07	0.06	0.01	1.00E-02	1,778
Estimated Fugitive Emissions of Particulate Matter from Material Transfers and Road Traffic								
Louisiana Connector Compressor Station	--	--	--	55.08	5.50	--	--	--
Louisiana Connector Meter Stations and Pipeline	--	--	--	402.95	47.26	--	--	--
Louisiana Connector Project Totals	**64.62**	**48.91**	**7.86**	**461.47**	**56.19**	**0.16**	**4.26E-01**	**21,885**

PALNG and PAPL would implement measures to control fugitive dust emissions. Each company prepared separate project-specific *Fugitive Dust Control Plans*, which were included with their respective FERC application. PALNG and PAPL would implement emission reduction measures such as water suppression, covering truckloads during transit, limiting on-site vehicle speed, paving or grading of roadways, and removing track-out on public roads. We reviewed the *Fugitive Dust Control Plans* and found them acceptable.

Construction equipment would be operated only on an as-needed basis to minimize the combustion emissions from diesel and gasoline engines. For the Louisiana Connector Project, PAPL would reduce emissions from surface coating and abrasive blasting by purchasing shop-coated components, using non-VOC surface coating materials, and using a sand substitute to reduce PM emissions from sand blasting. Onshore and offshore construction equipment would comply with the following state and federal emissions reduction programs, as applicable:

- Texas Low Emissions Diesel Program
- GHG Emission Standards for Medium- and Heavy-Duty Engines and Vehicles (Phases I and II)
- National Clean Diesel Campaign
- Cross-State Air Pollution Rule
- Clean Air Interstate Rule
- Tier 3 Vehicle / Fuel Standards
- Heavy-Duty Highway Diesel Rule
- Locomotive and Marine Compression-Ignition Engine Standards
- Annex VI of the International Convention for the Prevention of Pollution from Ships treaty

No open burning of construction debris would occur, thus emissions from open burning activities are not included in construction emissions. If open burning is proposed at some point, PALNG and PAPL would be required to secure the appropriate approvals from TCEQ and LDEQ.

Each train of the liquefaction terminal would be brought on line sequentially over a period of 6-12 months. During this period, simultaneous construction, commissioning, and operational emissions would occur. These overlapping emissions would likely be in excess of the modeled operational emissions (see table 4.11.1-10, below) during these months. During the period of simultaneous commissioning, construction, and operation, the high level of emissions may result in exceedances of the NAAQS in the industrial vicinity of the liquefaction terminal.

Most construction-related emissions on the pipeline projects would be temporary and localized and would dissipate with time and distance from areas of active construction. Further, construction emissions along the pipelines would subside once construction is complete. During construction, emissions would transition to operating emissions and would overlap with operating emissions for six months to one year. During this period, there may elevated impacts on the liquefaction terminal's industrial neighbors. Based on the mitigation measures outlined in PALNG's and PAPL's Fugitive Dust Control Plan, PAPL's commitment to obtain the applicable air permits and adhere to air quality regulations, and the temporary nature of pipeline construction, we conclude that construction of the pipeline projects would not have a significant impact on air quality. However, there may be potentially be significant impacts surrounding the liquefaction terminal as a result the overlap in operation and construction.

Operational Emissions

Most of the operational emissions from the Projects would result from the liquefaction facilities, the gas-fired North Compressor Station (associated with the Texas Connector Project), and the gas-fired Louisiana Connector Compressor Station. Texas Connector Project's South Compressor Station would be electric-driven and therefore not generate combustion-related emissions. However, all aboveground facilities, including the compressor stations, meter stations components, and mainline valves, and the pipeline would generate fugitive emissions of natural gas.

The Louisiana Connector's compressor station would consist of combustion sources including four turbines, four heaters, and two diesel-fired emergency generator engines. The Texas Compressor Station's North Compressor Station will consist of combustion sources including three turbines, three heaters, and two diesel-fired emergency generator engines. The turbines at the North Compressor Station (Texas Connector Project) and Louisiana Connector Project's compressor station would incorporate SoLoNOX (i.e., dry low NO_X or lean pre-mix) combustors to control NO_X emissions.

PALNG proposes to construct two liquefaction trains. Each train would contain one propane and one mixed refrigerant refrigeration compressor turbine. Each of the trains would be equipped with an Acid Gas Removal Unit. Emissions from the Removal Unit would be controlled using thermal oxidizers. LNG will be stored in three storage tanks and loaded onto marine vessels for export at the marine berthing area. Other emissions sources at the proposed facility include a marine flare, a ground flare, diesel engine-driven standby generators and firewater pumps, equipment leak fugitives, fixed roof storage tanks, truck loading, and combustion turbine generators for self-generation of electrical power. Mobile sources include those associated with two marine berths including shipboard engines used to power the LNG vessels and assist tugs that will operate within a 500-yard radius of the docking point. Equipment at the liquefaction facilities would incorporate BACT controls, including low-NO_X burners on the refrigeration turbines, thermal oxidizers, and fuel gas preheaters; low-NO_X burners with selective catalytic reduction technology on the power generation turbines; limited hours of operation and the use of ultra-low sulfur fuel in emergency generators; good combustion practices on all combustion equipment; a leak detection and repair program; a closed vent system on condensate storage tanks and pressurized tanks for storage of LNG, aqueous ammonia, propylene, and ethylene; and thermal oxidizers with destruction efficiency of 99.9 percent for VOC and sulfur compounds.

Air pollutant emissions from operation of the proposed liquefaction facilities and compressor stations were calculated using emissions factors from vendor data, the EPA's Compilation of Air Pollutant Emission Factors (AP-42), and 40 CFR 98. Fugitive gas emissions were estimated using emission factors from the Interstate Natural Gas Association of America and TCEQ. Emissions from blowdowns were included for the North Compressor Station (Texas Connector Project) and Louisiana Connector Project's compressor station; no blowdown facilities would be constructed at the liquefaction site. The potentials to emit from the liquefaction facilities, compressor stations, pipeline and meter stations are summarized in table 4.11.1-7.

TABLE 4.11.1-7

Operational Emissions from the Projects

Facility Description	NO_X	CO	VOC	SO_2	$PM/PM_{10}/PM_{2.5}$	CO_2e
	(tpy)					
LIQUEFACTION PROJECT						
Stationary Emissions Sources from the Liquefaction Project						
Refrigeration Compressor Turbines (4)	556.8	946.36	43.44	10.4	168.6	2,018,068
Generator Combustion Turbines (9)	253.89	277.56	35.37	16.92	79.56	1,412,208
Fire Water Pumps (5)	2.2	1.25	0.15	0.0028	0.05	260
Standby Generators (3)	7.11	4.17	0.51	0.0087	0.24	828
Thermal Oxidizers (2)	15.76	21.62	4.22	0.38	1.96	892,994
Gas Turbine Preheater (2)	1.64	2.74	0.18	0.04	0.24	3,898
Marine Flare	26.11	52.13	0.69	0	0.01	26,022
Ground Flare	348.97	586.35	23.29	0.06	0.22	304,396
Storage Tanks (13)	--	--	1.63	--	--	--
Equipment Fugitives	--	--	21.68	--	--	--
Subtotal	**1,212**	**1,892**	**131**	**29**	**251**	**4,658,674**
Mobil Emissions Sources from the Liquefaction Project						
LNG Vessels	163.02	329.54	TBD [a]	26.54	22.34	TBD [a]
Assist Tugboats	8.99	14.46	TBD [a]	1.24	0.195	TBD [a]
Subtotal	**172.01**	**344.00**	**TBD** [a]	**27.78**	**22.54**	**TBD** [a]
Liquefaction Project Totals	1,384	2,236	131	57	274	4,658,674
TEXAS CONNECTOR PROJECT						
North Compressor Station						
Gas Turbines (3)	94.94	106.06	11.42	1.14	14.19	207,496
Fuel Gas Heaters (3)	-	6.75	0.09	-	-	418
Diesel Engines (2)	0.50	0.18	0.12	0.00	0.00	50
Tanks (3)	-	-	0.36	-	-	64
Fugitive Emissions	-	-	0.00	-	-	-
Condensate Loadout	-	-	3.55	-	-	-
Subtotal	**95.46**	**112.97**	**15.96**	**1.15**	**14.20**	**208,070**
South Compressor Station	-	-	-	-	-	657
North and South Pipeline Segments and Laterals	-	-	0.001	-	-	3,491
Meter stations (6)	-	-	0.12	-	-	360.6
Texas Connector Project Totals	**95.46**	**112.97**	**16.08**	**1.15**	**14.20**	**212,579**

TABLE 4.11.1-7 (cont'd)

Operational Emissions from the Projects

Facility Description	NO_X	CO	VOC	SO_2	$PM/PM_{10}/PM_{2.5}$	CO_2e
	(tpy)					
LOUISIANA CONNECTOR PROJECT						
Louisiana Connector Compressor Station						
Gas Turbines (4)	158.26	163.96	60.01	4.20	26.6	315,284
Fuel Gas Heaters (4)	1.44	1.12	0.64	0.01	0.08	1,332
Diesel Engines (2)	0.62	0.18	0.62	0.00	0.01	87
Tanks (5)	-	-	0.81	-	-	2,252
Fugitive Emissions	-	-	0.05	-	-	-
Condensate Loadout	-	-	0.68	-	-	-
Subtotal	**160.32**	**165.26**	**62.82**	**4.21**	**26.68**	**318,955**
Louisiana Connector Mainline Pipeline	-	-	0.004	-	-	11,798
Meter stations (8)	-	-	0.16	-	-	412
Louisiana Connector Project Totals	**160.32**	**165.26**	**62.98**	**4.21**	**26.68**	**331,165**
TOTALS	**1,639.78**	**2,514.23**	**209.90**	**62.36**	**314.88**	**5,190,208**

[a] Values will be provided in the final EIS.

Air Modeling of Compressor Stations

To evaluate the air quality impacts of operational emissions from the compressor stations, PAPL performed air quality modeling analyses for the Texas Connector Project's North Compressor Station, and the Louisiana Connector Project's compressor station. The Texas Connector Project's South Compressor Station would be electric-driven, and therefore no modeling was conducted for that station. Background pollutant concentrations were estimated using existing ambient monitoring data for the region. Data were obtained from representative air quality monitoring stations to characterize the background air quality for each compressor station and are presented in table 4.11.1-2. The background monitors were determined based on proximity and general representativeness of the monitoring sites to each of the aboveground facilities.

Modeling for the Texas Connector Project's North Compressor Station was performed using the EPA-approved air dispersion model AERMOD Version 15181. Modeling for the Louisiana Connector Project's compressor station used AERMOD Version 16216r. PAPL conducted a screening analysis to determine whether operating emissions of SO_2, NO_2, CO, PM_{10}, or $PM_{2.5}$ would cause a significant impact. If the impacts are determined to be significant, a refined modeling analysis is required to determine the cumulative impact of the facility.

PAPL completed its screening analysis by modeling operating emissions from the compressor stations to determine the maximum ground level concentrations for each pollutant. As shown in table 4.11.1-8, the screening results for the Texas Connector Project's North Compressor Station indicate that SO_2, NO_2 (annual), CO, PM_{10}, and $PM_{2.5}$ are below their respective PSD modeling significant impact levels (SILs); therefore, further modeling was not required. However, the 1-hour NO_2 exceeded the corresponding SIL. As also shown in table 4.11.1-8, the screening results for the Louisiana Connector Project's compressor station indicate that SO_2, NO_2 annual, CO, and $PM_{2.5}$ (annual) are below their respective SILs. The 1-hour NO_2, 24-hour $PM_{2.5}$, and 24-hour PM_{10} exceeded their SILs.

TABLE 4.11.1-8

Significant Impact Analysis for Operating Emissions from the Texas Connector and Louisiana Connector Projects' Compressor Stations

Facility/ Pollutant	Averaging Period	Year	Maximum Modeled Concentration (μg/m^3)	SIL (μg/m^3)	Below SIL? (Yes or No)
TEXAS CONNECTOR PROJECT NORTH COMPRESSOR STATION					
SO_2	1-hour	2012	0.56	10	Yes
NO_2	1-hour	2012	37.8	7.5	No
	Annual	2012	0.96	1	Yes
CO	1-hour	2012	1,783.53	2,000	Yes
	8-hour	2012	307.8	500	Yes
$PM_{2.5}$	24-hour	2012	0.91	1.2	Yes
	Annual	2012	0.03	0.3	Yes
PM_{10}	24-hour	2012	2.18	5	Yes
LOUISIANA CONNECTOR PROJECT COMPRESSOR STATION					
SO_2	1-hour	2012-2016	0.99	10	Yes
NO_2	1-hour	2012-2016	47.1	7.5	No
	Annual	2012-2016	0.87	1	Yes
CO	1-hour	2012-2016	114	2,000	Yes
	8-hour	2012-2016	46	500	Yes
$PM_{2.5}$	24-hour	2012-2016	5.5	1.2	No
	Annual	2012-2016	0.15	0.3	Yes
PM_{10}	24-hour	2012-2016	6.3	5	No

μg/m^{3} = microgram per cubic meter

For pollutants which are above the SIL, a full impact (cumulative) modeling analysis was required. The cumulative analysis was completed for each pollutant and averaging period based on EPA rulemaking by combining background concentrations with the model results and comparing to the NAAQS. Table 4.11.1-8 presents the results of the refined modeling analysis. These results indicate that the Texas Compressor Station's North Compressor Station's 1-hour NO_2 emissions would not contribute to a violation of the corresponding NAAQS. As shown in table 4.11.1-9, results of the full impact analysis indicate that the Louisiana Connector Project's compressor station's 24-hour $PM_{2.5}$, and 24-hour PM_{10} emissions would not contribute to a violation of the corresponding NAAQS. However, the results exceeded the NAAQS for 1-hour NO_2. The cumulative model results include emissions from the Louisiana Connector Project's compressor station, ambient background concentration, and emissions from off-site sources within 70 kilometers. PAPL used the MAXDCONT setting in AERMOD to determine the contributions of the Louisiana Connector Project's compressor station at each receptor. The maximum contribution of the compressor station to an exceedance of the NAAQS is 4.29 $\mu g/m^3$. This value is below the SIL of 7.5 $\mu g/m^3$. Therefore, the Louisiana Connector Project's compressor station would not significantly contribute to a violation of the 1-hour NO_2 NAAQS.

TABLE 4.11.1-9

Summary of NAAQS Full Impact Analysis for the Texas Connector and Louisiana Connector Projects' Compressor Stations

Facility/ Pollutant	Averaging Period	Maximum Modeled Result (ug/m^3) [a]	Background Value (ug/m^3)	Modeled Result + Background Concentration (ug/m^3)	NAAQS [b] ($\mu g/m^3$)
TEXAS CONNECTOR PROJECT NORTH COMPRESSOR STATION					
NO_2	1-hour	30.3	75.8	106.1	188
LOUISIANA CONNECTOR PROJECT COMPRESSOR STATION					
NO_2	1-hour	165.4	67.1	232	188
PM2.5	24-hour	3.3	16.0	19.3	35
PM10	24-hour	4.5	62.8	67.3	150

[a] Maximum cumulative impact = (maximum predicted impact) + (background concentration)

[b] The form for each pollutant/averaging period (i.e., H1H, H4H, and H8H) is based on EPA rulemaking. https://www.epa.gov/criteria-air-pollutants/naaqs-table

$\mu g/m^3$ = microgram per cubic meter

Air Modeling of the Liquefaction Project

To evaluate the air quality impacts of operational emissions from the Liquefaction Project, PALNG performed an air quality modeling analysis which included land-based stationary source and mobile marine emissions. Background pollutant concentrations were obtained from representative air quality monitoring stations to characterize the background air quality for the area and are presented in table 4.11.1-2. The background monitors were determined based on proximity and general representativeness of the monitoring sites to each of the aboveground facilities.

Modeling for the Liquefaction Project was completed using the EPA's AERMOD Version 16216r. PALNG conducted a screening analysis to determine whether operating emissions of SO_2, NO_2, CO, PM_{10}, or $PM_{2.5}$ would cause a significant impact. If the impacts are determined to be significant, a refined modeling analysis was required to determine the cumulative impact of the facility.

PALNG completed its screening analysis by modeling operating emissions from the stationary liquefaction facilities and mobile marine sources to determine the maximum ground level impacts for each pollutant. As shown in table 4.11.1-10, the screening results indicate that SO_2 (annual), CO, and $PM_{2.5}$ (annual) emissions are below their respective SILs; therefore, further modeling was not required. However, the SO_2 (1-hour, 3-hour, 24-hour), NO_2 (1-hour), $PM_{2.5}$ (24-hour) and PM_{10} (24-hour) emissions exceeded the corresponding SIL, so a full impact (cumulative) modeling analysis was required.

TABLE 4.11.1-10

Significant Impact Analysis for Operating Emissions from the Liquefaction Project's Stationary and Mobile Sources

Facility/ Pollutant	Averaging Period	Year	Maximum Modeled Concentration (μg/m^3)	SIL (μg/m^3)	Below SIL? (Yes or No)
LOUISIANA CONNECTOR PROJECT COMPRESSOR STATION					
SO_2	1-hour	2011-2015	12.2	7.8	No
	3-hour	2011-2015	55.4	25	No
	24-hour	2011-2015	9.72	5	No
	Annual	2011-2015	0.4	1	Yes
NO_2	1-hour	2011-2015	60.2	7.5	No
	Annual	2011-2015	1.62	1	No
CO	1-hour	2011-2015	1192	2,000	Yes
	8-hour	2011-2015	311	500	Yes
$PM_{2.5}$	24-hour	2011-2015	7.35	1.2	No
	Annual	2011-2015	0.26	0.3	Yes
PM_{10}	24-hour	2011-2015	8.17	5	No

μg/m^3 = microgram per cubic meter

Cumulative modeling includes emissions from the liquefaction facilities stationary sources and mobile marine sources, off-site sources within 50 kilometers and ambient background concentrations. These results are compared to the NAAQS. Table 4.11.1-11 presents the results of the refined modeling analysis.

TABLE 4.11.1-11

Summary of NAAQS Full Impact Analysis for the Liquefaction Project's Stationary and Mobile Sources

Facility/ Pollutant	Averaging Period	Maximum Modeled Result [a, b] (ug/m^3)	Background Value (ug/m^3)	Modeled Result + Background Concentration (ug/m^3)	NAAQS [b] (μg/m^3)
LIQUEFACTION PROJECT					
SO_2	1-hour	23.4	169.4	193	196
	3-hour	45.5	224.2	270	1,300
	24-hour	8.84	60.1	69	365
NO_2	1-hour	220.4	56.0	276	188
	Annual	2.53	22.6	25	100
$PM_{2.5}$	24-hour	15.0	22.5	38	35
PM_{10}	24-hour	12.6	80.0	93	150

a Maximum Modeled Result includes stationary and mobile sources from the Liquefaction Project as well as nearby sources.
b The form for each pollutant/averaging period (i.e., H1H, H4H, and H8H) is based on EPA rulemaking. https://www.epa.gov/criteria-air-pollutants/naaqs-table
μg/m^3 = microgram per cubic meter

As also shown in table 4.11.1-10, results exceeded the NAAQS for 1-hour NO_2 and 24-hour $PM_{2.5}$. PALNG used the MAXDCONT setting in AERMOD to determine the contributions of the Liquefaction Project at each receptor with an exceedance. For NO_2 (1-hour), the maximum contribution of the Liquefaction Project is 0.11 $\mu g/m^3$ which is below the SIL of 7.5 $\mu g/m^3$. For $PM_{2.5}$ (24-hour), the maximum contribution of the Liquefaction Project is 0.10 $\mu g/m^3$ which is below the SIL of 35 $\mu g/m^3$. Therefore, the Liquefaction Project would not significantly contribute to a violation of the 1-hour NO_2 or the 24-hour $PM_{2.5}$ NAAQS.

Operation of the Projects would result in air quality impacts, particularly in the vicinity of the Liquefaction Project, the Texas Connector Project North Compressor Station, and the Louisiana Connector Project Compressor Station. However, modeled values of each facilities potential-to-emit, indicate that operation of the Projects would not result in or significantly contribute to an exceedance of the NAAQS.

4.11.2 Noise

Construction and operation of the Projects may affect overall noise levels in the Projects area. The ambient sound level of a region is defined by the total noise generated within the specific environment and is comprised of natural and man-made sounds. At any location, both the magnitude and frequency of environmental noise may vary considerably over the course of a day and throughout the week. This variation is caused in part by changing weather conditions and the effect of seasonal vegetation cover.

Two measurements used by some federal agencies to relate the time-varying quality of environmental noise to its known effects on people are the equivalent sound level (L_{eq}) and the day-night sound level (L_{dn}). The L_{eq} is a sound level over a specific time period corresponding to the same sound energy as measured for an instantaneous sound level assuming it is a constant noise source. Sound levels are perceived differently, depending on the length of exposure and time of day. The L_{dn} takes into account the time of day and duration the noise is encountered. Specifically, in calculation of the L_{dn}, late night and early morning (10:00 p.m. to 7:00 a.m.) noise exposures are increased by 10 dBA to account for people's greater sensitivity to sound during nighttime hours. Due to the 10 A-weighted decibels (dBA) nighttime penalty added prior to calculation of the L_{dn}, for a facility to meet the 55 dBA L_{dn} limit, the facility must be designed such that the constant 24-hour noise level does not exceed an L_{eq} of 48.6 dBA at any NSA. The A-weighted scale is used because human hearing is less sensitive to low and high frequencies than to mid-range frequencies.

Table 4.11.2-1 demonstrates the relative dBA noise levels of common sounds measured in the environment and industry. As a point of reference, a person's threshold of perception for a noticeable change in loudness is about 3 dBA, whereas a 5 dBA change is clearly noticeable and a 10 dBA change is perceived as either twice or half as loud.

TABLE 4.11.2-1

Sound Levels (dBA) and Relative Loudness [a]

Description of Sound	Sound Level (dBA)
Threshold of pain	140
Jet taking off (200-foot distance)	130
Operating heavy equipment	120
Night club with music	110
Construction site	100
Boiler room	90
Freight train (100-foot distance)	80
Classroom chatter	70

TABLE 4.11.2-1 (cont'd)

Sound Levels (dBA) and Relative Loudness [a]

Description of Sound	Sound Level (dBA)
Conversation (3-foot distance)	60
Urban residence	50
Soft whisper (5-foot distance)	40
North rim of Grand Canyon	30
Silent study room	20
Threshold of hearing (1,000 hertz)	0

[a] Adapted from 1999 OSHA Technical Manual, Chapter 5: Noise (chapter last updated August 15, 2013)

4.11.2.1 Federal Noise Regulations

In 1974, the EPA published its *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. This document provides information for state and local governments to use in developing their own ambient noise standards. The EPA has indicated that an L_{dn} of 55 dBA protects the public from indoor and outdoor activity interference. We have adopted this criterion and used it to evaluate the potential noise impacts from the proposed Projects at pre-existing NSAs such as schools, hospitals, and residences. At locations where existing ambient noise exceeds the 55 dBA threshold, Commission guidelines require the project-related noise increase to be below 10 dBA at any NSA. In addition, Commission regulations state that operation of project facilities may not result in any perceptible increase in vibration at any NSA.

4.11.2.2 State and Local Noise Regulations

The City of Port Arthur noise standard limits noise according to zoning district (e.g., residential, commercial, industrial) (Municipal Code Corporation [MCC], 2016a). The Liquefaction Project and Texas Connector Project's South Compressor Station are within the City of Port Arthur's jurisdiction and are zoned industrial. NSAs affected by these projects are in residential zones. As such, noise standards differ in areas zoned industrial versus areas zoned residential. The applicable City of Port Arthur noise standard for the NSAs in residential areas would limit project-generated noise to no greater than 57 dBA during the day (7 a.m. to 10 p.m.) and 52 dBA at night (10 p.m. to 7 a.m.). Construction-related noise is exempt from this standard provided that such activities do not take place during nighttime hours (MCC, 2016a). These noise standards are less restrictive than our noise criteria of 55 dBA L_{dn} and 48.6 dBA L_{eq}.

Cameron and Evangeline Parishes, Louisiana have qualitative nuisance regulations in place to prevent disturbance of the peace (MCC, 2015, 2016b). No other local noise ordinances applicable to the Projects area were identified. If additional local noise ordinances are identified through local permitting processes, PALNG and PAPL would address them during consultations with the local government.

Absent an applicable state or local noise level limit and, because the City of Port Arthur noise level limits are above the FERC noise criteria, our more stringent noise criterion of 55 dBA or no more than a 10 dBA increase over existing noise levels was used to evaluate the Projects' compliance with noise regulatory requirements.

4.11.2.3 Construction Noise Impacts and Mitigation

Noise would be generated during construction of the liquefaction facilities, pipeline, and aboveground facilities for the Projects. Noise levels would be highest in the immediate vicinity of construction activities and would diminish with distance from the work area. These impacts would be localized and temporary. The changing number and type of construction equipment at construction sites would result in varying levels of noise. Construction activities associated with the Projects would be performed with standard heavy equipment such as track-excavators, backhoes, cranes, bulldozers, dump trucks, boring equipment, and cement trucks. Noise would also be generated by trucks and other light vehicles traveling in and near areas under construction. Construction would generally not affect nighttime noise levels as it would be limited to 7 a.m. to 10 p.m., except for pile driving, HDD activities, and specific, limited construction activities such as tie-ins and hydrostatic testing.

Surface topography, vegetation cover, wind, and weather conditions would also affect the distance that construction-related noise would extend from the workspace. Tall, dense vegetation and rolling topography typically attenuates noise when compared to less vegetated, open land. Typically, the most prevalent sound source during construction would be the internal combustion engines used to power the construction equipment. Pile driving would be the most prominent source of construction noise during construction of the Liquefaction Project. Table 4.11.2-2 provides estimated noise levels (50 feet from the source) for typical construction equipment.

TABLE 4.11.2-2

Noise Levels of Major Construction Equipment [a]

Equipment Type	Sound Level at 50 Feet (dBA)
Trucks	85
Crane	85
Roller	85
Bulldozers	85
Pickup Trucks	55
Backhoes	80
Grader	85
Portable generators	84
Jackhammer	89
Pumps	81
Horizontal Boring Hydraulic Jack	82

[a] Federal Highway Administration, 2011

Liquefaction Project

Construction of the Liquefaction Project, which would also encompass the Texas Connector Project's South Compressor Station, would take about 45 months and would occur 6 days a week, 7 a.m. to 10 p.m. Table 4.11.2-6 depicts the distance and direction to the nearest NSAs, which are located 1.6 miles away. The noise levels associated with operation of construction equipment at the liquefaction site are expected to be less than 42 dBA at the nearest NSA. In addition to typical construction equipment, a concrete batch plant would be used at the site. The concrete batch plant would operate intermittently for a total of 3,120 hours over 2 years. The maximum noise from the concrete batch plant would be 57 dBA, which would be reduced to less than 42 dBA at the nearest NSA.

Pile-driving activities would also be required as part of the Liquefaction Project construction. Pile driving would take place for about 3 months during construction of the Pioneer Dock, 4 months during construction of the MOF, 16 months during construction of the berths, and 15 to 19 months during construction of the main liquefaction facilities. PALNG states that pile-driving activities would take place 10 hours per day, 6 days a week. The maximum noise from pile driving could reach 60 dBA at the nearest NSA; however, pile driving would only occur during daylight hours.

Texas Connector and Louisiana Connector Projects

Construction equipment noise levels would typically be about 90 dBA at 50 feet when equipment is operating at full load, which could be heard by people in nearby buildings. However, most pipeline construction noise would be localized. PAPL would construct the pipelines between the hours of 7 a.m. to 10 p.m. Some discrete activities (e.g., HDDs, hydrostatic testing, tie-ins, and purging/packing the pipeline) may require 24 hours of activity for limited periods of time; however, these activities would be temporary to short term. Due to the temporary, transitory, and localized nature of pipeline construction, we conclude that pipeline construction noise would not have a significant impact on nearby landowners.

Construction of the compressor stations, meter stations, MLVs, and pig launchers/receivers associated with the Texas Connector and Louisiana Connector Projects would occur over a period of several weeks to several months and would take place between the hours of 7 a.m. to 10 p.m. 6 days a week. Table 4.11.2-7 includes the distance and direction to NSAs within 0.5 mile of the North and South Compressor Stations (Texas Connector Project) and Louisiana Connector Project compressor station, respectively. Table 4.11.2-8 depicts the distance and direction to the NSAs within 0.5 mile of the KMLP, NGPL, GTS/CIPCO, FGT, HPL, TETCO, Centana, Egan, Pine Prairie, TGT, ANR, CGT, and TGP Meter Stations, respectively. Noise impacts associated with construction of the meter stations would be temporary. Construction equipment used for the Louisiana Connector Project would operate with functional mufflers, would be in good repair, and would only occur during the hours of 7 a.m. to 10 p.m.

Ambient sound levels near the Louisiana Connector Project's compressor station is 57 dBA, which is higher than our recommended 55 dBA. PAPL performed an acoustical analysis to determine the noise level attributable to the construction of the Louisiana Connector Project's compressor station. During some construction activities, noise levels at the nearest NSA to each station would be 58 dBA, which would exceed our 55 dBA L_{dn} criterion. However, due to the high ambient noise levels at the NSAs, the project-related noise impacts would be about 1 dBA above existing noise levels, which is a barely perceptible change in noise. Based on the analysis above, the temporary nature of construction, and compliance with the 55 dBA L_{dn} criterion, we conclude that construction noise at the aboveground facility sites would not have a significant impact on nearby NSAs.

Horizontal Directional Drills

The Texas Connector and Louisiana Connector Projects include HDDs that would generate continuous noise at drill entry and exit points at specific locations. HDD activities in any one area could last from several weeks to several months depending on the length of the drill and the hardness of the substrate being drilled. Table 4.11.2-3 lists the estimated noise levels anticipated on NSAs based on HDD activities and the estimated durations of the drill.

TABLE 4.11.2-3

Estimated Noise Levels for HDD Entry and Exit Sites Along the Texas Connector and Louisiana Connector Projects

Project/HDD Segment MPs (Entry to Exit Site)	Estimated Duration (days)	Distance (feet) and Direction to Closest NSA to HDD Entry	Distance (feet) and Direction to Closest NSA to HDD Exit	Ambient L_{dn} (entry/exit) (dBA)	Calculated L_{dn} Attributable to HDD (entry/exit) (dBA)	HDD Operations + Ambient L_{dn} (entry/exit) (dBA)	Change in the Sound Level (entry/exit) (dB)
TEXAS CONNECTOR PROJECT							
Southern Pipeline							
1.0 - 0.1	44	None	None				
2.2 - 2.5	19	None	2,500/NE	54.0	36.4	54.1	0.1
2.9 - 3.7	43	None	2,000/NW	46.2	38.6	49.9	0.7
7.0 - 6.0	50	None	None				
7.5 - 7.1	19	None	None				
Northern Pipeline							
2.6 - 1.5	53	None	None				
5.2 - 4.1	53	None	None				
5.2 - 6.2	49	None	None				
8.9 - 8.2	32	None	None				
10.9 - 10.0	44	None	None				
11.6 - 12.2	32	1,900/W	None	48.1	50.4	52.4	4.3
13.0 - 13.3	15	None	None				
14.2 - 14.4	14	None	None				
17.5 - 18.1	28	2,200/S	None	52.8	48.8	54.2	1.4
18.5 - 18.2	18	None	None				
19.0 - 18.6	19	None	None				
20.2 - 19.6	30	1,900/E	None	63.3	49.4	63.5	0.2
20.8 - 20.3	27	None	1,800/SE	63.3	39.7	63.3	0.0
21.6 - 22.4	39	None	None				
23.7 - 22.9	34	None	None				
25.2 - 24.6	31	None	None				
GTS Lateral							
0.8 - 0.5	17	None	2,500/N	61.6	37.9	61.6	0.0
0.8 - 1.1	17	None	None				
FGT Lateral							
1.2 - 0.8	22	400/S	900/E	49.9/49.9	68.1/46.8	68.2/51.6	18.2/1.7

TABLE 4.11.2-3 (cont'd)

Estimated Noise Levels for HDD Entry and Exit Sites Along the Texas Connector and Louisiana Connector Projects

Project/HDD Segment MPs (Entry to Exit Site)	Estimated Duration (days)	Distance (feet) and Direction to Closest NSA to HDD Entry	Distance (feet) and Direction to Closest NSA to HDD Exit	Ambient L_{dn} (entry/exit) (dBA)	Calculated L_{dn} Attributable to HDD (entry/exit) (dBA)	HDD Operations + Ambient L_{dn} (entry/exit) (dBA)	Change in the Sound Level (entry/exit) (dB)
LOUISIANA CONNECTOR PROJECT (MILEPOST)							
0.0 - 0.8	TBD [a]	None	1,850/SW	52	50	54	2
4.3 - 4.8		None	None				
18.1 - 17.5		None	None				
18.2 - 19.2		None	None				
27.2 - 26.5		None	None				
27.5 – 28.3		None	None				
30.9 - 30.6		None	None				
38.7 – 39.1		1,000/NE	1,600/NW	47	58	58	<10*
40.5 – 40.2		950/NW	1,500/NW	47	58	58	<10
42.5 – 42.0		1,800	None	52	53	56	4
47.9 – 47.5		700/NW	500/N	52	62	62	<10
48.5 – 48.2		700/NW	680/NW	52	62	62	<10
50.0 – 50.3		None	None				
54.6 – 54.8		1,600/N	850/NW	47	53	54	7
56.8 - 57.4		500/SE	2,300/SW	52	65	65	<10
60.2 – 59.7		1,700/SW	450/E	57	56	60	3
60.5 – 60.8		2,600/NW	None	52	48	53	1
63.9 - 64.3		None	None				
65.0 – 65.4		None	None				
79.4 – 78.8		430/NE	None	47	66	66	19
91.1 – 91.2		1,100/NW	1,900/W	57	58	61	4
94.7 – 94.5		None	1,900/NW	47	48	51	4
96.9 – 96.7		350/E	430/NE	57	68	68	<10
110.1 – 109.9		850/SE	1,800/SE	47	60	68	<10
110.3 – 110.6		900/SW	975/SW	47	61	61	<10
119.0 – 119.2		2,500/S	2,100/NE	47	49	51	4

[a] This information has not been provided for the Louisiana Connector Project. Therefore, we are recommending below that the duration for each HDD be provided prior to construction.

Typical equipment used at HDD entry sites includes:

- drilling rig and engine-driven hydraulic power unit;
- engine-driven mud pump(s) and engine-driven generator set(s);
- mud mixing/cleaning equipment;
- mobile equipment including a crane, backhoe, front loader, forklift, and/or trucks(s);
- frac tanks; and
- engine-driven lights.

Noise associated with HDD exit sites could result from use of the following equipment:

- Backhoe, side boom, and/or truck(s).
- Engine-driven generator and pump.
- Engine-driven lights.

In order to reduce HDD impacts on occupants of NSAs to an L_{dn} of 55 dBA, PAPL would use noise mitigation measures, which may include temporary noise barriers or tents around the workspace; temporary noise barriers or tents around individual units; exhaust silencers on generators, pumps, or the hydraulic power unit; and the use of low-noise generators. Homeowners of NSAs would be notified of HDD activity via telephone, email, or in person at least 48 hours prior to commencing HDD activities and may be offered voluntary compensation and relocation. To ensure that HDD-related noise would not have a significant impact on local residents, **we recommend that:**

- **<u>Prior to construction of HDDs at MPs</u> 19.6 and 20.3 along the Texas Connector Project's Northern Pipeline; MP 0.5 along the GTS Lateral; MP 0.8 along the FGT Lateral; and MPs 38.7, 40.5, 42.5, 47.9, 48.5, 56.8, 60.2, 79.4, 91.1, 96.9, 110.1, and 110.3 along the Louisiana Connector Project where <u>HDD-related noise could exceed the sound level criterion at the closest NSA</u>, PAPL should file with the Secretary, for the review and written approval by the Director of OEP, an HDD noise mitigation plan to reduce the projected noise level attributable to the proposed drilling operations at nearby NSAs. During drilling operations, PAPL 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 or 10 dBA above background where nighttime ambient noise is above 55 dBA L_{dn}.**

Because of the distance of the liquefaction facilities from NSAs, the temporary nature of pipeline construction activities, and our HDD noise condition, we conclude that no significant noise impacts are anticipated from construction of the proposed Projects.

4.11.2.4 Operations Noise Impacts and Mitigation

Liquefaction Project

PALNG performed noise impact evaluations that consider the regular, operational noise produced by all significant sound sources associated with the proposed Liquefaction Project that could impact the sound contribution at nearby NSAs. Prominent sound sources include the liquefaction trains, compressors, turbines, power generation units, and cooling fans.

No blowdown activities would take place at the liquefaction facilities during normal operations; however, the liquefaction terminal would produce periodic noise from alarms associated with the marine loading and unloading operations. These warning alarms are governed by 33 CFR 127.207(b) and (c) and must have "… a minimum 1/3 octave band sound pressure level at 1 meter of 125 decibels" and must be "audible for 1 mile in all directions." Alarms such as these are generally tested on a weekly basis and would be audible at NSAs.

PALNG's noise evaluation, performed using the SoundPLAN software, accounted for terrain, meteorological effects, building shielding effects, and ground propagation and incorporates reductions due to the proposed noise controls. Noise mitigation includes the use of enclosures for the power generation turbines, silencers on the exhaust outlet and air intake, acoustic lagging on inter-compressor piping, and a flood protection berm. Table 4.11.2-4 shows the estimated noise impact at the nearest NSAs due to the full load operation of the Liquefaction Project.

TABLE 4.11.2-4

Estimated Noise Levels for the Liquefaction Project During Facility Operations

Nearest NSA	Distance (miles)/Direction	Ambient Sound Level (dBA L_{dn})	Facilities Operation (dBA L_{dn})	Facilities + Ambient L_{dn} (dBA)	Change in Ambient Sound Level (dB)
M1 (Res., Martin Luther King, Jr. Drive)	0.95 / E	64	54	64.4	0.4
M2 (Res., west side of ship channel)	1.4 / SE	56	46	56.4	0.4

[a] Existing sound level at the NSA from measured ambient sound data reported in the "Port Arthur Liquefaction Project – Baseline Noise Assessment and Noise Impact Analysis" report prepared September 2, 2016 by AECOM.

The results of the acoustical analyses indicate that the sound contribution of operation of the liquefaction facilities would not exceed our 55 dBA L_{dn} criterion at the nearest NSAs during operation, and the change in ambient sound would be below 3 dBA (the threshold at which most people perceive a difference in loudness). In addition, the nearest NSAs would be able to hear alarms at the liquefaction terminal, but this noise would be limited in duration and is not expected more than weekly. Therefore, operation of the Liquefaction Project would not have a significant effect on the ambient sound level.

To ensure that the actual noise levels resulting from operation of the Liquefaction Project are not significant, **we recommend that:**

- **PALNG should file a noise survey with the Secretary <u>no later than 60 days</u> after placing each Liquefaction Project train in service. If a full load condition noise survey is not possible, PALNG should instead file an interim survey at the maximum possible horsepower load and file the full load survey <u>within 6 months</u>. If the noise attributable to the operation of all of the equipment at the liquefaction site under interim or full horsepower load exceeds 55 dBA L_{dn} at any nearby NSA, PALNG 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. PALNG should confirm compliance with the 55 dBA L_{dn} requirement by filing a second noise survey with the Secretary <u>no later than 60 days</u> after it installs the additional noise controls.**

Texas Connector and Louisiana Connector Projects

PAPL performed noise impact evaluations that considered the noise produced by all sound sources associated with the Texas Connector Project's North Compressor Station and the Louisiana Connector Project's compressor station that could impact the sound level at nearby NSAs. No noise analysis was performed for the Texas Connector Project's South Compressor Station since it would be electric-driven with minimal noise generated.

Prominent sound sources at the North Compressor Station include the turbine-driven compressor units, scrubbers, unit and station blowdowns, gas cooling equipment, system utilities, and aboveground gas piping. The noise evaluation incorporates reductions due to distance, ground absorption, and from the proposed noise controls. Noise mitigation for the compressor equipment includes the use of compressor enclosures and silencers on the exhaust outlet and air intake. Table 4.12.2-5 shows the estimated noise impact at the nearest NSAs due to the full load operation of North Compressor Station as well as the distance and direction to the nearest NSA from each compressor station.

TABLE 4.11.2-5

Estimated Noise Levels for the Texas Connector and Louisiana Connector Projects' Compressor Stations

Project/Nearest NSA	Distance (feet)/Direction	Ambient Sound Level (dBA L_{dn})	Station Operation (dBA L_{dn})	Station + Ambient L_{dn} (dBA)	Change in Ambient Sound Level (dB)
TEXAS CONNECTOR PROJECT NORTH COMPRESSOR STATION					
House on Moore Road	600/E	60	55	61	1
LOUISIANA CONNECTOR PROJECT COMPRESSOR STATION AND TETCO METER STATION					
House on Lyles Road	1,100/SE	64	54.1	64.4	0.4
House on Hwy 165	1,650/E	70.6	51.6	70.7	0.1
House on Green Oak Cemetery Road	1,300/SE	64.0	54.5	64.5	0.5
House on Green Oak Road	2,700/NW	60.6	53.2	61.3	0.7

[a] Existing station sound level at the NSA from measured ambient sound data reported in the "Port Arthur Pipeline Project – Northern Compressor Station Noise Impact Analysis" report prepared August 26, 2016 by AECOM.

Major sound sources at the Louisiana Connector Project's compressor station include the turbine-driven compressor units, gas cooling equipment, lube oil coolers, the TETCO meter station, unit and station blowdowns, and aboveground gas piping. The noise evaluation, performed using the CadnaA software, incorporates reductions due to distance, air absorption, partial ground absorption, shielding from buildings, and the proposed noise controls. The analysis included sound reflections off the ground and buildings. Noise mitigation for the Louisiana Connector Projects' compressor station includes acoustically treated compressor enclosures, silencers on the exhaust outlet and air intake, and acoustically treated wall and roof fan openings. Table 4.11.2-7 shows the estimated noise impact at the nearest NSAs due to the full load operation of compressor station.

The results of the acoustical analyses indicate that the sound contribution of the compressor stations would not exceed our 55 dBA L_{dn} criterion at the nearest NSAs during operation. Additionally, the change in ambient sound for both stations is below the 3-dBA threshold at which most people perceive a difference in loudness. Therefore, operation of the Texas Connector Project North Compressor Station and Louisiana Connector Project's compressor station may not have a noticeable effect on the ambient sound level at the nearby NSAs.

To ensure that the actual noise levels resulting from operation of the Texas Connector Project's North Compressor Station and Louisiana Connector Project's compressor station are as predicted, **we recommend that:**

- **PAPL should file a noise survey with the Secretary <u>no later than 60 days</u> after placing the Texas Connector Project's North Compressor Station and Louisiana Connector Project's compressor station in service. If a full load condition noise survey is not possible, PAPL should instead file an interim survey at the maximum possible horsepower load and file the full load survey <u>within 6 months</u>. If the noise attributable to the operation of all of the equipment at any station under interim or full horsepower load exceeds 55 dBA L_{dn} at any nearby NSA, PAPL 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. PAPL should confirm compliance with the 55 dBA L_{dn} requirement by filing a second noise survey with the Secretary <u>no later than 60 days</u> after it installs the additional noise controls.**

Meter Stations

PAPL completed a noise analysis for each of its proposed meter stations. Table 4.11.2-6 summarizes the results, and shows the distance and direction of the nearest NSA to each meter station.

TABLE 4.11.2-6

Estimated Noise Levels at Nearest NSAs to the Texas Connector and Louisiana Connector Projects' Meter Stations

Project/Meter Station	Distance (feet)/ Direction	Ambient L_{dn} (dBA)	Estimated L_{dn} due to Meter Station (dBA)	Meter Station L_{dn} + Ambient L_{dn} (dBA)	Change in Ambient Sound Level (dB)
TEXAS CONNECTOR PROJECT					
KMLP Meter Station	6,666/W	60	36	60	0
NGPL Meter Station	913/NE	60	53	61	1
GTS/CIPCO Meter Station	3,071/NE	60	43	60	0
FGT Meter Station	539/N	60	48[b]	60	0
HPL Meter Station	344/N	60	52[b]	61	1
LOUISIANA CONNECTOR PROJECT [a]					
PALNG Meter Station	NA				
Centana Meter Station	2,600/E	52	40	52	0
Egan Meter Station	NA				
Pine Prairie Meter Station	NA				
TGT Meter Station	1,500/N	47	49	51	4
ANR Meter Station	2,400/SE	47	42	48	1
CGT Meter Station	300/E	47	53[b]	54	6
TGP Meter Station	1,800/SW	52	46	53	1

[a] The TETCO Meter Station is included in the North Compressor Station noise analysis.
[b] Includes mitigation (24 gauge steel building enclosure)

Based on the above analysis and adherence to our noise criterion of 55 dBA L_{dn} (including station blowdowns), we conclude that the noise resulting from operation of the meter stations would not have a noticeable impact on the ambient sound level at most nearby NSAs and would not represent a significant impact on any nearby NSA.

4.12 RELIABILITY AND SAFETY

4.12.1 LNG Facility Reliability, Safety, and Security Regulatory Oversight

LNG facilities handle flammable and sometimes toxic materials that can pose a risk to the public if not properly managed. These risks are managed by the companies owning the facilities, through selecting the site location and plant layout as well as through suitable design, engineering, construction, and operation of the LNG facilities. Multiple federal agencies share regulatory authority over the LNG facilities and the operator's approach to risk management. The safety, security, and reliability of PALNG's Liquefaction Project would be regulated by the DOT, USCG, and FERC.

In February 2004, the DOT, USCG, and FERC entered into an Interagency Agreement to ensure greater coordination among these three agencies in addressing the full range of safety and security issues at LNG terminals, including terminal facilities and LNG vessel operations, and maximizing the exchange of information related to the safety and security aspects of LNG facilities and related marine operations. Under the Interagency Agreement, FERC is the lead federal agency responsible for the preparation of the analysis required under NEPA for impacts associated with terminal construction and operation. The DOT and USCG participate as cooperating agencies but remain responsible for enforcing their regulations covering LNG facility siting, design, construction, and operation. All three agencies have some oversight and responsibility for the inspection and compliance during the LNG facility's operation.

The DOT establishes and has the authority to enforce the federal safety standards for the 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 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 192. On August 31, 2018, the DOT and FERC signed a MOU regarding methods to improve coordination throughout the LNG permit application process for FERC jurisdictional LNG facilities. In the MOU, the DOT agreed to issue a LOD stating whether a proposed LNG facility would be capable of complying with location criteria and design standards contained in Subpart B of Part 193. The Commission committed to rely upon the DOT determination in conducting its review of whether the facilities would be consisted with the public interest. The issuance of the LOD does not abrogate the DOT's continuing authority and responsibility over a proposed project's compliance with Part 193 during construction and future operation of the facility. The DOT's conclusion on the siting and hazard analysis required by Part 193 would be based on preliminary design information which may be revised as the engineering design progresses to final design. DOT regulations also contain requirements for the design, construction, installation, inspection, testing, operation, maintenance, and contingency plans for LNG facilities, which would be completed during later stages of the Liquefaction Project. If the project is constructed and becomes operational, the liquefaction facilities would be subject to the DOT's inspection program to ensure compliance with the requirements of 49 CFR 193.

The USCG has authority over the safety of an LNG terminal's marine transfer area and LNG marine traffic, as well as security plans for the entire LNG terminal and LNG marine traffic. The USCG regulations for LNG facilities are codified in 33 CFR 105 and 33 CFR 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 operated in accordance with 33 CFR 105 and 33 CFR 127. If the facilities are constructed and become operational, the facilities would be subject to the USCG inspection program to ensure compliance with the requirements of 33 CFR 105 and 33 CFR 127.

FERC authorizes the siting and construction of LNG facilities under the NGA and delegated authority from the DOE. FERC requires standard information to be submitted to perform safety and reliability engineering reviews. FERC's filing regulations are codified in 18 CFR 380.12 (m) and (o), and requires each applicant to identify how its proposed design would comply with the DOT's siting requirements of 49 CFR 193 Subpart B. The level of detail necessary for this submittal requires the applicant to perform substantial front-end engineering review of the complete project. The design information is required to be site-specific and developed to the extent that further detailed design would not result in significant changes to the siting considerations, basis of design, operating conditions, major equipment selections, equipment design conditions, or safety system designs. As part of the review required for a FERC order, we use this information from the applicant to assess whether the proposed facilities would have a public safety impact and to suggest additional mitigation measures for the Commission to consider for incorporation as conditions in the order. If the facilities are approved and the suggested mitigation measures are incorporated into the order as conditions, FERC staff would review material filed to satisfy the conditions of the order and conduct periodic inspections throughout construction and operation.

4.12.2 DOT Safety Regulatory Requirements and 49 CFR 193 Subpart B Determination

Siting the liquefaction facilities with regard to ensuring that the proposed site selection and location would not pose an unacceptable level or risk to public safety is required by DOT's regulations in 49 CFR 193, Subpart B. The Commission's regulations under 18 CFR 380.12 (o) (14) require PALNG to identify how the proposed design complies with the siting requirements in DOT regulations under 49 CFR 193, Subpart B. The scope of DOT's siting authority under 49 CFR 193 applies to LNG facilities used in the transportation of gas by pipeline subject to the federal pipeline safety laws and 49 CFR 192.[40]

DOT reviews the information and criteria submitted by PALNG to demonstrate compliance with the safety standards prescribed in 49 CFR 193 Subpart B and issues a LOD to the Commission on whether the proposed facilities would meet the DOT siting standards. The LOD will evaluate the hazard modeling results and endpoints used to establish exclusion zones, as well as PALNG's evaluation on potential incidents and safety measures incorporated in the design or operation of the facility specific to the site that have a bearing on the safety of plant personnel and the surrounding public. The LOD will serve as one of the considerations for the Commission to deliberate in its decision to authorize, with or without conditions, or deny an application.

The requirements in 49 CFR 193 Subpart B state that an operator or government agency must exercise legal control over the activities as long the facility is in operation 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 or ignition of LNG vapor. Approved mathematical models must be used to calculate the dimensions of these exclusion zones. The siting requirements specified in NFPA 59A (2001), an industry consensus standard for LNG facilities, are incorporated into 49 CFR 193 Subpart B by reference, with regulatory preemption in the event of conflict. The following sections of 49 CFR 193 Subpart B specifically address siting requirements:

- Section 193.2051, Scope, states that each LNG facility designed, replaced, relocated or significantly altered after March 31, 2000, must be provided with siting requirements in accordance with Subpart B and NFPA 59A (2001). In the event of a conflict with NFPA 59A (2001), the regulatory requirements in Part 193 prevail.

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

40 49 CFR 193.2001(b)(3), Scope of part, excludes any matter other than siting provisions pertaining to marine cargo transfer systems between the LNG vessel and the last manifold or valve immediately before a storage tank.

- Section 193.2059, Flammable vapor-gas dispersion protection, requires that each LNG container and LNG transfer system have a dispersion exclusion zone in accordance with sections 2.2.3.3 and 2.2.3.4 of NFPA 59A (2001).

- Section 193.2067, Wind forces, requires that shop fabricated containers of LNG or other hazardous fluid containers less than 70,000 gallons must be designed to withstand wind forces based on the applicable wind load data in ASCE 7 (2005). All other LNG facilities must be designed for a sustained wind velocity of not less than 150 mph unless the DOT Administrator finds a lower wind speed is justified or the most critical combination of wind velocity and duration for a 10,000-year mean return interval.

As stated in section 193.2051, LNG facilities must meet the siting requirements of NFPA 59A (2001), Chapter 2, and include but may not be limited to:

- NFPA 59A (2001) section 2.1.1(c) requires consideration of protection against forces of nature. Section 2.1.1(d) 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 2.2.3.2 requires provisions to minimize the damaging effects of fire from reaching beyond a property line, and requires provisions to prevent a radiant heat flux level of 1,600 British thermal units per square foot 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 have been approved by DOT.

- NFPA 59A (2001) 2.2.3.4 requires provisions to minimize the possibility of any flammable mixture of vapors from a design spill from reaching a property line that can be built upon and that would result in a distinct hazard. Determination of the distance that the flammable vapors extend is to be determined with DEGADIS or approved alternative models that take into account physical factors influencing LNG vapor dispersion. [41]

Taken together, 49 CFR 193 Subpart B and NFPA 59A (2001) require that flammable LNG vapors either from an LNG tank impoundment or from a design spill do not extend beyond areas in which the operator or a government agency legally controls all activities. Furthermore, consideration of other hazards which may affect the public or plant personnel must be evaluated as prescribed in NFPA 59A (2001) section 2.1.1(d).

Title 49 CFR 193 Subpart B and NFPA 59A (2001) also specify three radiant heat flux levels which must be considered for LNG storage tank spills for as long as the facility is in operation:

41 DOT has approved two additional models for the determination of vapor dispersion exclusion zones in accordance with 49 CFR 193.2059: FLACS 9.1 Release 2 (Oct. 7, 2011) and PHAST-UDM Version 6.6 and 6. 7 (Oct. 7, 2011).

- 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 are used for outdoor assembly by groups of 50 or more persons; [42]
- 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 contain assembly, educational, health care, detention or residential buildings or structures; [43] and
- 10,000 Btu/ft^2-hr - This level cannot extend beyond the plant property line that can be built upon. [44]

The requirements for design spills from process or transfer areas are more stringent. For LNG spills, the 1,600 Btu/ft^2-hr flux level cannot extend beyond the plant property line onto a property that can be built upon.

In addition, section 2.1.1 of NFPA 59A (2001) requires that factors applicable to the specific site with a bearing on the safety of plant personnel and the surrounding public must be considered, including an evaluation of potential incidents and safety measures incorporated into the design or operation of the facility. DOT has indicated that potential incidents, such as vapor cloud explosions and toxic releases should also be considered to comply with Part 193 Subpart B.[45]

On March 20, 2018, the DOT provided a letter to FERC staff regarding its preliminary review of the information filed by PALNG that stated it had no objection to the design spill methodologies being used for the selection of leakage sources to meet the requirements of 49 CFR 193 Subpart B.[46] In addition, the DOT's letter also stated that the associated vapor dispersion results extend beyond the boundary of the proposed Liquefaction Project and into an area belonging to the TPWD (i.e., the J.D. Murphree WMA). The DOT noted that PALNG is working with the TPWD to secure a land use agreement to satisfy the requirements for Part 193. In addition, as an alternative, PALNG could apply for a special permit from the DOT for any measures that would provide equal or greater level of safety as the DOT's exclusion zone regulations or relocate facilities such that the TPWD areas would not be within exclusion zone areas.

In accordance with the August 31, 2018 MOU, the DOT will issue a LOD to the Commission after the DOT completes its analysis of whether the proposed liquefaction facilities would meet the DOT's siting standards. The LOD will evaluate the hazard modeling results and endpoints used to establish exclusion zones, as well as PALNG's evaluation on potential incidents and safety measures incorporated in the design or operation of the facility specific to the site that have a bearing on the safety of plant personnel and

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42 The 1,600 Btu/ft2-hr flux level is associated with producing pain in less than 15 seconds, first degree burns in 20 seconds, second degree burns in approximately 30-40 seconds, 1% mortality in approximately 120 seconds, and 100% mortality in approximately 400 seconds, assuming no shielding from the heat, and is typically the maximum allowable intensity for emergency operations with appropriate clothing based on average 10 minute exposure.

43 The 3,000 Btu/ft2-hr flux level is associated with producing pain in less than 5 seconds, first degree burns in 5 seconds, second degree burns in approximately 10-15 seconds, 1% mortality in approximately 50 seconds, and 100% mortality in approximately 180 seconds, assuming no shielding from the heat, and is typically the critical heat flux for piloted ignition of common building materials (e.g., wood, PVC, fiberglass, etc.) with prolonged exposures.

44 The 10,000 Btu/ft2-hr flux level is associated with producing pain in less than 1 seconds, first degree burns in 1 seconds, second degree burns in approximately 3 seconds, 1% mortality in approximately 10 seconds, and 100% mortality in approximately 35 seconds, assuming no shielding from the heat, and is typically the critical heat flux for unpiloted ignition of common building materials (e.g., wood, PVC, fiberglass) and degradation of unprotected process equipment after approximate 10 minute exposure and to reinforced concrete after prolonged exposure.

45 The US DOT PHMSA's "LNG Plant Requirements: Frequently Asked Questions" item H1, https://www.phmsa.dot.gov/pipeline/liquified-natural-gas/lng-plant-requirements-frequently-asked-questions, accessed Aug 2018.

46 March 20, 2018 letter "Re: Port Arthur LNG Liquefaction Project, FERC Docket CP17-20" from Kenneth Lee to Rich McGuire. Filed in Docket Number CP17-20-000 on March 22, 2018. Accession Number 20180322-3040.

surrounding public. The LOD will serve as one of the considerations for the Commission to deliberate in its decision to authorize or deny an application.

The DOT's conclusion on the siting and hazard analysis required by Part 193 would be based on preliminary design information which may be revised as the engineering design progresses to final design. DOT regulations also contain requirements for the design, construction, installation, inspection, testing, operation and maintenance, and contingency plans for LNG facilities, which would be completed during later stages of the Liquefaction Project. If the facilities are approved and constructed, final compliance with the requirements of 49 CFR 193 Subpart B will be subject to the DOT's inspection and enforcement programs.

4.12.3 USCG Safety Regulatory Requirements and Letter of Recommendation

4.12.3.1 LNG Marine Carrier Historical Record

Since 1959, ships have transported LNG without a major release of cargo or a major accident involving an LNG vessel. There are more than 370 LNG vessels in operation routinely transporting LNG between more than 100 import/export terminals currently in operation worldwide. Since U.S. LNG terminals first began operating under FERC jurisdiction in the 1970s, there have been thousands of individual LNG vessel 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.

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 vessels, including minor collisions with other vessels of all sizes, groundings, minor LNG releases during cargo unloading operations, and mechanical/equipment failures typical of large vessels. Some of the more significant occurrences, representing the range of incidents experienced by the worldwide LNG vessel 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 vessel 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 LNG 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 LNG vessel's vapor handling system on September 10, 2001, during unloading at Everett, Massachusetts. Approximately 100 gallons of LNG were vented and sprayed onto the protective decking over the cargo tank dome, resulting in several cracks. After inspection by the USCG, the Khannur was allowed to discharge its LNG cargo.

- **Mostefa Ben Boulaid** had LNG spill onto its deck during loading operations in Algeria in 2002. The spill, which is believed to have been caused by overflow rather than a mechanical failure, caused significant brittle fracturing of the steelwork. The LNG vessel was required to discharge its cargo, after which it proceeded to dock for repair.

- **Norman Lady** was struck by the USS Oklahoma City nuclear submarine while the submarine was rising to periscope depth near the Strait of Gibraltar in November 2002. The 87,000 m3 LNG vessel, 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 LNG 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 LNG 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 carrier off the Port of Fujairah on February 23, 2017. Al Khattiya had discharged its cargo and was anchored at the time of the incident. A small amount of LNG was retained within the LNG 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.

4.12.3.2 LNG Carrier Safety Regulatory Oversight

The USCG exercises regulatory authority over LNG vessels under 46 CFR 154, which contains the United States safety standards for self-propelled vessels carrying bulk liquefied gases. The LNG vessels visiting the proposed facility would also be constructed and operated in accordance with the IMO *Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk* and the *International Convention for the Safety of Life at Sea*. All LNG vessels 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 LNG vessel is designed and operated in accordance with both international standards and the U.S. regulations for bulk LNG vessels under Title 46 CFR 154.

The LNG vessels that would deliver or receive LNG to or from the proposed liquefaction facilities would also need to comply with various U.S. and international security requirements. The IMO adopted the *International Ship and Port Facility Security Code* in 2002. This code requires both 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 on shore; 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 (e.g., 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 to transmit ship-to-shore security alerts identifying the ship, its location, and an indication of whether 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.
- Ships must have equipment onboard to help maintain or enhance the physical security of the ship.

In 2002, the MTSA was enacted by the U.S. Congress and aligned domestic regulations with the maritime security standards of the *International Ship and Port Facility Security Code* and the *Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk* and the *International Convention for the Safety of Life at Sea*. The USCG's regulations in 33 CFR 104 require vessels to conduct a vessel security assessment and develop a vessel security plan that addresses each vulnerability identified in the vessel security assessments. All LNG 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, LNG 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 FSP review, approval, and compliance verification as provided in Title 33 CFR 105.

The USCG regulations in 33 CFR 127 apply to the marine transfer area of waterfront facilities between the LNG vessel and the last manifold or valve immediately before the receiving tanks. 33 CFR 127 applies to the marine transfer area for LNG of each new waterfront facility handling LNG and to new construction in the marine transfer areas for LNG of each existing waterfront facility handling LNG. The scope of the regulations includes the design, construction, equipment, operations, inspections, maintenance, testing, personnel training, firefighting, and security of the marine transfer area of LNG waterfront facilities. The safety systems, including communications, emergency shutdown (ESD), gas detection, and fire protection, must comply with the regulations in 33 CFR 127. Under 33 CFR 127.019, PALNG would be required to submit two copies of its Operations and Emergency Manuals to the USCG COTP for examination.

Both the USCG regulations under 33 CFR 127 and FERC regulations under 18 CFR 157.21, require an applicant who intends to build an LNG terminal facility to submit a Letter of Intent to the USCG no later than the date that the owner/operator initiates pre-filing with FERC, but, in all cases, at least 1 year prior to the start of construction. In addition, the applicant must submit a WSA to the COTP with the LOI.

The Preliminary WSA provides an initial explanation of the port community and the proposed facility and transit routes. It provides an overview of the expected impacts LNG operations may have on the port and the waterway. Generally, the Preliminary WSA does not contain detailed studies or conclusions. This document is used by the COTP to begin his or her evaluation of the suitability of the waterway for LNG marine traffic. The Preliminary WSA must provide an initial explanation of the following:

- Port characterization.
- Characterization of the LNG facility and the LNG vessel route.
- Risk assessment for maritime safety and security.
- Risk management strategies.
- Resource needs for maritime safety, security, and response.

A Follow-On WSA must be provided no later than the date the owner/operator files an application with FERC, but in all cases at least 180 days prior to transferring LNG. The Follow-on WSA must provide a detailed and accurate characterization of the LNG facility, the LNG vessel route, and the port area. The Follow-on WSA provides a complete analysis of the topics outlined in the Preliminary WSA. It should identify credible security threats and navigational safety hazards for the LNG marine traffic, along with appropriate risk management measures and the resources (i.e., federal, state, local, and private sector) needed to carry out those measures. Until a facility begins operation, applicants must also annually review their WSAs and submit a report to the COTP as to whether changes are required. This document is reviewed and validated by the USCG and forms the basis for the agency's LOR to the FERC.

In order to provide the USCG COTPs/Federal Maritime Security Coordinators, members of the LNG industry, and port stakeholders with guidance on assessing the suitability of a waterway for LNG marine traffic, the USCG has published a Navigation and Vessel Inspection Circular – *Guidance on Assessing the Suitability of a Waterway for Liquefied Natural Gas (LNG) Marine Traffic* (NVIC 01-11).

NVIC 01-11 directs the use of the three concentric Zones of Concern, based on LNG 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:

- Zone 1 – impacts on structures and organisms are expected to be significant within 500 meters (1,640 feet). The outer perimeter of Zone 1 is approximately the distance to thermal hazards of 37.5 kW/m^2 (12,000 Btu/ft^2-hr) from a pool fire.
- Zone 2 – impacts would be significant but reduced, and damage from radiant heat levels are expected to transition from severe to minimal between 500 and 1,600 meters (1,640 and 5,250 feet). The outer perimeter of Zone 2 is approximately the distance to thermal hazards of 5 kW/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 lower flammability limit 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 both in the waterway and when in port.

As required by its regulations (33 CFR 127.009), the USCG is responsible for issuing a LOR to 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.
- Distance of berthed LNG 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.

4.12.3.3 PALNG's Waterway Suitability Assessment

On March 17, 2015, PALNG submitted a LOI and a Preliminary WSA to the COTP, Marine Safety Unit Port Arthur to notify the USCG that it proposed to construct an LNG export terminal. In order to assess the safety and security aspects of the Liquefaction Project, the COTP Marine Safety Unit Port Arthur consulted with various safety and security working groups, including the Area Maritime Security Committee, Harbor Safety Committee, state and local government representatives, and local emergency response groups. PALNG submitted a Follow-On WSA to the USCG on July 14, 2015.

4.12.3.4 LNG Carrier Routes and Hazard Analysis

As described in PALNG's WSAs, an LNG vessel's transit to the terminal would begin at the SNWW, where it would enter the pilot boarding station located approximately 20 miles offshore in the Gulf of Mexico. The LNG vessel then would travel 20 miles north to the entrance of the shipping channel. From here, the LNG vessel would transit approximately 6 nautical miles towards Sabine Lake, before turning left to enter the Port Arthur Ship Canal. Once in the Port Arthur Ship Canal, the LNG vessel would transit approximately 4.3 nautical miles to reach its final destination at PALNG's Facility. LNG vessels would return to sea by reversing their travel. Pilotage is compulsory for foreign vessels and U.S. vessels under registry in foreign trade when in U.S. waters. All deep draft ships currently entering the shared waterway would employ a U.S. pilot. The National Vessel Movement Center in the U.S. would require a 96-hour advance notice of arrival for deep draft vessels calling on U.S. ports. During transit, LNG vessels would be required to maintain voice contact with controllers and check in on designated frequencies at established way points.

NVIC 01-11 references the "Zones of Concern" for assisting in a risk assessment of the waterway. As LNG vessels proceed along the intended transit route, no hospitals, cultural centers, city centers, or military installations would be located within any of the three zones of concern. Hazard Zone 1 encompasses the Sabine Pass community and single residences as well as a USCG station, the Cheniere Sabine Pass LNG facility, and the Golden Pass LNG facility. Hazard Zone 2 encompasses the same locations as Hazard Zone 1. Hazard Zone 3 is a wider zone that encompasses the same locations as Hazard Zones 1 and 2 as well as the Sabine Pass High School.

The areas impacted by the three different hazard zones are illustrated for accidental and intentional events in figures 4.12-1 and 4.12-2, respectively.

Accidental Sandia Hazard Zone 1 (0-250m)
Accidental Sandia Hazard Zone 2 (250-750m)
Accidental Sandia Hazard Zone 3 (750-1700m)

Figure 4.12.1-1 Accidental Hazard Zones along LNG Carrier Route

Intentional Sandia Hazard Zone 1 (0-500m)
Intentional Sandia Hazard Zone 2 (500-1600m)
Intentional Sandia Hazard Zone 3 (1600-3500m)

Figure 4.12-2 Intentional Hazard Zones along LNG Carrier Route

4.12.3.5 Coast Guard Letter of Recommendation and Analysis

In a letter dated September 11, 2015, the USCG issued an LOR and LOR Analysis to FERC stating that the Sabine Neches River Ship Channel would be considered suitable for accommodating the type and frequency of LNG marine traffic associated with the Liquefaction Project. The LOR was based on full implementation of the strategies and risk management measures identified by the USCG to PALNG in its WSA.

Although PALNG has suggested mitigation measures for responsibly managing the maritime safety and security risks associated with LNG vessel 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 require that applicants annually review WSAs until a facility begins operation. The annual review and report to the USCG would identify any changes in conditions, such as changes to the port environment, the liquefaction facility, or the LNG vessel route, that would affect the suitability of the waterway. Accordingly, PALNG submitted its annual WSA update on September 19, 2017 and the USCG determined that the annual review met the requirements of 33 CFR 127.

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 liquefaction 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 ERP or the Cost Sharing Plan. As stated in the LOR, the USCG would assess each transit on a case by case basis to identify what, if any, safety and security measures would be necessary to safeguard the public health and welfare, critical infrastructure and key resources, the port, the marine environment, and the LNG vessel.

Under the Ports and Waterways Safety Act, the Magnuson Act, the MTSA, and the Security and Accountability For Every Port Act, the COTP has the authority to prohibit LNG transfer or LNG vessel 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 the Liquefaction Project is approved and if appropriate resources are not in place prior to LNG vessel 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.

4.12.4 LNG Facility Security Regulatory Requirements

The security requirements for the proposed Liquefaction Project are governed by 33 CFR 105, 33 CFR 127, and 49 CFR 193 Subpart J. Title 33 CFR 105, as authorized by the MTSA, requires all terminal owners and operators to submit a Facility Security Assessment (FSA) and a FSP to the USCG for review and approval before commencement of operations of the proposed project facilities. PALNG would also be required to control and restrict access, patrol and monitor the plant, detect unauthorized access, and respond to security threats or breaches under 33 CFR 105. Some of the responsibilities of the applicant include, but are not limited to:

- designating a Facility Security Officer with a general knowledge of current security threats and patterns, security assessment methodology, vessel and facility operations, conditions, security measures, emergency preparedness, response, and contingency plans, who would be responsible for implementing the FSA and FSP and performing an annual audit for the life of the Liquefaction Project;
- conducting a FSA to identify site vulnerabilities, possible security threats and consequences of an attack, and facility protective measures; developing a FSP based on the FSA, with procedures for: responding to transportation security incidents; notification and coordination with federal, state, and local authorities; prevention of unauthorized access; measures to prevent or deter entrance with dangerous substances or devices; training; and evacuation;
- defining the security organizational structure with facility personnel with knowledge or training in current security threats and patterns; recognition and detection of dangerous substances and devices, recognition of characteristics and behavioral patterns of persons who are likely to threaten security; techniques to circumvent security measures; emergency procedures and contingency plans; operation, testing, calibration, and maintenance of security equipment; and inspection, control, monitoring, and screening techniques;
- implementing scalable security measures to provide increasing levels of security at increasing maritime security levels for facility access control, restricted areas, cargo handling, LNG vessel stores and bunkers, and monitoring; ensuring that the Transportation Worker Identification Credential (TWIC) program is properly implemented;
- ensuring coordination of shore leave for LNG vessel personnel or crew change out as well as access through the facility for visitors to the LNG vessel;
- conducting drills and exercises to test the proficiency of security and facility personnel on a quarterly and annual basis; and
- reporting all breaches of security and transportation security incidents to the National Response Center.

Title 33 CFR 127 has requirements for access controls, lighting, security systems, security personnel, protective enclosures, communications, and emergency power. In addition, an LNG facility regulated under 33 CFR 105 and 33 CFR 127 would be subject to the TWIC Reader Requirements Rule issued by the USCG on August 23, 2016. This rule requires owners and operators of certain vessels and facilities regulated by the USCG to conduct electronic inspections of TWICs (e.g., readers with biometric fingerprint authentication) as an access control measure. The final rule would also include recordkeeping requirements and security plan amendments that would incorporate these TWIC requirements. The implementation of the rule was first proposed to be in effect by August 23, 2018. In a subsequent notice issued on June 22, 2018, USCG indicated delaying the effective date for certain facilities by 3 years, until August 23, 2021. On August 2, 2018, the President of the United States signed into law the TWIC Accountability Act of 2018 (H.R. 5729). This prohibits the USCG from implementing the rule requiring electronic inspections of TWICs until after the Department of Homeland Security (DHS) has submitted a report to the Congress. Although the implementation of this rule has been postponed, the company may need to consider the rule when developing access control and security plan provisions for the facility.

Title 49 CFR 193 Subpart J also specifies security requirements for the onshore components of LNG terminals, including requirements for conducting security inspections and patrols, including a liaison with local law enforcement officials, design and construction of protective enclosures, lighting, monitoring, alternative power sources, and warning signs.

If the Liquefaction Project is constructed and operated, compliance with the security requirements of 33 CFR 105, 33 CFR 127, and 49 CFR 193 Subpart J would be subject to the respective USCG and DOT inspection and enforcement programs.

PALNG provided preliminary information on these security features and indicated additional details would be completed in the final design. In accordance with the February 2004 Interagency Agreement among FERC, DOT, and USCG, FERC staff would collaborate with USCG and DOT on the Liquefaction Project's security features.

4.12.5 FERC Engineering and Technical Review of the Preliminary Engineering Designs

4.12.5.1 LNG Facility Historical Record

The operating history of the U.S. LNG industry has been free of safety-related incidents resulting in adverse effects on the public or the environment with the exception of the October 20, 1944, failure at an LNG plant in Cleveland, Ohio. The 1944 incident in Cleveland led to a fire that killed 128 people and injured 200 to 400 more people.[47] The failure of the LNG storage tank was due to the use of materials not suited for cryogenic temperatures. LNG migrated through streets and into underground sewers due to inadequate spill impoundments at the site. Current regulatory requirements ensure that proper materials suited for cryogenic temperatures are used in the design and that spill impoundments are designed and constructed properly to contain a spill at the site. To ensure that this potential hazard would be addressed for proposed LNG facilities, we evaluate the preliminary and final specifications for suitable materials of construction and for the design of spill containment systems that would properly contain a spill at the site.

Another operational accident occurred in 1979 at the Cove Point LNG plant in Lusby, Maryland. A pump electrical seal located on a submerged electrical motor LNG pump leaked causing flammable gas vapors to enter an electrical conduit and settle in a confined space. When a worker switched off a circuit breaker, the flammable gas ignited, causing severe damage to the building and a worker fatality. With the

47 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.

participation of the FERC, lessons learned from the 1979 Cove Point accident led to changes in the national fire codes to better ensure that the situation would not occur again. To ensure that this potential hazard would be addressed for proposed facilities that have electrical seal interfaces, we evaluated the preliminary designs and recommend in section 4.12.6 that PALNG provide, for review and approval, the final design details of the electrical seal design at the interface between flammable fluids and the electrical conduit or wiring system, details of the electrical seal leak detection system, and the details of a downstream physical break (i.e., air gap) in the electrical conduit to prevent the migration of flammable vapors.

On January 19, 2004, a blast occurred at Sonatrach's Skikda, Algeria, LNG liquefaction plant that killed 27 and injured 56 workers. No members of the public were injured. The investigation suggested that a cold hydrocarbon leak occurred at Liquefaction Train 40 and was introduced into a high-pressure steam boiler by the combustion air fan. An explosion developed inside the boiler firebox, which subsequently triggered a larger explosion of the hydrocarbon vapors in the immediate vicinity. The resulting fire damaged the adjacent liquefaction process and liquid petroleum gas separation equipment of Train 40, and spread to Trains 20 and 30. Although Trains 10, 20, and 30 had been modernized in 1998 and 1999, Train 40 had been operating with its original equipment since start-up in 1981. To ensure that this potential hazard would be addressed for proposed facilities, we evaluate the preliminary design for mitigation of flammable vapor dispersion and ignition in buildings and combustion equipment to ensure they are adequately covered by hazard detection equipment that could isolate and deactivate any combustion equipment whose continued operation could add to or sustain an emergency. We also recommend in section 4.12.6 that PALNG provide, for review and approval, the final design drawings of hazard detection equipment, including the location and elevation of all detection equipment, instrument tag numbers, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment.

On March 31, 2014, a detonation occurred within a gas heater at Northwest Pipeline Corporation's LNG peak-shaving plant in Plymouth, Washington.[48] 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 the pre-treatment facilities and penetrated the outer shell of one of the single containment LNG storage tanks. All damaged facilities were ultimately taken out of service for repair. The accident investigation showed that an inadequate purge after maintenance activities resulted in a fuel-air mixture remaining in the system. The fuel-air mixture auto-ignited during startup after it passed through the gas heater at full operating pressure and temperature. To ensure that this potential hazard would be addressed for proposed facilities, FERC staff recommends in section 4.12.6 that PALNG provide a plan for purging, for review and approval, which addresses the requirements of the American Gas Association *Purging Principles and Practice* and to provide justification if not using an inert or non-flammable gas for purging. In evaluating such plans, we would assess whether the purging could be done safely based on review of other plans and lessons learned from this and other past incidents. If a plan proposes the use of flammable mediums for cleaning, dry-out or other activities, we would evaluate the plans against other recommended and generally accepted good engineering practices, such as NFPA 56, *Standard for Fire and Explosion Prevention during Cleaning and Purging of Flammable Gas Piping Systems*.

We also recommend in section 4.12.6 that PALNG provide for review and approval operating and maintenance plans, including safety procedures, prior to commissioning. In evaluating such plans, we

48 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.

would assess whether the plans cover all standard operations, including purging activities associated with startup and shutdown. Also, in order to prevent other sources of projectiles from affecting occupied buildings and storage tanks, we recommend in section 4.12.6 that PALNG incorporate mitigation measures into their final design with supportive information, for review and approval, that demonstrates it would mitigate the risk of a pressure vessel burst or boiling liquid expanding vapor explosion (BLEVE) from occurring.

FERC requires an applicant to provide safety, reliability, and engineering design information as part of its application, including hazard identification studies and front-end-engineering-design (FEED) information for a proposed project. FERC staff evaluates this information with a focus on potential hazards from within and nearby the site, including external events, which may have the potential to cause damage or failure to the Liquefaction Project facilities, and the engineering design and safety and reliability concepts of the various protection layers to mitigate the risks of potential hazards.

The primary concerns are those events that could lead to a hazardous release of sufficient magnitude to create an offsite hazard or interruption of service. In general, FERC staff considers an acceptable design to include various layers of protection or safeguards to reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public. These layers of protection are generally independent of one another so that any one layer would perform its function regardless of the initiating event or failure of any other protection layer. Such design features and safeguards typically include:

- a facility design that prevents hazardous events, including the use of inherently safer designs; suitable materials of construction; adequate design margins from operating limits for process piping, process vessels, and storage tanks; adequate design for wind, flood, seismic, and other outside hazards;
- control systems, including monitoring systems and process alarms, remotely-operated control and isolation valves, and operating procedures to ensure that the facility stays within the established operating and design limits;
- safety instrumented prevention systems, such as safety control valves and ESD 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, hazard 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. The review of the engineering design for these layers of protection is initiated in the application process and carried through to the next phase of the proposed project in final design if authorization is granted by the Commission.

The reliability of these layers of protection is informed by occurrence and likelihood of root causes and the potential severity of consequences based on past incidents and validated hazard modeling. As a result of the continuing engineering review, FERC staff recommends mitigation measures and continuous oversight to the Commission for consideration to include as conditions in the Order. If a facility is authorized and recommendations are adopted as conditions to the Order, FERC staff would continue its engineering review through final design, construction, commissioning, and operation.

Process Design

In order to liquefy natural gas, most liquefaction technologies require that the feed gas stream be pre-treated to remove components that could freeze out and clog the liquefaction equipment or would otherwise be incompatible with the liquefaction process or equipment, including mercury, H_2S, CO_2, water, and heavy hydrocarbons. For example, mercury is typically limited to concentrations less than 0.01 micrograms per normal cubic meter because it can cause embrittlement and corrosion resulting in catastrophic failure of equipment.

The inlet gas would be conditioned to remove solids and water droplets and for pressure regulation prior to entering feed gas pretreatment processes. Once the inlet gas is conditioned, the feed gas would enter the mercury removal system consisting of mercury adsorber(s) to reduce the mercury concentration in the feed gas. Once the mercury is removed, the feed gas would enter an acid gas removal unit consisting of a CO_2 absorber and amine regeneration unit to reduce the H_2S and CO_2 present in the feed gas. The H_2S would further be reduced using a H_2S scavenger bed. The gas leaving the scavenger unit would be sent to a thermal oxidizer, where any remaining traces of H_2S and hydrocarbons would be incinerated. Water would be removed from the feed gas by a dehydration unit using molecular sieve beds to prevent hydrate formation in downstream equipment.

A Heavy Hydrocarbon Removal Unit would be used to extract the heavy hydrocarbons from the feed gas. The resulting heavy hydrocarbon stream would be stabilized and sent to the condensate storage tank and removed by truck.

After the heavy hydrocarbons and other impurities are removed, the feed gas would be pre-cooled by thermal exchange with propane and further cooled using a mixed refrigerant stream to condense the natural gas into a liquid at -260°F. The Liquefaction Project expects to utilize a liquefaction process designed and optimized by Air Products and Chemicals Inc. The mixed refrigerant process stream is comprised of a mixture of nitrogen, CH_4, ethane, and propane designed to achieve the liquefaction temperature. Refrigerants required for the liquefaction process would be unloaded from trucks and stored onsite for initial filling and use, as needed, for make-up. Propane and ethane refrigerant make-up storage vessels would be provided for both of the liquefaction trains. The truck loading/unloading facility would serve to unload make-up refrigerants brought to the site and would also load condensate product stored onsite.

After cooling the natural gas into its liquid form, this LNG would be stored in three full-containment LNG storage tanks where it would be stored and sent out through in-tank pumps to a marine transfer line and marine transfer arms connected to LNG ships. The LNG transferred to the ships would displace vapors from the ships, which would be sent back to the LNG storage containers. Once loaded, the LNG ship would be disconnected and leave for export.[49]

49 PALNG has not identified specific LNG export destinations for the proposed Project. LNG from the Terminal may be exported to any importing terminal throughout the world for which PALNG has authorization to export from DOE.

In addition, the Liquefaction Project would include many utilities and associated auxiliary equipment. The major auxiliary systems required for the operation of the liquefaction facility include BOG, fuel gas, hot oil, flares, instrument and utility air supply, water supply, demineralized water, nitrogen, and backup power. Furthermore, hot oil would be used to provide the heat demand to the plant users, molecular sieve regeneration, amine regeneration, and deethanizer and debutanizer reboilers. There are two types of proposed flare systems, including ground flares and an elevated marine flare stack. The ground flares would be designed to handle the vent gases from the process areas associated with the liquefaction operations, while the elevated marine flare stack would be designed to control vent gases associated with the LNG storage tanks and LNG ship vapor return from the ship during unloading and cooldown operation. Diesel would be stored in dedicated tanks for their respective equipment, which includes essential firewater pumps and three diesel generators. Electric power would be generated on-site but would be located outside the storm levee and would require using eight of nine gas turbine driven generators. Liquid nitrogen vaporizers would be used to supply gaseous nitrogen for various uses in the plant including pre-commissioning and start-up. In addition, aqueous ammonia would be used in the selective catalytic removal process to reduce the NO_x emissions from the self-generation power turbines proposed as part of the Liquefaction Project.

The failure of process equipment could pose potential harm if not properly safeguarded through the use of appropriate engineering controls and operation. PALNG 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. PALNG would develop facility operation procedures after completion of the final design; this timing is fully consistent with accepted industry practice. PALNG would design their control systems and human machine interfaces to meet the International Society for Automation (ISA) Standards 5.3, 5.5, 60.1, 60.3, 60.4, and 60.6, and other standards and recommended practices. FERC staff recommends in section 4.12.6 that PALNG provide more information, for review and approval, on the operating and maintenance procedures, including safety procedures, hot work procedures and permits, abnormal operating conditions procedures, and personnel training prior to commissioning. We would evaluate these procedures to ensure that an operator can operate and maintain all systems safely, based on benchmarking against other operating and maintenance plans and comparing against recommended and generally accepted good engineering practices, such as American Institute of Chemical Engineers, *Guidelines for Writing Effective Operating and Maintenance Procedures*. In addition, FERC staff recommends in section 4.12.6 that PALNG tag and label instrumentation and valves, piping, and equipment and provide car-seals/locks to address human factor considerations and improve facility safety and prevent incidents. We also recommend in section 4.12.6 that PALNG develop and implement an alarm management program, for review and approval to ensure the effectiveness of the alarms. FERC staff would evaluate the alarm management program against recommended and generally accepted good engineering practices, such as ISA Standard 18.2.

In the event of a process deviation, ESD valves and instrumentation would be installed to monitor, alarm, shutdown, and isolate equipment and piping during process upsets or emergency conditions. The Liquefaction Project would have an ESD system to initiate closure of valves and shutdown of the process during emergency situations. Safety-instrumented systems would comply with ISA Standard 84.01 and other recommended and generally accepted good engineering practices. However, it is unclear as to whether the Liquefaction Project would have the ability to shut down the entire facility via a single plant-wide ESD command. A single plant-wide shutdown is common among jurisdictional LNG facilities at FERC, including sister facilities of PALNG owned by Sempra. To address reliability concerns of false trips, a plant wide shutdown button is often safeguarded from inadvertent actuation by necessitating multiple actions by the operator and have redundancies built in the circuitry with supervisory alarms that would not trip the entire plant on a failure. Given the uncertainty as to whether PALNG would include a single plant wide shutdown button or not, FERC staff recommends in section 4.12.6 that PALNG provide details of the ESD system, for review and approval, including whether a plant-wide ESD button with proper sequencing and reliability is present or whether another system exists that is demonstrated through a human reliability analysis to provide a means to quickly and reliably shutdown the entire plant. We also recommend in section 4.12.6 that PALNG file information, for review and approval, on the final design, installation, and commissioning of instrumentation and ESD equipment to ensure appropriate cause-and-effect alarm or shutdown logic and enhanced representation of the ESD system in the plant control room and throughout the plant.

In developing the FEED, PALNG conducted a hazard identification review to identify potential hazards (both safety and environmental) associated with the proposed facility location, site layout, process design, marine operations, simultaneous operations, and construction. A more detailed hazard and operability review (HAZOP) analysis would be performed by PALNG during the final design to identify the major process hazards that may occur during the operation of the facilities. The HAZOP study would be intended to address hazards of the process, engineering and administrative controls and would provide a qualitative evaluation of a range of possible safety, health, and environmental consequences that may result from the process hazard, and identify whether there are adequate safeguards (e.g., engineering and administrative controls) to prevent or mitigate the risk from such events. Where insufficient engineering or administrative controls were identified, recommendations to prevent or minimize these hazards would be generated from the results of the HAZOP review. FERC staff recommends in section 4.12.6 that PALNG file the HAZOP study on the completed final design for review and approval. We would evaluate the HAZOP to ensure all systems and process deviations are addressed appropriately based on likelihood, severity and risk values with commensurate layers of protection in accordance with recommended and generally accepted good engineering practices, such as American Institute of Chemical Engineers, *Guidelines for Hazard Evaluation Procedures*. We also recommend in section 4.12.6 that PALNG file the resolutions of the recommendations generated by the HAZOP review for evaluation and approval by FERC staff. Once the design has been subjected to a HAZOP review, the design development team would track, manage, and keep records of changes in the facility design, construction, operations, documentation, and personnel. PALNG would evaluate these changes to ensure that the safety, health, and environmental risks arising from these changes are addressed and controlled based on its management of change procedures. If FERC staff's recommendations are adopted into the Commission Order, resolutions of the recommendations generated by the HAZOP review would be monitored by FERC staff. We also recommend in section 4.12.6 that PALNG file all changes to their FEED for review and approval by FERC staff. However, major modifications could require an amendment or new proceeding.

If a project is authorized and constructed, PALNG would install equipment in accordance with its design. FERC staff recommends in section 4.12.6 that that project facilities be subject to construction inspections and that PALNG provide, for review and approval, commissioning plans, procedures and commissioning demonstration tests that would verify the performance of equipment. In addition, FERC staff recommends in section 4.12.6 that PALNG provide semi-annual reports that include abnormal operating conditions and planned facility modifications. Furthermore, FERC staff recommends in section 4.12.6 that the project facilities be subject to regular inspections throughout the life of the facilities to verify that equipment is being properly maintained and to verify basis of design conditions, such as feed gas and sendout conditions, do not exceed the original basis of design.

Mechanical Design

PALNG provided codes and standards for the design, fabrication, construction and installation of piping and equipment and specifications for the facility. The design specifies materials of construction and ratings suitable for the pressure and temperature conditions of the process design. Piping would be designed, fabricated, assembled, erected, inspected, examined, and tested in accordance with the ASME Standards B31.3, 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 193 Subparts C, D, and E, and by incorporation NFPA 59A (2001). Portions of the facility regulated under 33 CFR 127 for the marine transfer system, including piping, hoses, and loading arms should also be tested in accordance with 33 CFR 127.407. In addition, the operator should verify the set pressure of the pressure relief valves meet the requirements in 33 CFR 127.407.

Low-pressure storage tanks such as the LNG, amine, and condensate storage tanks, would be designed, inspected, and maintained in accordance with the API Standards 620, 625, 650, and 653. Concrete LNG storage tanks would also be designed in accordance with ACI 376. All LNG storage tanks would also include BOG compression to prevent the release of boil-off to the atmosphere in accordance with NFPA 59A (2001) for an inherently safer design. Heat exchangers would be designed to ASME BPVC section VIII standards; API Standards 660 and 661; and the Tubular Exchanger Manufacturers Association standards. Rotating equipment would be designed to standards and recommended practices, such as API Standards 610, 613, 614, 616, 617, 670, 671, 675, 676, and 682; and ASME Standards B73.1 and B73.2. Valves would be designed to standards and recommended practices such as API Standards 600, 602, 607, and 609; ASME Standards B16.5, B16.10, B16.20, B16.25, and B16.34; and ISA Standard 75.08.01.

Pressure and vacuum safety relief valves and flares would be installed to protect the storage containers, pressure vessels, process equipment, and piping in the event of an unexpected vapor release or uncontrolled pressure excursion. The safety relief valves would be designed to handle process upsets and thermal expansion, per NFPA 59A (2001), ASME Standard B31.3, and ASME BPVC section VIII; and would be designed in accordance with API Standards 520, 521, 526, 527, and 2000; and other recommended and generally accepted good engineering practices. In addition, FERC staff recommends in section 4.12.6 that PALNG provide final design information on pressure and vacuum relief devices, for review and approval, to ensure that the final sizing, design, and installation of these components are adequate and in accordance with the standards reference and other recommended and generally accepted good engineering practices.

If the project is authorized and constructed, PALNG would install equipment in accordance with its design and FERC staff would verify equipment nameplates to ensure equipment is being installed based on the approved design. In addition, FERC staff would conduct construction inspections including reviewing quality assurance and quality control plans to ensure construction work is being performed according to proposed project specifications, procedures, codes and standards. FERC staff recommends in section 4.12.6 that PALNG provide semi-annual reports that include equipment malfunctions and abnormal maintenance activities. In addition, FERC staff recommends in section 4.12.6 that the project facilities be subject to inspections throughout the life of the facility to verify that the plant equipment is being properly maintained.

Hazard Mitigation Design

If operational control of the facilities were lost and operational controls and ESD systems failed to maintain the Liquefaction Project within the design limits of the piping, containers, and safety relief valves, a release could potentially occur. FERC regulations under 18 CFR 380.12 (o) (1) through (4) require applicants to provide information on spill containment, spacing and plant layout, hazard detection, hazard control, and firewater systems. In addition, 18 CFR 380.12 (o) (7) require applicants to provide engineering studies on the design approach and 18 CFR 380.12 (o) (14) requires applicants to demonstrate how they comply with 49 CFR 193 and NFPA 59A. As required by 49 CFR 193 Subpart I and by incorporation section 9.1.2 of NFPA 59A (2001), fire protection must be provided for all DOT-regulated LNG plant facilities based on an evaluation of sound fire protection engineering principles, analysis of local conditions, hazards within the facility, and exposure to or from other property. NFPA 59A (2001) also requires a fire protection evaluation to determine the type, quantity, and location of hazard detection and hazard control, passive fire protection, ESD and depressurizing systems, and emergency response equipment, training, and qualifications. All facilities, once constructed, must comply with the requirements of 49 CFR 193 Subpart I and would be subject to the DOT's inspection and enforcement programs. However, NFPA 59A (2001) also indicates the wide range in size, design, and location of LNG facilities precludes the inclusion of detailed fire protection provisions that apply to all facilities comprehensively and includes subjective performance-based language on where ESD systems and hazard control are required and does not provide any additional guidance on placement or selection of hazard detection equipment and provides minimal requirements on firewater. Therefore, FERC staff evaluated the proposed spill containment and spacing, hazard detection, ESD and depressurization systems, hazard control, firewater coverage, structural protection, and onsite and offsite emergency response to ensure they would provide adequate protection of the LNG facilities as described more fully below.

PALNG performed a preliminary fire protection evaluation to ensure that adequate mitigation would be in place, including spill containment and spacing, hazard detection, ESD and depressurization systems, hazard control, firewater coverage, structural protection, and onsite and offsite emergency response. FERC staff recommends in section 4.12.6 that PALNG provide a final fire protection evaluation for review and approval, and to provide more information on the final design, installation, and commissioning of spill containment, hazard detection, hazard control, firewater systems, structural fire protection, and onsite and offsite emergency response procedures for review and approval.

Spill Containment

In the event of a release, sloped areas at the base of storage and process facilities would direct a spill away from equipment and into the impoundment system. This arrangement would minimize the dispersion of flammable vapors into confined, occupied, or public areas and minimize the potential for heat from a fire to impact adjacent equipment, occupied buildings, or public areas if ignition were to occur.

Title 49 CFR 193.2181 under Subpart C specifies that each impounding system serving an LNG storage tank must have a minimum volumetric liquid capacity of 110 percent of the LNG tank's maximum design liquid capacity for an impoundment serving a single tank, unless surge is accounted for in the impoundment design. All facilities, once constructed, must comply with the requirements of 49 CFR 193 Subpart C and would be subject to the DOT's inspection and enforcement programs. For full containment LNG tanks, we also consider it prudent to provide a barrier to prevent liquid from flowing to an unintended area (i.e., outside the plant property). The purpose of the barrier is to prevent liquid from flowing off the plant property and does not define containment or an impounding area for thermal radiation or flammable vapor exclusion zone calculations or other code requirements already met by sumps and impoundments throughout the site. PALNG proposes three full-containment LNG storage tanks for which the outer tank wall would serve as the impoundment system. FERC staff verified that the LNG storage tank's outer concrete wall would have a liquid capacity of at least 110 percent of the inner LNG tank's maximum liquid capacity. In addition, PALNG would also install a berm (i.e., 20-foot storm surge barrier) around the LNG storage tank area to prevent liquid in the storage tank area from flowing off-site in the event of an outer tank failure.

PALNG proposes to install a LNG Spill Impoundment Basin #1 located between the LNG storage tanks (T-2002 and T-2001) that would collect a spill from the process area of Liquefaction Trains 1 and 2, the main pipe rack, and a portion of the jetty loading line located at the northwest corner of the south berth. PALNG proposes to install another LNG Impoundment Basin #2 located at the north marine berth area that would collect a potential spill from the remaining portion of the north jetty LNG loading line. PALNG would also provide a Refrigerant Impoundment Basin designed to contain a spill from the refrigerant storage tanks with a capacity to exceed the volume of largest refrigerant storage tank. The Liquefaction Project would also have a Condensate Storage Tank Impoundment designed to contain a spill from the condensate storage tanks with a capacity of 110 percent of one of the condensate tank's volumetric capacity. PALNG would also include an Amine Spill Impoundment that would be sized for 100 percent of one amine tank's volumetric capacity. PALNG would also include a Hot Oil Spill Impoundment that would be sized for 130 percent of the hot oil tank's volumetric capacity. Lastly, the Liquefaction Project proposes a Diesel Storage Tank Impoundment that would collect a spill from the diesel tank area.

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. All facilities, once constructed, must comply with the requirements of 49 CFR 193 Subpart C and would be subject to the DOT's inspection and enforcement programs. As part of our preliminary engineering review, we evaluate impoundment systems to ensure they would 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. In addition, FERC staff recommends in section 4.12.6 that PALNG provide additional information on the final design of the impoundment systems for review and approval.

PALNG indicated that all piping, hoses, and equipment that could produce a hazardous liquid spill would be provided with spill collection and/or spill conveyance systems. In the Application, PALNG indicated that the stormwater pumps would be automatically operated by level control and interlocked using low temperature detectors to prevent pumps from operating if LNG is present. PALNG also stated that smaller sump pumps would be used to routinely discharge small amounts of rainwater that collects in the sump in accordance with all applicable permits. PALNG would need to verify that the sump pumps meet the automatic shutdown controls and water removal requirements specified in 49 CFR 193 Subpart C. If the facilities are approved and constructed, final compliance with the requirements of 49 CFR 193 Subpart C would be subject to the DOT's inspection and enforcement programs.

If a project is authorized and constructed, PALNG would install spill impoundments in accordance with its design and FERC staff would verify during construction inspections that the spill containment system including dimensions, and slopes of curbing and trenches, and volumetric capacity matches final design information. In addition, FERC staff recommends in section 4.12.6 that project facilities be subject to regular inspections throughout the life of the facility to verify that impoundments are being properly maintained.

Spacing and Plant Layout

The spacing of vessels and equipment between each other, from ignition sources, and to the property line would need to meet the requirements of 49 CFR 193 Subparts C, D, and E, which incorporate NFPA 59A (2001). NFPA 59A (2001) includes requirements for spacing and plant layout further references NFPA Standards 30, NFPA 58, and NFPA 59 for additional spacing and plant layout requirements. If the facilities are approved and constructed, final compliance with the requirements of 49 CFR 193 would be subject to the DOT's inspection and enforcement programs.

In addition, FERC staff evaluated the spacing to determine if there could be cascading damage and identify what fire protection measures may be necessary to reduce the risk of cascading damage. A pool fire at the proposed LNG Impoundment Basin #1 located between LNG storage tanks (T-2002 and T-2001) would result in high radiant heats at both adjacent LNG storage tanks, elevated piperacks and troughs. In addition, we note that radiant heats greater than 3,000 Btu/ft^2-hr level from an impoundment fire could impact adjacent process equipment, refrigerant storage vessels, process vessels, and pipe racks. FERC staff also note that thermal radiation levels from a T-2003 tank roof top fire could potentially impact the adjacent buildings (i.e., hazardous chemical storage building and maintenance storage yard). To mitigate against a

LNG roof top fire, a condensate tank containment fire, and jet fires within the plant, PALNG proposes thermal radiation mitigation measures to prevent cascading events in the design, including fire-safe ESD valves with fire resistant instrument and power cabling, depressurizing valves on large volume lines, fire and gas detectors, fire proofing of structural steel columns supporting critical equipment, deluge systems, low expansion foam systems, and fire monitors and hydrants. However, details of these systems would be done in final design. FERC staff recommends in section 4.12.6 that PALNG provide the final design of these thermal mitigation measures, for review and approval, to demonstrate cascading events would be mitigated. In addition, FERC staff recommends in section 4.12.6 that PALNG provide an analysis, for review and approval, demonstrating the adjacent tank can withstand the radiant heat from a tank roof fire or adjacent tank roof fire.

To address impacts to plant buildings from fires or explosions, FERC staff recommends in section 4.12.6 that PALNG conduct a facility siting study, for review and approval, to assess the external fire and explosion risks for all buildings routinely occupied by plant personnel. In addition, *Guidelines for Evaluating Process Plant Buildings for External Explosions and Fires* (Center for Chemical Process Safety of the American Institute of Chemical Engineers, 1996) and API 752 provide guidance on identifying and evaluating explosion and fire impacts to plant buildings and occupants resulting from events external to the buildings. Furthermore, to minimize risk for flammable or toxic vapor ingress into buildings, FERC staff recommends in section 4.12.6 that PALNG conduct a technical review of facility, for review and approval, to identify all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and verify that these areas would be adequately covered by hazard detection devices that would isolate or shut down any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency. FERC staff also recommend in section 4.12.6 that project facilities be subject to periodic inspections during construction to verify flammable/toxic gas detection equipment is installed in heating, ventilation and air condition intakes of buildings at appropriate locations. In addition, FERC staff recommends in section 4.12.6 that project facilities be subject to regular inspections throughout the life of the facilities to continue to verify that flammable/toxic gas detection equipment installed in building air intakes function as designed and are being maintained and calibrated.

If the project is authorized, PALNG would finalize the plot plan, and FERC staff recommends in section 4.12.6 that PALNG provide any changes for review and approval to ensure capacities and setbacks are maintained. If the facilities are constructed, PALNG would install equipment in accordance with the spacing indicated on the plot plans, and FERC staff recommends in section 4.12.6 that project facilities be subject to periodic inspections during construction to verify equipment is installed in appropriate locations and the spacing is met in the field. In addition, FERC staff recommends in section 4.12.6 that project facilities be subject to regular inspections throughout the life of the facilities to continue to verify that equipment setbacks from other equipment and ignition sources are being maintained during operations.

Ignition Controls

PALNG's plant areas would be designated with an appropriate hazardous electrical classification and process seals commensurate with the risk of the hazardous fluids being handled in accordance with NFPA 59A (2001), 70, 497, and API RP 500. All facilities, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to the DOT's inspection and enforcement programs, which require compliance, by incorporation by reference, with NFPA 59A (2001) and NFPA 70. Depending on the risk level, these areas would either be classified as Class 1 Division 1, Class 1 Division 2, or non-classified. Electrical equipment located in these areas would be designed such that in the event a flammable vapor is present, the equipment would have a minimal risk of igniting the vapor. FERC staff evaluated the PALNG electrical area classification drawings to verify that companies would meet these electrical area classification requirements in NFPA 59A, 70, 497, and API RP 500. If the project is authorized, PALNG would finalize the electrical area classification drawings and would describes changes made from the FEED design. FERC staff recommends in section 4.12.6 that PALNG file the final design of the electrical area classification drawings for review and approval. If facilities are constructed, PALNG would install appropriately classed electrical equipment, and FERC staff recommends in section 4.12.6 that project facilities be subject to periodic inspections during construction for FERC staff to spot check electrical equipment and verify equipment is installed per classification and are properly bonded or grounded in accordance with NFPA 70. In addition, FERC staff recommends in section 4.12.6 that project facilities be subject to regular inspections throughout the life of the facility to ensure electrical equipment is maintained (e.g., bolts on explosion proof equipment properly installed and maintained, panels provided with purge, etc.), and electrical equipment are appropriately de-energized and locked out and tagged out when being serviced.

In addition, submerged electrical motor pumps and instrumentation would be equipped with electrical process seals, and instrumentation in accordance with NFPA 59A (2001) and NFPA 70. FERC staff recommends in section 4.12.6 that PALNG provide, for review and approval, final design drawings showing process seals installed at the interface between a flammable fluid system and an electrical conduit or wiring system that meet the requirements of NFPA 59A (2001) and NFPA 70. In addition, FERC staff recommends in section 4.12.6 that PALNG file, for review and approval, details of an air gap or vent equipped with a leak detection device that should continuously monitor for the presence of a flammable fluid, alarm the hazardous condition, and shut down the appropriate systems. In addition, FERC staff recommends in section 4.12.6 that project facilities be subject to regular inspections throughout the life of the facility to ensure electrical process seals for submerged electrical motor pumps continue to conform to NFPA 59A and NFPA 70 and that air gaps are being properly maintained.

Hazard Detection, Emergency Shutdown, and Depressurization Systems

PALNG 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 ESD, depressurization, or initiate appropriate procedures, and would meet NFPA Standard 72, ISA Standard 12.13, and other recommended and generally accepted good engineering practices. However, we note that PALNG did not make reference to ISA 12.13 publications, which provide performance requirements for flammable/combustible gas detectors. Additionally, PALNG did not include a specification for hazard detection in Appendix T of the Application. Therefore, FERC staff recommends in section 4.12.6 that PALNG provide specifications, for review and approval, of the final design of fire safety specifications, including hazard detection, hazard control, and firewater systems.

FERC staff also evaluated the adequacy of the hazard detection equipment type, location, and layout to ensure adequate coverage to detect cryogenic spills, flammable and toxic vapors, and fires near potential release sources (i.e., pumps, compressors, sumps, trenches, flanges, and instrument and valve connections). FERC staff also reviewed the fire and gas cause and effect matrices to evaluate the detectors that would initiate an alarm, shutdown, depressurization, or other action based on the FEED. FERC staff recommends in section 4.12.6 that PALNG provide additional information, for review and approval, on the final design of all hazard detection systems (e.g., manufacturer and model, elevations, etc.) and hazard detection layout drawings. If the project is authorized and constructed, PALNG would install hazard detectors according to its specifications, and FERC staff recommends in section 4.12.6 that project facilities be subject to periodic inspections during construction to verify hazard detectors and ESD pushbuttons are appropriately installed per approved design and functional based on cause and effect matrixes prior to introduction of hazardous fluids. In addition, FERC staff recommends in section 4.12.6 that project facilities be subject to regular inspections throughout the life of the facility to verify hazard detector coverage and functionality is being maintained and are not being bypassed without appropriate precautions.

Hazard Control

If ignition of flammable vapors occurred, hazard control devices would be installed to extinguish or control incipient fires and releases, and would meet NFPA 59A (2001); NFPA 10, 12, 15, 17, and 2001; API 2218, and 2510A; as well as other recommended and generally accepted good engineering practices. FERC staff evaluated the adequacy of the number and availability of handheld, wheeled, and fixed fire extinguishing devices throughout the site based on the FEED. FERC staff also generally evaluated whether the spacing of the fire extinguishers meet NFPA 10. In addition, FERC staff generally evaluate whether clean agent systems would be installed in all electrical switchgear, and instrumentation buildings systems in accordance with NFPA 2001 and CO_2 systems in gas turbine enclosures in accordance with NFPA 12. In addition, FERC staff recommends in section 4.12.6 that PALNG file additional information on the final design of these systems, for review and approval, where details are yet to be determined (e.g., manufacturer and model, elevations, flowrate, capacities, etc.) and where the final design could change as a result of these details or other changes in the final design of the Liquefaction Project. If the project is authorized and constructed, PALNG would install hazard control equipment, and FERC staff recommends in section 4.12.6 that project facilities be subject to periodic inspections during construction to verify hazard control equipment is installed in the field and functional prior to introduction of hazardous fluids. In addition, FERC staff recommends in section 4.12.6 that project facilities be subject to regular inspections throughout the life of the facility to verify in the field that hazard control coverage and functionality is being properly maintained and inspected.

Passive Cryogenic and Fire Protection

If a fire could not be separated, controlled, or extinguished to limit fire exposures or cryogenic releases onto facility components to insignificant levels, passive fire protection (e.g., fireproofing structural steel) would be provided to prevent failure of structural supports of equipment and pipe racks. The structural fire protection would comply with NFPA 59A (2001) and other recommended and generally accepted good engineering practices. FERC staff evaluated whether passive cryogenic and fire protection is applied to pressure vessels and structural supports to facilities that could be exposed to cryogenic liquids or to radiant heats of 4,000 Btu/ft^2-hr or greater from fires with durations that could result in failures[50] and that they are specified in accordance with recommended and generally accepted good engineering practices with a fire protection rating commensurate to the radiant heat and duration. In addition, FERC staff recommends in section 4.12.6 that PALNG provide additional information on the final design of these systems, for review and approval, 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 Liquefaction Project. It was unclear as to whether PALNG would incorporate cryogenic protection or use materials of construction that would protect equipment and structural supports that could potentially be exposed to cryogenic releases or fires. Therefore, FERC staff recommends in section 4.12.6 that PALNG file drawings and specifications, for review and approval, for the structural passive protection systems to protect equipment and supports from cryogenic releases and fires.

If the project is authorized and constructed, PALNG would install structural cryogenic and fire protection according to its design, and FERC staff recommends in section 4.12.6 that project facilities be subject to periodic inspections during construction to verify structural cryogenic and fire protection is properly installed in the field as designed prior to introduction of hazardous fluids. In addition, FERC staff

50 Pool fires from impoundments are generally mitigated through use of ESDs, depressurization systems, structural fire protection, and firewater, while jet fires are primarily mitigated through the use of ESDs, depressurization systems, and firewater without structural fire protection.

recommends in section 4.12.6 that project facilities be subject to regular inspections throughout the life of the facility to continue to verify that passive protection is being properly maintained.

Firewater Systems

PALNG would also provide firewater systems, including remotely operated firewater monitors, sprinkler systems, fixed water spray systems, and firewater hydrants and hoses for use during an emergency to cool the surface of storage vessels, piping, and equipment exposed to heat from a fire. These firewater systems would be designed to meet NFPA 59A (2001), 13, 15, 20, 22, and 24 requirements. FERC staff evaluates the adequacy of the general firewater or foam system coverage and verifies the appropriateness of the associated firewater demands of those systems and worst-case fire scenarios to size the firewater and foam pumps. PALNG provided firewater coverage drawings for the firewater monitors, but did not provide coverage for the fire hydrants. Furthermore, the firewater coverage circles were not centered on the elevated monitors by the marine berths and it was not explained why the drawings had concentric circles. Where coverage circles intersect pipe racks, large vessels or process equipment, the firewater coverage could be blocked, and the coverage circles should be modified to account for obstructions during the final design. Therefore, FERC staff recommends in section 4.12.6 that PALNG complete and document the firewater monitor and hydrant coverage test to verify that actual coverage area from each monitor and hydrant as shown on facility plot plan(s).

FERC staff also assessed whether the reliability of the firewater pumps and firewater source or onsite storage volume are appropriate. In addition, FERC staff recommends in section 4.12.6 that PALNG file an updated fire protection evaluation performed on the final design, for review and approval, where details are yet to be determined (e.g., manufacturer and model, 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 Liquefaction Project. If the project is authorized and constructed, PALNG would install the firewater and foam systems as designed, and FERC staff recommends in section 4.12.6 that project facilities be subject to periodic inspections during construction and that companies provide results of commissioning tests to verify the firewater and foam systems are installed and functional as designed prior to introduction of hazardous fluids. In addition, FERC staff recommends in section 4.12.6 that project facilities be subject to regular inspections throughout the life of the facility to ensure firewater and foam systems are being properly maintained and tested.

Geotechnical and Structural Design

PALNG provided geotechnical and structural design information for its facilities to demonstrate the site preparation and foundation designs would be appropriate for the underlying soil characteristics and to ensure the structural design of the Liquefaction Project facilities would be in accordance with federal regulations, standards, and recommended and generally accepted good engineering practices. The application focuses on the resilience of the Liquefaction Project facilities against natural hazards, including extreme geological, meteorological, and hydrological events, such as earthquakes, tsunamis, seiche, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea level rise, landslides, wildfires, volcanic activity, and geomagnetism.

Geotechnical Evaluation

FERC regulations under 18 CFR 380.12 (h) (3) require geotechnical investigations to be provided. In addition, FERC regulations under 18 CFR 380.12 (o) (14) require an applicant to demonstrate compliance with regulations under 49 CFR 193 and NFPA 59A (2001). All facilities, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to the DOT's inspection and enforcement programs. DOT regulations incorporated by reference NFPA 59A (2001). NFPA 59A (2001) section 2.1.4 requires soil and general investigations of the site to determine the design basis for the facility.

However, no additional requirements are set forth in 49 CFR 193 or NFPA 59A on minimum requirements for evaluating existing soil site conditions or evaluating the adequacy of the foundations, therefore FERC staff evaluated the existing site conditions, geotechnical report, and proposed foundations to ensure they are adequate for the LNG facilities as described below.

PALNG contracted Fugro to conduct geotechnical investigations to evaluate the existing soil site conditions and proposed foundation design for the Liquefaction Project. The existing site elevation ranges from +1 feet to +8 feet NAVD88. The site would be cleared, grubbed, and prepared using standard earthmoving and compaction equipment. Site preparation would result in a final grade elevation being raised from +1 to +8 feet to +6.5 (excluding the MOF) to +13 feet (including the MOF) NAVD88 with between 2 feet 6 inches and 13 feet of fill added across the site, depending on the location. The offshore berth area would be dredged to -45 feet MLLW. On the canal side, the berm crest elevation would be a post-settlement height of +20.6 feet NAVD88, and on all land sides, the floodwall crest elevation would be a post-settlement height of +17.0 feet NAVD88 to protect the facilities from storm surge as discussed in more detail later in this section. The fill material would consist of various layers, including two different layers of fill placed in lifts specified in the Geotechnical Engineering Report and would be compacted to 90 to 98 percent of maximum dry density for standard proctor tests in accordance with ASTM D698 depending on location. Alternatively, cement stabilization is provided as an alternative to one of the layers of fill for improving the soil conditions and bearing capacity.

Fugro conducted 11 soil borings to depths ranging from 100 feet to 300 feet below existing grade, 12 cone penetration tests (CPT) to depths ranging from 100 feet to 167 feet (or to refusal) below existing grade, and 7 seismic cone penetration tests (SCPT) to depths ranging from 153 feet to 165 feet below existing grade. Additionally, three (3) previous geotechnical investigations completed between 2004 and 2015 consisted of a total of 71 soil borings and 19 CPTs. Over 15 different tests were conducted on 486 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 evaluated the geotechnical investigation to ensure the adequacy in the number, coverage, and types of the geotechnical borings, CPTs, SCPTs, and other tests, and found them to more than adequately cover all major facilities, including the marine facilities, LNG storage tanks, liquefaction areas, pretreatment areas, flare system, buildings, power generation, and berms. FERC staff will continue its review of the results of the geotechnical investigation to ensure foundation designs are appropriate prior to construction of final design and throughout the life of the facilities.

Based on the test borings conducted, the site is composed of approximately 0 to 25 feet of surficial soil consisting of unconsolidated very soft, soft, and silty clay underlain by firm to very stiff clays and silty clay from 25 to 160 feet below ground surface; very dense sand, silty sands, and sandy silts from 160 to 180 feet below ground surface; and stiff to very stiff clays from depths of 180 feet to over 200 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 several deterioration of concrete based on sulfate ion concentrations depending on location within the site. Based on these results, the Liquefaction Project has 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; however, for heavier structures in areas with these types of soil conditions, the LNG storage tanks, liquefaction blocks, and many associated structures would require deep foundations. Therefore, PALNG is proposing to use driven precast square concrete piles, displacement cast-in-place concrete piles, or driven steel pipe piles for facilities including, but not limited to: loading facilities and trestles, LNG storage tanks, LNG booster pumps, gas turbines, pre-treatment and liquefaction equipment, compressors, and blowers. Piles are proposed to be embedded between 80 and 160 feet below grade, depending on the equipment being supported, pile spacing, pile type, and pile diameter. Grade-supported slabs would only be used for light structures insensitive to total and/or differential vertical movements.

Subsidence is the sudden sinking or gradual downward settling of land with little or no horizontal motion, caused by movements on surface faults or by subsurface mining or pumping of oil, natural gas, or ground water. The results of PALNG's geotechnical investigation at the Liquefaction Project site indicate that subsurface conditions are generally suitable for the proposed facilities, if adequate site preparation, foundation design, and construction methods are implemented. Because subsidence is a recognized concern in the area of the Liquefaction Project, PALNG proposes to install all key liquefaction facilities on piles, including but not limited to: loading facilities and trestles, LNG storage tanks, LNG booster pumps, gas turbines, pre-treatment and liquefaction equipment, and all compressors and blowers. PALNG would monitor foundations and other critical facilities to ensure they are maintained within acceptable limits. Site preparation activities would be monitored to ensure adherence to the geotechnical design. Surface subsidence would be controlled by potential use of lime stabilization of the fill materials during placement and compaction with monitoring settlement and systematic reworking, as needed. Foundations would be constructed with pile supports to protect equipment and interconnecting piping from differential movement. Earthen containment embankments would be earth-supported and constricted with wide bases (using 2 horizontal to 1 vertical or 3 horizontal to 1 vertical slopes, depending on height) to ensure stability. Earth-supported elements, such as the storm surge barrier and plant roads, would require periodic maintenance to mitigate the long-term effects of settlements and differential movements. Because site-specific geotechnical mitigation has been incorporated into the Liquefaction Project (e.g., pile-supported foundations) in accordance with NFPA 59A (2001) and where applicable, NFPA 59A (2006), subsidence would not be a significant hazard to the proposed facilities.

Dredging would occur to create the marine berth area to achieve the proposed final grade of -45 feet MLLW. The existing shoreline of the SNWW would be excavated, dredged, and sloped during construction. 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. The proposed rip-rap armoring would minimize the potential for erosion where the shoreline would be excavated.

The results of PALNG's geotechnical investigation at the project site indicate that subsurface conditions are generally suitable for the proposed facilities, if proposed site preparation, foundation design, and construction methods are implemented appropriately.

Structural and Natural Hazard Evaluation

FERC regulations under 18 CFR 380.12 (m) requires applicants to address the potential hazard to the public from failure of facility components resulting from accidents or natural catastrophes, evaluate how these events would affect reliability, and describe the design features and procedures that would be used to reduce potential hazards. In addition, 18 CFR 380.12 (o) (14) require an applicant to demonstrate how they would comply with 49 CFR 193 and NFPA 59A. In addition, all facilities, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to the DOT's inspection and enforcement programs. DOT regulations under 49 CFR 193 have some specific requirements on designs to withstand certain loads from natural hazards and also incorporates by reference NFPA 59A (2001 and 2006) and ASCE 7-05 and ASCE 7-93 via NFPA 59A (2001). Once constructed, all facilities would be subject to the DOT's inspection and enforcement program.

In addition, the facilities would be constructed to the requirements in the 2012 International Building Code (IBC), ASCE 7-05, and ASCE 7-10. These standards require various structural loads to be applied to the design of the facilities, including live (i.e., dynamic) loads, dead (i.e., static) loads, and environmental loads. FERC staff also evaluated potential the engineering design to withstand impacts from natural hazards, such as earthquakes, tsunamis, seiche, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea level rise, landslides, wildfires, volcanic activity, and geomagnetism. FERC staff recommends in section 4.12.6 that PALNG file final design information (e.g., drawings, specifications, and calculations) and associated quality assurance and quality control procedures with the documents reviewed, approved, and stamped and sealed by a professional engineer of record registered in the state of Texas. If a project is authorized and constructed, the company would install equipment in accordance with its final design. In addition, FERC staff recommends in section 4.12.6 that PALNG file, for review and approval, settlement results during hydrostatic tests of the LNG storage containers and periodically thereafter to verify settlement is as expected and does not exceed the applicable criteria in API 620, API 625, API 653, and ACI 376.

Earthquakes, Tsunamis, and Seiche

Earthquakes and tsunamis have the potential to cause damage from shaking ground motion and fault ruptures. Earthquakes and tsunamis often result from sudden slips along fractures in the earth's crust (i.e., faults) and the resultant ground motions caused by those movements, but can also be a result of volcanic activity or other causes of vibration in the earth's crust. The damage that could occur as a result of ground motions is affected by the type/direction and severity of the fault activity and the distance and type of soils the seismic waves must travel from the hypocenter (or point below the epicenter where seismic activity occurs). To assess the potential impact from earthquakes and tsunamis, PALNG 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).[51] The location of the Liquefaction Project is within the Gulf Coast Basin geologic tectonic province. The Gulf Coast Basin is characterized as having thick sedimentary rocks above basement rock structures. The province's sedimentary strata thickens toward the south, with salt domes and relatively shallow listric growth faults that run parallel to the Gulf of Mexico Coastline and extend outside of Texas. 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).

PALNG conducted a site-specific seismic risk analysis for the Liquefaction Project, involving field investigations and subsequent data evaluation. PALNG's *Seismic and Fault Studies* report includes the examination of growth faults in the region of the Liquefaction 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 Liquefaction Project site, there may be a potential source of surface deformation. 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 in 49 CFR 193.2101 under Subpart C require that field-fabricated LNG tanks must comply with section 7.2.2. of NFPA 59A (2006) for seismic design. NFPA 59A (2006) requires LNG storage tanks to be designed to continue safely

51 USGS. Earthquake Hazards Program. Quaternary Fault and Fold Database of the United States. Available at: https://earthquake.usgs.gov/hazards/qfaults/ Accessed August 2018

operating with earthquake ground motions at the ground surface at the site that have a 10 percent probability of being exceeded in 50 years (475 year mean return interval), termed the operating basis earthquake (OBE). In addition, DOT regulations in 49 CFR 193.2101 under Subpart C require that LNG tanks be designed to have the ability to safely shutdown when subjected to earthquake ground motions which have a 2 percent probability of being exceeded in 50 years (2,475 year mean return interval) at the ground surface at the site (termed the safe shutdown earthquake [SSE]). DOT regulations in 49 CFR 193.2101 under Subpart C also incorporate by reference of NFPA 59A (2001) Chapter 6, which require piping systems conveying flammable liquids and flammable gasses with service temperatures below -20 °F, be designed as required for seismic ground motions. The facilities, once constructed, would be subject to the DOT's inspection and enforcement programs.

In addition, FERC staff recognizes this leaves a gap for hazardous fluid piping with service temperatures at -20 °F and higher and equipment other than piping and LNG storage containers. We also recognize the current FERC regulations under Title 18 CFR 380.12 (h) (5) continues to incorporate NBSIR 84-2833. NBSIR 84-2833 provides guidance on classifying stationary storage containers and related safety equipment as Category I and classifying the remainder of the LNG project structures, systems, and components as either Category II or Category III, but does not provide specific guidance for the seismic design requirements for them. Absent any other regulatory requirements, this guidance recommends that other LNG project structures classified as Seismic Category II or Category III be seismically designed to satisfy the Design Earthquake and seismic requirements of the ASCE 7-05 in order to demonstrate there is not a significant impact on the safety of the public. ASCE 7-05 is recommended as it is a complete American National Standards Institute (ANSI) consensus design standard, its seismic requirements are based directly on the NEHRP Recommended Provisions, and it is referenced directly by the IBC. Having a link directly to the IBC and ASCE 7 is important to accommodate seals by the engineer of record because the IBC is directly linked to state professional licensing laws while the NEHRP Recommended Provisions are not.

The geotechnical investigations of the existing site indicate the site is classified as Site Class E[52] in accordance with ASCE 7-05 and in accordance with IBC 2009 based on a site average shear wave velocity that ranged between 360 and 643 feet per second (Fugro, 2017a) in the upper 100 feet of strata. Sites with soil conditions of this type could experience significant amplifications of surface earthquake ground motions. However, due to the absence of a major fault in proximity to the site and lower ground motions, the seismic risk to the site is considered low.

Fugro performed a site-specific seismic hazard study for the site. The study concluded that the site would have an OBE PGA of 0.042 g, a SSE PGA of 0.116 g, a 0.2-second design spectral acceleration value of 0.164 g, a 1.0-second design spectral acceleration at the site of 0.118 g and a Design Earthquake of 0.064 g (Fugro, 2017a). FERC staff independently evaluated the OBE PGA, SSE PGA, 0.2-second design spectral acceleration, and 1.0-second design spectral accelerations for the site using the USGS Earthquake Hazards Program Seismic Design Maps[53] and Unified Hazard[54] tools for all occupancy categories (I through IV). FERC believes the SSE PGA, OBE PGA, and 5 percent-damped spectral design accelerations used by PALNG are acceptable. These ground motions are relatively low compared to other locations in the United States. Based on the design ground motions for the site and the importance of the facilities, the facility seismic design is assigned Seismic Category I for LNG containers, systems required for isolation of LNG containers, and systems required for safe shutdown or fire protection. Seismic

52 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).

53 https://earthquake.usgs.gov/designmaps/us/application.php

54 https://earthquake.usgs.gov/hazards/interactive/

Category 2 structures include facilities and systems not included in Category 1 required for safe plant operation, which include LNG liquefaction trains, inlet facilities, pre-treatment area(s), power generation area(s), fuel gas system, interconnecting piping systems, metering systems, LNG pumps, and other items. Seismic Category 3 includes all other facilities that are not included in Categories 1 and 2, including administration buildings, dock service equipment, waste treatment plant, and incoming electrical power supply.

ASCE 7-05 also requires determination of the Seismic Design Category based on the Occupancy Category (or Risk Category in ASCE7-10 and 7-16) and severity of the earthquake design motion. The Occupancy Category (or Risk Category) is based on the importance of the facility and the risk it poses to the public.[55] FERC staff has identified the project as a Seismic Design Category B based on the ground motions for the site and an Occupancy Category (or Risk Category) of III, this seismic design categorization would appear to be consistent with the 2009 IBC and ASCE 7-05 (and ASCE 7-10).

Seismic events can also result in soil liquefaction in which saturated, non-cohesive soils temporarily lose their strength/cohesion and liquefy (i.e., behave like viscous liquid) as a result of increased pore pressure and reduced effective stress when subjected to dynamic forces such as intense and prolonged ground shaking. Areas susceptible to liquefaction may include saturated soils that are generally sandy or silty. Typically, these soils are located along rivers, streams, lakes, and shorelines or in areas with shallow groundwater. The site-specific geotechnical investigations indicate the presence of layers of silty sands and sandy silts that are dense to very dense. These sand layers could be liquefiable under sufficiently strong ground motions. However, due to the low seismicity of the region, the potential for soil liquefaction to occur is low. In addition, PALNG would address possible issues relating to the potential for soil liquefaction and loss of soil strength by using piles in the foundation design. Should soil improvement be required to counteract soil liquefaction, PALNG would utilize ground improvement techniques (e.g., cementitious strengthening).

Seismic events in waterbodies can also cause tsunamis or seiches by sudden displacement of the sea floors in the ocean or standing water. Tsunamis and seiche may also be generated from volcanic eruptions or landslides. Tsunami wave action can cause extensive damage to coastal regions and facilities. The 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 did occur in the Gulf of Mexico in the early 20th century and had wave heights of 3 feet or less (USGS, 2009), which is not significantly higher than the average breaking wave height of 1.5 feet (Owen, 2008). 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, despite recorded seismic activity in the area.

The potential for tsunamis associated with submarine landslides is more likely a source in the Gulf of Mexico and remains a focus of government research (USGS, 2009). PALNG's *Seismic and Fault Study*

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55 ASCE 7-05 defines Occupancy Categories I, II, III, and IV. Occupancy Category I represents facilities with a low hazard to human life in even of failure, such as agricultural facilities; Occupancy Category III represents facilities with a substantial hazard to human life in the event of failure or with a substantial economic impact or disruption of day to day civilian life in the event of failure, such as buildings where more than 300 people aggregate, daycare facilities with facilities greater than 150, schools with capacities greater than 250 for elementary and secondary and greater than 500 for colleges, health care facilities with 50 or more patients, jails and detention facilities, power generating stations, water treatment facilities, telecommunication centers, hazardous facilities that could impact public; Occupancy Category IV represents essential facilities, such as hospitals, fire, rescue, and police stations, emergency shelters, power generating stations and utilities needed in an emergency, aviation control towers, water storage and pump structures for fire suppression, national defense facilities, and hazardous facilities that could substantially impact public; and Occupancy Category II represents all other facilities. ASCE 7-10 changed the term to Risk Categories I, II, III, and IV with some modification.

report included a Tsunami Hazard Assessment for the Liquefaction Project area. There are four main submarine landslide hazard zones in the Gulf of Mexico including the Northwest Gulf of Mexico, Mississippi Canyon and Fan, the Florida Escarpment, and the Campeche Escarpment (USGS, 2009). Based on modeling and limited historical data, it is estimated that tsunamis generated from landslides would be more than 2 feet and less than 13 feet. These tsunami run-up elevations are significantly less than the hurricane design storm surge elevations discussed below, so any tsunami hazard has been considered in design.

Hurricanes, Tornadoes, and other Meteorological Events

Hurricanes, tornadoes, and other meteorological events have the potential to cause damage or failure of facilities due to high winds and floods, including failures from flying or floating debris. To assess the potential impact from hurricanes, tornadoes, and other meteorological events, PALNG 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.

Because of its location, the Liquefaction Project site would likely be subject to hurricane force winds during the life of the project. PALNG states that all project facilities would be designed to withstand a 183-mph 3-second gust. A 183 mph 3-second gust would convert to a sustained wind speed of 150 mph, using the Durst Curve in ASCE 7-05 or using a 1.23 gust factor recommended for offshore winds at a coast line in World Meteorological Organization, *Guidelines for Converting between Various Wind Averaging Periods in Tropical Cyclone Conditions*. These wind speeds are equivalent to approximately 14,000-year mean return interval or 0.36 percent probability of exceedance in a 50-year period for the site, based on whether ASCE 7-05 wind speed return period conversions. The 183 mph 3-second gust equates to a strong Category 4 Hurricane using the Saffir-Simpson scale (130-156 mph sustained winds, 166-195 mph 3-second gusts). PALNG must meet 49 CFR 193.2067 under Subpart B for wind load requirements. In accordance with the MOU, the DOT will evaluate in its LOD whether an applicant's proposed project meets the DOT siting requirements under Subpart B. If the project is constructed and becomes operational, the facilities would be subject to the DOT's inspection and enforcement programs. Final determination of whether the facilities are in compliance with the requirements of 49 CFR 193 would be made by the DOT staff.

However, as noted in the limitation of ASCE 7-05, tornadoes were not considered in developing basic wind speed distributions. This leaves a potential gap in potential impacts from tornadoes. Therefore, FERC staff evaluated the potential for tornadoes. Appendix C of ASCE 7-05 makes reference to American Nuclear Society 2.3 (1983 edition), *Standard for Estimating Tornado and Extreme Wind Characteristics at Nuclear Power Sites*. This document has since been revised in 2011 and reaffirmed in 2016 and is consistent with NUREG/CR-4461, Tornado Climatology of the Contiguous U.S. Rev. 2 (NUREG2007). These documents provide maps of a 100,000-mean-year return period for tornadoes using 2° latitude and longitude boxes in the region to estimate a tornado striking within 4,000-ft of an area. Figures 5-8 and 8-1 from NUREG/CR-4461 indicate a 100,000-year-maximum tornado wind speeds would be approximately 140 mph 3-second gusts for the project site location. Later editions of ASCE 7 (ASCE 7-10 and ASCE 7-16) make reference to International Code Council 500, Standard for Design and Construction of Storm Shelters, for 10,000-year tornadoes. However, the International Code Council 500 maps were conservatively developed based on tornadoes striking regions and indicate a 200 mph 3-second gust for a 10,000-year event, which is higher than the 140 mph 3-second gust in American Nuclear Society 2.3 and NUREG/CR-4461. As a result, FERC staff believes the use of a of 150 mph sustained wind speed, 183 mph 3-second gust, is adequate for the LNG storage tanks and conservative from a risk standpoint for the other LNG facilities.

ASCE 7 also recognizes the facility would be in a windborne debris region. Windborne debris has the potential to perforate equipment and the LNG storage tanks if not properly designed to withstand such impacts. The potential impact is dependent on the equivalent projectile wind speed, characteristics of projectile, and methodology or model used to determine whether penetration or perforation would occur. Unfortunately, no criteria are provided in 49 CFR 193 or ASCE 7 for these specific parameters. However, NFPA 59A (2016) recommends CEB 187 be used to determine projectile perforation depths. In order to address the potential impact, FERC staff recommends in section 4.12.6 that PALNG provide a projectile analysis, for review and approval, to demonstrate that the outer concrete impoundment wall of a full-containment LNG tank could withstand wind borne projectiles prior to construction of the final design. The analysis should detail the projectile speeds and characteristics and method used to determine penetration or perforation depths. FERC staff would compare the analysis and specified projectiles and speeds using established methods, such as CEB 187, and DOE and Nuclear Regulatory Commission guidance.

In addition, FERC staff evaluated historical tropical storm, hurricane, and tornado tracks in the vicinity of the project facilities using data from the DHS Homeland Infrastructure Foundation Level Data and NOAA Historical Hurricane Tracker.[56,57] Between 1865 and August 2017, 45 hurricanes and tropical storms made landfall within 60 miles of the Liquefaction Project site (NOAA, 2017a), including Unnamed Hurricane (Category 1) in 1886, Hurricane Audrey (Category 3) in 1957, and Hurricane Rita (Category 5) in 2005,[58] which all made landfall within 30 miles of Port Arthur, Texas and produced significant storm surges, with maximum heights greater than 12 feet AMSL (Needham and Keim, 2012).[59] In addition, in 2008, Hurricane Ike (Category 4)[60] made landfall east of Houston, Texas and continued northwest toward Port Arthur, resulting in water height of 14.5 feet (NOAA, 2009; LSU, 2013). On August 30, 2017, Hurricane Harvey (Category 4) made landfall near Cameron, Louisiana. The Port Arthur area received 26 inches of rain in 24 hours, with a storm total of over 47 inches, resulting in widespread flooding, and is being considered a 500-year or 1,000-year storm event. NOAA reported that the maximum storm surge near Port Arthur was between 3 and 5 feet (NOAA, 2017b). PALNG would be designed to withstand 183 mph 3 second gusts and flood elevations of historical events.

Potential flood levels may also be informed from the FEMA Flood Insurance Rate Maps, which identifies Special Flood Hazard Areas (base flood) that have a 1 percent probability of exceedance in 1 year to flood (or a 100 year mean return interval) and moderate flood hazard areas that have a 0.2 percent probability of exceedance in 1 year to flood (or a 500 year mean return interval). According to the FEMA National Flood Insurance Rate Maps (FEMA, 2013) for Jefferson County, Texas, the 100-year Base Flood Elevation for the Liquefaction Project site is 12 feet in reference to the National Geodetic Vertical Datum of 1929 and 12.04 feet in reference to the NAVD88. We also recognize that a 500-year flood event has been recommended as the basis of design for critical infrastructure in publications, including ASCE 24, *Flood Resistant Design and Construction*. Therefore, we believe it is good practice to design critical energy infrastructure to withstand 500-year event from a safety and reliability standpoint for both SWEL and wave crests. PALNG has proposed to design the project to withstand a 500-year flood event. Furthermore, we believe the use of intermediate values from NOAA for sea level rise and subsidence is more appropriate for design and higher projections are more appropriate for planning in accordance with NOAA 2017,[61] which

56 DHS. Homeland Infrastructure Foundation Level Data. Available at: https://hifld-geoplatform.opendata.arcgis.com/. Accessed August 2018.

57 NOAA. Historical Hurricane Tracker. Available at: https://coast.noaa.gov/hurricanes/. Accessed August 2018.

58 Global and Regional Sea Level Rise Scenarios for the United States. U.S. Department of Commerce. National Ocean and Atmospheric Administration. National Ocean Service Center for Operational Oceanographic Products and Services. January 2017.

59 Global and Regional Sea Level Rise Scenarios for the United States. U.S. Department of Commerce. National Ocean and Atmospheric Administration. National Ocean Service Center for Operational Oceanographic Products and Services. January 2017.

60 Global and Regional Sea Level Rise Scenarios for the United States. U.S. Department of Commerce. National Ocean and Atmospheric Administration. National Ocean Service Center for Operational Oceanographic Products and Services. January 2017.

61 Global and Regional Sea Level Rise Scenarios for the United States. U.S. Department of Commerce. National Ocean and Atmospheric Administration. National Ocean Service Center for Operational Oceanographic Products and Services. January 2017.

recommends defining a central estimate or mid-range scenario as baseline for shorter-term planning, such as setting initial adaptation plans for the next two decades and defining upper bound scenarios as a guide for long-term adaptation strategies and a general planning envelope.

The entire Liquefaction Project site would be enclosed for flood protection by construction of earthen levees on the channel and land sides. The channel-side earthen levee height is designed to a 500-year SWEL of 14.0 feet NAVD88, a 500-year wave of 5.9 feet (rounded to 6.0 feet for the purposes of levee sizing), 0.6 feet of sea level rise and subsidence, and 1.6 feet of expected settlement, yielding an initial crest height of 22.2 feet with a final post-settlement height not lower than 20.6 feet. The land-side earthen levee height is designed to a combined 100-year SWEL, 100-year wave, and sea level rise height of 17.0 feet, and 2.0 feet of expected settlement, yielding an initial crest height of 19.0 feet with a final post-settlement crest height not lower than 17.0 feet. In addition, given the uncertainty in levee settlement, PALNG would periodically monitor and maintain the crest elevation of the levee to be no less than 20.6 feet NAVD88 on the channel side and no less than 17.0 feet NAVD88 on the land side.

We generally evaluate the design against a 500-year SWEL with a 500-year wave crest and sea level rise and subsidence. Using maximum envelope of water (MEOW) storm surge inundation maps generated from the Sea, Lake, and Overland Surge from Hurricanes model developed by NOAA National Hurricane Center, a 500-year event would equate to a Category 2 Hurricane and approximately 3-9 feet MEOW.[62] This is lower than indicated in the 500-year FEMA maps. In addition, while NOAA seems to provide higher resolution of topographic features, it limits its SLOSH maps to storm surge levels at high tide above 9 feet. As a result, FERC staff evaluated the storm surge against other sources using SLOSH maps that indicate a similar upper range of 8-10 feet MEOW for Category 2 Hurricanes, and also indicated 13-16 feet MEOW for Category 3 Hurricanes, 16-20 feet MEOW for Category 4 Hurricanes, and 20-25 feet MEOW for Category 5 Hurricanes.[63] This data suggests that PALNG design may withstand Category 3 or 4 Hurricane storm surge SWEL equivalent to 1,000 to 10,000 year mean return intervals. In addition, wave heights would likely impact the channel side, but would not reach the landward side. We also would expect the sea level rise to be closer to the 1.21 feet intermediate projection provided by NOAA. As a result of the SLOSH data and NOAA sea level rise projections, we would expect the berm to be at least 20.1 feet on the channel side and 14.2 feet on the landward side post settlement. However, given the uncertainty in the 500-year SWEL data, 500-year wave data, SLOSH maps, sea level rise and subsidence projections, and settlement projections and uncertainties, we agree that the 20.6 feet and 17.0 feet post settlement levee would provide adequate protection of the PALNG site and should be periodically monitored and maintained to assure the crest elevation would not be lower than 20.6 feet NAVD88 on the channel side and 17.0 feet NAVD88 on the land side. We also recommend in section 4.12.6 that PALNG provide the monitoring and maintenance plan that has been reviewed, approved, stamped and sealed by a professional engineer of record registered in the state of Texas.

The Texas and Louisiana Gulf Coast area is experiencing the highest rates of coastal erosion and wetland loss in the United States (Ruple, 1993). The average coastal erosion rates is -1.2 meters per year between 2000 and 2012 along the Texas coastal shoreline, with the area between Sabine Pass and Rollover Pass experiencing a shoreline loss rate of -4.7 meters per year between 2000 and 2012 (McKenna, 2014). Shoreline erosion could occur at the Liquefaction Project site and along the opposite shoreline as a result of waves, currents, and vessel wakes. To prevent erosion, new revetment in the form of sheet piling and rip rap would be installed on the water side of the storm protection berm. Even though shoreline erosion is a concern at the site, the proposed mitigation measures would minimize erosion and scour impacts.

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62 U.S. Department of Commerce. NOAA. National Hurricane Center. National Storm Surge Hazard Maps. Available at: https://www.nhc.noaa.gov/nationalsurge/#pop. Accessed August 2018.

63 Masters. J. Weather Underground. Storm Surge Inundation Maps for the U.S. Coast. Available at:https://www.wunderground.com/hurricane/surge_images.asp. Accessed August 2018.

Landslides and other Natural Hazards

Due to the low relief across the PALNG site, there is little likelihood that landslides or slope movement at the 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 Liquefaction Project area has low relief which reduces the possibility of landslides.

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[64] and DHS[65] 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 700 miles away across the Gulf of Mexico in Los Atlixcos, Mexico.

Geomagnetic disturbances (GMD) may occur due to solar flares or other natural events with varying frequencies that can cause geomagnetically induced currents, which can disrupt the operation of transformers and other electrical equipment. USGS provides a map of GMD intensities with an estimated 100 year mean return interval.[66] The map indicates the PALNG site could experience GMD intensities of 70-100 nano-Tesla with a 100 year mean return interval. However, PALNG would be designed such that if a loss of power were to occur the valves would move into a fail-safe position. In addition, PALNG is an export facility that does not serve any U.S. customers.

External Impact Review

To assess the potential impact from external events, FERC staff conducted a series of reviews to evaluate transportation routes, land use, and activities within the facility and surrounding the Liquefaction Project site, and the safeguards in place to mitigate the risk from events, where warranted. FERC staff coordinated the results of the reviews with other federal agencies to assess potential impacts from vehicles and rail; aircraft impacts to and from nearby airports and heliports; pipeline impacts from nearby pipelines; impacts to and from adjacent facilities that handle hazardous materials under the EPA's Risk Management Plan (RMP) regulations and power plants, including nuclear facilities under the Nuclear Regulatory Commission regulations. Specific mitigation of impacts from use of external roadways, rail, helipads, airstrips, or pipelines are also considered as part of the engineering review done in conjunction with the NEPA review.

FERC staff uses a risk-based approach to assess the potential impact of the external events and the adequacy of the mitigation measures. The risk-based approach uses data based on the frequency of events that could lead to an impact and the potential severity of consequences posed to the Liquefaction Project site and the resulting consequences to the public beyond the initiating events. The frequency data is based on past incidents and the consequences are based on past incidents and/or hazard modeling of potential failures.

Road

FERC staff generally reviews whether any truck operations would be associated with the project and whether any existing roads would be located near the site. FERC staff uses this information to evaluate whether the project and any associated truck operations could increase the risk along the roadways and subsequently to the public and whether any pre-existing unassociated vehicular traffic could adversely

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64 United States Geological Survey. U.S. Volcanoes and Current Activity Alerts. Available at: https://volcanoes.usgs.gov/index.html. Accessed August 2018.

65 Department of Homeland Security. Homeland Infrastructure. Foundation-Level data (HIFLD). Natural Hazards. hifld-geoplatform.opendata.arcgis.com. accessed Aug 2018

66 United States Geological Survey. Magnetic Anomaly Maps and Data for North America. Available at: https://mrdata.usgs.gov/magnetic/map-us.html#home. Accessed August 2018.

increase the risk to the project site and subsequently increase the risk to the public. In addition, all facilities, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to the DOT's inspection and enforcement programs. DOT regulations under 49 CFR 193.2155(a) (5) (ii) under Subpart C require that structural members of an impoundment system must be designed and constructed to prevent impairment of the system's performance reliability and structural integrity as a result of a collision by or explosion of a tank truck that could reasonably be expected to cause the most severe loading if the liquefaction facility adjoins the right-of-way of any highway. Similarly, NFPA 59A (2001), section 8.5.4, requires transfer piping, pumps, and compressors to be located or protected by barriers so that they are safe from damage by rail or vehicle movements. However, the DOT regulations and NFPA 59A (2001) requirements do not indicate what collision(s) or explosion(s) could reasonably be expected to cause the most severe loading. FERC staff evaluated consequence and frequency data from these events to evaluate these potential impacts.

FERC staff evaluated the risk of the truck operations based on the consequences from a release, incident data from the DOT Federal Highway Administration, National Highway Traffic Safety Administration, and PHMSA, and frequency of trucks and proposed mitigation to prevent or reduce the impacts of a vehicular incident from PALNG.

Unmitigated consequences under worst case weather conditions from catastrophic failures of trucks proposed at the site generally can range from 200-2,000 feet for flammable vapor dispersion, 850-1,500 feet for radiant heat of $5kW/m^2$ from fireballs, and 275-350 feet for radiant heat of $5kW/m^2$ from jet fires with projectiles from BLEVEs possibly extending farther. These values are also close to the distances provided by DOT Federal Highway Administration for designating hazardous material trucking routes (0.5 mi for flammable gases for potential impact distance) and DOT PHMSA for emergency response (0.5-1 mi for initial evacuation and 1 mi for potential BLEVEs for flammable gases).[67] Unmitigated consequences under average ambient conditions from releases of 1,000 gallons through a 1-inch hole would result in much more modest distances ranging from 25-200 feet for flammable vapor dispersion, and 75-175 feet for jet fires.

Incident data indicates hazardous material incidents are very infrequent (4e-3 incidents per lane-mile per year) and nearly 75-80 percent of hazardous material vehicular incidents occur during unloading and loading operations while the other 20-25 percent occur while in transit or in transit storage. In addition, approximately 99 percent of releases are 1,000 gallons or less and catastrophic events that would spill 10,000 gallons or more make up less than 0.1 percent of releases. In addition, less than 1 percent of all reportable hazardous material incidents with spillage result in injuries and less than 0.1 percent of all reportable hazardous material incidents with spillage result in fatalities.

During operation of the project, PALNG estimates 30 trucks or tanker trucks would transport commodities (e.g., liquid nitrogen, condensate product, etc.) to or from the facility each week. Diesel trucks would come to and from the facility on a bi-weekly basis. This would result in approximately 1,586 trucks or tanker trucks that would transport hazardous fluids to or from the site each year. PALNG would relocate the existing SH 87 to the western side of the proposed site. SH 87 would remain a two-lane highway with a speed limit of 65 miles per hour. PALNG also proposes to install a 17 feet high storm levee that would separate SH 87 from the process equipment and piping within the liquefaction facility. Distances from external roads to the berm is approximately 400 feet with another approximate 100 feet to equipment. FERC staff did not identify any other major highways or roads within close proximity to piping or equipment containing hazardous materials at the site that would not be protected by the berm to raise concerns of direct impacts from a vehicle impacting the site. The berm and separation distances would also provide some

67 USGS. Earthquake Hazards Program. Quaternary Fault and Fold Database of the United States. Available at: https://earthquake.usgs.gov/hazards/qfaults/ Accessed August 2018

protection from flammable vapor dispersion and radiant heats. While we believe the berm would provide adequate protection from most potential accidental and intentional vehicle impacts, FERC staff recommends in section 4.12.6 that PALNG file specifications and drawings of vehicle barriers at the access points, for review and approval, to further mitigate accidental and intentional vehicle impacts. In addition, FERC staff recommends in section 4.12.6 that PALNG file an evaluation, for review and approval, on the need to install turning lanes to minimize the risk of incidents from hazardous material truck and other vehicle incidents entering and exiting the facility from SH 87. In addition, while FERC staff could find information on the protection of fire hydrants, FERC staff could not locate information in the application indicating that PALNG would install guard rails, bollards, stop signs, speed limits, etc. that would be located internal to the liquefaction facility to protect equipment containing hazardous fluids and safety related equipment. Therefore, FERC staff recommends in section 4.12.6 that PALNG provide final design information, for review and approval, on internal road and vehicle protections, (e.g., guard rails, barriers, and bollards) to protect transfer piping, pumps, and compressors, etc. and to ensure that they are located away from roadway or protected from damage by vehicle movements.

With the implementation of our recommendations, FERC staff does not believe the proposed project would pose a significant risk or significant increase in risk to the public due to vehicle impacts as a result of the potential consequences, incident data, and frequency of trucks.

Rail

FERC staff generally reviews whether any rail operations would be associated with the project and whether any existing rail lines would be located near the site. FERC staff uses this information to evaluate whether the project and any associated rail operations could increase the risk along the rail line and subsequently to the public and whether any pre-existing unassociated rail operations could adversely increase the risk to the PALNG site and subsequently increase the risk to the public. In addition, all facilities, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to the DOT's inspection and enforcement programs. DOT regulations under 49 CFR 193.2155 (a) (5) (ii) under Subpart C states if the LNG facility adjoins the right-of-way of any railroad, the structural members of an impoundment system must be designed and constructed to prevent impairment of the system's performance reliability and structural integrity as a result of a collision by or explosion of a train or tank car that could reasonably be expected to cause the most severe loading. Section 8.5.4 of NFPA 59A (2001), incorporated by reference in 49 CFR 193, requires transfer piping, pumps, and compressors to be located or protected by barriers so that they are safe from damage by rail or vehicle movements. However, the DOT regulations and NFPA 59A (2001) requirements do not indicate what collision(s) or explosion(s) could reasonably be expected to cause the most severe loading. Therefore, FERC staff evaluated consequence and frequency data from these events to evaluate these potential impacts. There would be no rail transportation associated with the Liquefaction Project.

FERC staff evaluated the risk of the truck operations based on the consequences from a release, incident data from the DOT Federal Rail Administration and DOT PHMSA, and frequency of rail operations nearby PALNG.

Unmitigated consequences under worst case weather conditions from catastrophic failures of rail cars containing various flammable products generally can range from 300-3,000 feet for flammable vapor dispersion, 1,250-2,100 feet for radiant heat of 5kW/m^2 from fireballs, and 450 -575 feet for radiant heat of 5kW/m^2 from jet fires with projectiles from BLEVEs possibly extending farther. These values are also close to the distances provided by DOT PHMSA for emergency response (0.5-1 mi for initial evacuation and 1 mi for potential BLEVEs for flammable gases).[68] Unmitigated consequences under average ambient

68 USGS. Earthquake Hazards Program. Quaternary Fault and Fold Database of the United States. Available at: https://earthquake.usgs.gov/hazards/qfaults/ Accessed August 2018

conditions from releases of 1,000 gallons through a 1-inch hole would result in much more modest distances ranging from 25-200 feet for flammable vapor dispersion, and 75-175 feet for jet fires.

Incident data indicates hazardous material incidents are very infrequent (6e-3 incidents per rail-mile per year). In addition, approximately 95 percent of releases are 1,000 gallons or less and catastrophic events that would spill 30,000 gallons or more make up less than 1 percent of releases. In addition, less than 1 percent of hazardous material incidents result in injuries and less than 0.1 percent of hazardous material incidents result in fatalities.

The closest rail line is located adjacent to SH 87 near the West Port Arthur Bridge approximately 3 miles away that services the adjacent chemical facilities (KMTEX, etc.). This would be farther than the consequence distances under worst case weather conditions and events. In addition, the position of the rail operations would be to the north of the Liquefaction Project and in closer proximity to populated areas than the liquefaction facilities.

Therefore, FERC staff does not believe the proposed project would pose a significant risk or significant increase in risk to the public due to nearby rail as a result of the potential consequences, incident data, and distance and position of the closest rail lines serving other industrial facilities relative to the populated areas to the north of the liquefaction facilities and industrial facilities.

Air

FERC staff generally reviews whether any aircraft operations would be associated with the project and whether any existing aircraft operations would be located near the site. FERC staff uses this information to evaluate whether the project and any associated aircraft operations could increase the risk to the public and whether any pre-existing unassociated aircraft operations could adversely increase the risk to the project site and subsequently increase the risk to the public. In addition, all facilities, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to the DOT's inspection and enforcement programs. DOT regulations under 49 CFR 193.2155 (b) under Subpart C require an 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 and that the height of LNG structures in the vicinity of an airport must comply with DOT FAA requirements. In addition, FERC staff evaluated the risk of an aircraft impact from nearby airports. There would be no aircraft associated with the Liquefaction Project (e.g., helipads) that would warrant a review that would increase the risk to the public from aircraft operations.

The closest airport to the Liquefaction Project site is the Vaughn Farm Airport located approximately 6.1 miles away. FERC staff also identified 4 other airports within a 20-mile radius from the proposed site: Jack Brooks Regional Airport located 11.4 miles away, Kelley Crop Service Airport located 17.1 miles away, Wilber Farms Airport located 18.0 miles away, and Chesson Airport located 19.3 miles away. These are all farther than the 0.25-mile distance referenced in DOT regulations.

The DOT FAA regulations in 14 CFR 77 require PALNG to provide a notice to the FAA of its proposed construction. This notification should identify all equipment that are more than 200 feet above ground level or lesser heights if the facilities are within 20,000 feet of an airport (at 100:1 ratio or 50:1 ratio depending on length of runway) or within 5,000 feet of a helipad (at 100:1 ratio). In addition, mobile objects, including the LNG vessel that would be above the height of the highest mobile object that would normally traverse it would require notification to DOT FAA. The FAA aeronautical study would identify which structures and mobile objects exceed obstruction standards and would indicate if the identified structures would be a hazard to air navigation. Based on this study, FAA would issue a determination for each structure and mobile object that exceeds the obstruction standards.

The proposed liquefaction facilities may include equipment taller than 200 feet and it is unclear as to whether the LNG vessels would be higher than other mobile objects in the waterway. Preliminary heights of permanent structures and temporary construction equipment were not provided in the application. Given the distance to the nearest airport exceeding 20,000 feet, PALNG would need to file notice to the FAA for any structures exceeding 200 feet to initiate an aeronautical study for determining whether they would constitute obstructions to air navigation. PALNG would also need to file notice if the LNG vessel is higher than other objects that traverse the waterway in accordance with 14 CFR 77. Therefore, FERC staff recommends in section 4.12.6 that PALNG indicate whether any permanent or temporary structures and mobile objects would exceed height requirements in 14 CFR 77 and file notice to FAA for both permanent and temporary structures, and LNG vessel that would require an Aeronautical Study. Furthermore, FERC staff recommends in section 4.12.6 that PALNG provide a final determination from the FAA that the proposed facilities would not pose a hazard to air navigation.

In addition, FERC staff analyzed existing aircraft operation frequency data based on the airports identified above and their proximity to the LNG storage tanks and process areas, the type and frequency of aircraft operations, take-off and landing directions, and the non-airport flight paths using the DOE Standard, DOE-STD-3014-2006, *Accident Analysis for Aircraft Crash into Hazardous Facilities*. Based upon that review, FERC staff does not believe the proposed Liquefaction Project would pose a significant risk as a result of the proximity of the project to the airports, and FERC staff recommends in section 4.12.6 that PALNG receive a determination of no hazard (with or without conditions) from FAA prior to initial site preparation to demonstrate there would not be an impact to the safety of aircraft.

With the implementation of our recommendations, FERC staff does not believe the proposed project would pose a significant risk or significant increase in risk to the public due to nearby aircraft operations as a result of the potential consequences, incident data, and distance and position of the closest aircraft operations relative to the populated areas north of the LNG terminal.

Pipelines

FERC staff generally reviews whether any pipeline operations would be associated with the project and whether any existing pipelines would be located near the site. FERC staff uses this information to evaluate whether the project and any associated pipeline operations could increase the risk to the pipeline facilities and subsequently to the public and whether any pre-existing unassociated pipeline operations could adversely increase the risk to the project site and subsequently increase the risk to the public. In addition, pipelines associated with this project must meet DOT regulations under 49 CFR 192 and are discussed in section 4.12.2. All facilities, once constructed, must comply with the requirements of 49 CFR 192 and 49 CFR 193 and would be subject to the DOT's inspection and enforcement programs. FERC staff evaluated the risk of a pipeline incident impacting the Liquefaction Project and the potential of cascading damage increasing the risk to the public based on the consequences from a release, incident data from the DOT PHMSA, and proposed mitigation to prevent or reduce the impacts of a pipeline incident from PALNG.

PALNG identified five pipelines located adjacent to SH 87. The pipelines would either be relocated or abandoned in connection with the development of the project and adequately marked during construction of the Liquefaction Project. FERC staff evaluated the potential risk from an incident from the pipelines and their potential impacts. Based on the proposed re-route, marking, and damage prevention measures and based on an evaluation of the potential likelihood of pipeline incidents and potential consequences from a pipeline incident, FERC staff does not believe the proposed project would significantly increase the risk to the public beyond existing risk levels that are present from the pipelines.

Therefore, FERC staff does not believe the proposed project would pose a significant increase in risk to the public as a result of the potential consequences from the pipelines in the vicinity of the Liquefaction Project, the frequency of pipeline incidents, and the proposed mitigation to prevent and reduce the impacts of a pipeline incident from PALNG.

Hazardous Material Facilities and Power Plants

FERC staff reviewed whether any EPA RMP regulated facilities handling hazardous materials and power plants were located near the site to evaluate whether the facilities could adversely increase the risk to the project site and whether the project site could increase the risk to the EPA RMP facilities and power plants and subsequently increase the risk to the public.

There were no adjacent facilities handling hazardous materials or power plants identified adjacent to the site. FERC staff also evaluated whether any EPA RMP regulated facilities would be located near the proposed site and if these facilities could adversely increase the risk to the PALNG site and whether the Liquefaction Project could increase the risk to the EPA RMP facilities and power plants and subsequently increase the risk to the public. The closest facility handling hazardous materials would be the KMCO Port Arthur facility located approximately 2.8 miles north of the LNG storage tanks. In addition, the Golden Pass LNG terminal would be located approximately 2.8 miles southeast of the LNG storage tanks. The closest power plant identified was a gas power plant at a refinery approximately 4 miles north of the facility and the closest nuclear power plant is over 100 miles away.

Given the distances and locations of the facilities relative to the populated areas of the Port Arthur and Sabine Pass communities, FERC staff does not believe the proposed project would pose a significant increase in risk to the public or that the hazardous material facilities and power plants would pose a significant risk to the project and subsequently to the public.

Onsite and Offsite Emergency Response Plans

As part of its application, PALNG indicated that it would develop a comprehensive ERP with local, state, and federal agencies and emergency response officials to discuss the Liquefaction Project. PALNG would continue these collaborative efforts during the development, design, and construction of the Project. The emergency procedures would provide for the protection of personnel and the public as well as the prevention of property damage that may occur as a result of incidents at the project facilities. The facility would also provide appropriate personnel protective equipment to enable operations personnel and first responder access to the area.

As required by 49 CFR 193.2509 under Subpart F, PALNG would need to prepare emergency procedures manuals that provide for: a) responding to controllable emergencies and recognizing an uncontrollable emergency; b) taking action to minimize harm to the public including the possible need to evacuate the public; and c) coordination and cooperation with appropriate local officials. Specifically, 49 CFR 193.2509(b)(3) requires "Coordinating with appropriate local officials in preparation of an emergency evacuation plan…," which sets forth the steps required to protect the public in the event of an emergency, including catastrophic failure of an LNG storage tank. DOT regulations under 49 CFR 193.2905 under Subpart J also require at least two access points in each protective enclosure to be located to minimize the escape distance in the event of emergency.

33 CFR 127.307 also requires the development of emergency manual that incorporates additional material, including LNG release response and ESD procedures, a description of fire equipment, emergency lighting, and power systems, telephone contacts, shelters, and first aid procedures. In addition, 33 CFR 127.207 establishes requirements for warning alarm systems. Specifically, 33 CFR 127.207(a) requires

that the LNG marine transfer area to be equipped with a rotating or flashing amber light with a minimum effective flash intensity, in the horizontal plane, of 5000 candelas with at least 50 percent of the required effective flash intensity in all directions from 1.0 degree above to 1.0 degree below the horizontal plane. Furthermore, 33 CFR 127.207(b) requires the marine transfer area for LNG to have a siren with a minimum 1⁄3-octave band sound pressure level at l meter of 125 dB referenced to 0.0002 microbars. The siren must be located so that the sound signal produced is audible over 360 degrees in a horizontal plane. Lastly, Title 33 CFR 127.207 (c) requires that each light and siren must be located so that the warning alarm is not obstructed for a distance of 1.6 km (1 mile) in all directions. The warning alarms would be required to be tested in order to meet 33 CFR 127. PALNG would be required to meet the warning alarms requirements specified in 33 CFR 127.207.

In accordance with the EPAct 2005, FERC must also approve an ERP covering the terminal and ship transit prior to construction. Section 3A(e) of the NGA, added by section 311 of the EPAct 2005, stipulates that in any order authorizing an LNG terminal, the Commission must require the LNG terminal operator to develop an ERP in consultation with the USCG and state and local agencies. The final ERP would need to be evaluated by appropriate ERPs and officials. Section 3A (e) of the NGA (as amended by EPAct 2005) specifies that the ERP must include a Cost-Sharing Plan that contains a description of any direct cost reimbursements the applicant agrees to provide to any state and local agencies with responsibility for security and safety at the LNG terminal and in proximity to LNG marine carriers that serve the facility. The Cost-Sharing Plan must specify what the LNG terminal operator would provide to cover the cost of the state and local resources required to manage the security of the LNG terminal and LNG 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.

PALNG described the ERP that would be developed to addresses emergency events and potential release scenarios in the Application. The ERP would include public notification, protection, and evacuation. As part of FEED, FERC staff evaluate the initial draft of the emergency response procedures to assure that it covers the hazards associated with the Liquefaction Project. In addition, FERC staff recommends in section 4.12.6 that PALNG provide additional information, for review and approval, on development of updated ERPs prior to initial site preparation. We also recommend in section 4.12.6 that PALNG file three-dimensional drawings, for review and approval, that demonstrate there is a sufficient number of access and egress locations. If this project is authorized and constructed, PALNG would coordinate with local, state, and federal agencies on the development of an ERP and cost sharing plan. FERC staff recommends in section 4.12.6 that PALNG provide periodic updates on the development of these plans for review and approval, and ensure they are in place prior to introduction of hazardous fluids. In addition, FERC staff recommends in section 4.12.6 that project facilities be subject to regular inspections throughout the life of the facility and would continue to require companies to file updates to the ERP.

4.12.6 Recommendations from FERC Preliminary Engineering and Technical Review

Based on our preliminary engineering and technical review of the reliability and safety of the Liquefaction Project, FERC staff recommends the following mitigation measures to the Commission for consideration to incorporate as possible conditions to an order. These recommendations would be implemented prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout the life of the facility to enhance the reliability and safety of the facility and to mitigate the risk of impact on the public.

- **<u>Prior to the end of the draft EIS comment period</u>, PALNG should file with the Secretary documentation demonstrating it has filed for an Aeronautical Study under 14 CFR 77 for all permanent structures, temporary construction equipment, and mobile objects that exceed the height requirements in 14 CFR 77.9.**

- **<u>Prior to initial site preparation</u>, PALNG should file with the Secretary documentation demonstrating it has received a determination of no hazard (with or without conditions) by DOT FAA for all permanent structures, temporary construction equipment, and mobile objects that exceed the height requirements in 14 CFR 77.9.**

- **<u>Prior to construction of final design</u>, PALNG should file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in Texas:**

  a. Site preparation drawings and specifications.

  b. LNG terminal structures and foundation design drawings and calculations (including prefabricated and field constructed structures).

  c. Seismic specifications for procured equipment.

  d. Quality control procedures to be used for civil/structural design and construction.

  In addition, PALNG should file, in its Implementation Plan, the schedule for producing this information.

- **<u>Prior to commencement of service</u>, PALNG should file with the Secretary a monitoring and maintenance plan, stamped and sealed by the professional engineer-of-record registered in Texas, for the perimeter levee which ensures the crest elevation relative to mean sea level will be maintained for the life of the facility considering berm settlement, subsidence, and sea level rise.**

Information pertaining to the following 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 submitted 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 **a minimum of 30 days** before approval to proceed is requested.

- **Prior to initial site preparation, PALNG should file an overall project schedule, which includes the proposed stages of the commissioning plan.**

- **Prior to initial site preparation, PALNG should file quality assurance and quality control procedures for construction activities.**

- **Prior to initial site preparation, PALNG should file procedures for controlling access during construction.**

- **Prior to initial site preparation, PALNG should develop an ERP (including evacuation) and coordinate procedures with the USCG; state, county, and local emergency planning groups; fire departments; state and local law enforcement; and appropriate federal agencies. This plan should include at a minimum:**

  a. designated contacts with state and local emergency response agencies;

  b. scalable procedures for the prompt notification of appropriate local officials and emergency response agencies based on the level and severity of potential incidents;

  c. procedures for notifying residents and recreational users within areas of potential hazard;

  d. evacuation routes/methods for residents and public use areas that are within any transient hazard areas along the route of the LNG marine transit;

  e. locations of permanent sirens and other warning devices; and

  f. an "emergency coordinator" on each LNG vessel to activate sirens and other warning devices.

  PALNG should notify the FERC staff of all planning meetings in advance and should report progress on the development of its ERP at 3‑month intervals.

- **Prior to initial site preparation, PALNG 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. PALNG should notify FERC staff of all planning meetings in advance and should report progress on the development of its Cost Sharing Plan at 3-month intervals.**

- **Prior to construction of final design, PALNG should file change logs that list and explain any changes made from the FEED provided in PALNG's application and filings. A list of all changes with an explanation for the design alteration should be provided and all changes should be clearly indicated on all diagrams and drawings.**

- **<u>Prior to construction of final design</u>, PALNG should file information/revisions pertaining to PALNG' response numbers 9, 11, 18, 19, 24, 28, 29, 30-33, 34, 36-41, 43-46, 54-55 of its January 29, 2018 filing and 52 and 57 of its February 7, 2018 filing, which indicated features to be included or considered in the final design.**

- **<u>Prior to construction of final design</u>, PALNG should file a plot plan of the final design showing all major equipment, structures, buildings, and impoundment systems.**

- **<u>Prior to construction of final design</u>, PALNG should file three-dimensional plant drawings to confirm plant layout for maintenance, access, egress, and congestion.**

- **<u>Prior to construction of final design</u>, PALNG should file drawings of the storage tank piping support structure and support of horizontal piping at grade including pump columns, relief valves, pipe penetrations, instrumentation, and appurtenances.**

- **<u>Prior to construction of final design</u>, PALNG should file a complete specification and drawings of the proposed LNG tank design and installation.**

- **<u>Prior to construction of final design</u>, PALNG should file an up-to-date equipment list, process and mechanical data sheets, and specifications. The specifications should include:**

  a. building Specifications (control buildings, electrical buildings, compressor buildings, storage buildings, pressurized buildings, ventilated buildings, blast resistant buildings);

  b. mechanical Specifications (piping, valve, insulation, rotating equipment, heat exchanger, storage tank and vessel, other specialized equipment);

  c. electrical and Instrumentation Specifications (power system specifications, control system specifications, safety instrument system [SIS] specifications, cable specifications, other electrical and instrumentation specifications);

  d. security and Fire Safety Specifications (security, passive protection, hazard detection, hazard control, firewater)

- **<u>Prior to construction of final design</u>, PALNG should file up-to-date process flow diagrams (PFDs) and piping and instrument diagrams (P&IDs) including vendor P&IDs. The PFDs should include heat and material balances. The P&IDs should include the following information:**

  a. Equipment tag number, name, size, duty, capacity, and design conditions.

  b. Equipment insulation type and thickness.

  c. Storage tank pipe penetration size and nozzle schedule.

  d. Valve high pressure side and internal and external vent locations.

  e. Piping with line number, piping class specification, size, and insulation type and thickness.

f. Piping specification breaks and insulation limits.

g. All control and manual valves numbered.

h. Relief valves with size and set points.

i. Drawing revision number and date.

- **<u>Prior to construction of final design</u>, PALNG should file P&IDs, specifications, and procedures that clearly show and specify the tie-in details required to safely connect subsequently constructed facilities with the operational facilities.**

- **<u>Prior to construction of final design</u>, PALNG 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 final design</u>, the engineering, procurement, and construction contractor should verify that the recommendations from the FEED Hazard Identification are complete and consistent with the requirements of the final design as determined by the engineering, procurement, and construction contractor.**

- **<u>Prior to construction of final design</u>, PALNG should file a HAZOP review prior to issuing the P&IDs for construction. A copy of the review, a list of the recommendations, and actions taken on the recommendations should be filed.**

- **<u>Prior to construction of final design</u>, PALNG should file the safe operating limits (upper and lower), alarm and shutdown set points for all instrumentation (e.g., temperature, pressures, flows, and compositions).**

- **<u>Prior to construction of final design</u>, PALNG should file cause-and-effect matrices for the process instrumentation, fire and gas detection system, and ESD system for review and approval. The cause-and-effect matrices should include alarms and shutdown functions, details of the voting and shutdown logic, and set points.**

- **<u>Prior to construction of final design</u>, PALNG should file an evaluation of ESD valve closure times. The evaluation should account for the time to detect an upset or hazardous condition, notify plant personnel, and close the ESD valve.**

- **<u>Prior to construction of final design</u>, PALNG should file an evaluation of dynamic pressure surge effects from valve opening and closure times and pump operations.**

- **<u>Prior to construction of final design</u>, PALNG should demonstrate that hazardous fluid 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 final design</u>, PALNG should specify that all drains from high pressure hazardous fluid systems are equipped with double isolation and bleed valves.**

- **<u>Prior to construction of final design</u>, PALNG should file electrical area classification drawings.**

- **<u>Prior to construction of final design</u>, PALNG 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).**

- **<u>Prior to construction of final design</u>, PALNG 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 final design</u>, PALNG should include layout and design specifications of the pig trap, inlet separation and liquid disposal, inlet/send-out meter station, and pressure control.**

- **<u>Prior to construction of final design</u>, PALNG should specify that piping and equipment that may be cooled with liquid nitrogen is to be designed for liquid nitrogen temperatures, with regard to allowable movement and stresses.**

- **<u>Prior to construction of final design</u>, PALNG should include LNG tank fill flow measurement with high flow alarm.**

- **<u>Prior to construction of final design</u>, PALNG should include BOG flow, tank density profile, and temperature profile measurement for each tank.**

- **<u>Prior to construction of final design</u>, PALNG should file the structural analysis of the LNG storage tank and outer concrete impoundment wall to demonstrate they are designed to withstand all loads and combinations.**

- **<u>Prior to construction of final design</u>, PALNG should file an analysis of the structural integrity of the outer containment of the full containment storage tanks when exposed to a roof tank top fire or adjacent tank top fire.**

- **<u>Prior to construction of final design</u>, PALNG should evaluate and utilize the minimum distance required for valve maintenance, between the LNG loading header and the first valve in the discharge piping to the loading arm.**

- **<u>Prior to construction of final design</u>, PALNG 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 final design</u>, PALNG should file detailed cooldown plans showing the piping flow paths, valve alignment, and instruments used to monitor the initial cooldown and filling of the LNG storage tanks.**

- **<u>Prior to construction of final design</u>, PALNG should include detailed procedures for import of LNG during the initial cooldown of the LNG storage tanks including detailed P&IDs with flow paths and valve alignment showing the position of valves and lockout/tagout devices.**

- **<u>Prior to construction of final design</u>, PALNG should file an evaluation on the need to install fixed toxic gas detection to detect H_2S releases from loss of containment from the acid gas piping system and potential release points (i.e., vents, relief valves, vent stacks, and thermal oxidizer stack).**

- **<u>Prior to construction of final design</u>, PALNG should file process simulation results for the deethanizer, depropanizer depressurized conditions to ensure the associated deethanizer, deepropanizer, reboiler, piping, and other associated equipment are adequately designed for settle out and upset conditions to prevent brittle facture of piping and associated equipment.**

- **<u>Prior to construction of final design</u>, PALNG should evaluate the minimum design metal temperature needed for the deethanizer, depropanizer, reboiler, and piping during upset/settleout conditions.**

- **<u>Prior to construction of final design</u>, PALNG should include a back pressure control valve at the outlet of the regenerator to control the regenerator at constant pressure.**

- **<u>Prior to construction of final design</u>, PALNG should include a thermal relief valve between the propane shutoff valves (XV-30687 and XV0-30686) to protect piping.**

- **<u>Prior to construction of final design,</u> PALNG should include a thermal relief valve between the ethane shutoff valves (XV0-30729 and XV0-30731) to protect piping.**

- **<u>Prior to construction of final design</u>, PALNG should include an automatic shutoff valve, actuated by low temperature in the dry flare knockout drum located on the drain line from the dry flare knockout drum to the blow case.**

- **<u>Prior to construction of final design</u>, PALNG should include details of the flare knockout drum heater and detailed procedures for draining flare knockout drums to a safe location.**

- **<u>Prior to construction of final design</u>, PALNG should file detailed calculations for the flow rate of the jockey pumps accounting for flow rate losses due to leaks or when drain valves are opened to ensure that system losses do not exceed the specified design flow rate of the jockey firewater pumps.**

- **<u>Prior to construction of final design</u>, PALNG should evaluate the need to install pressure relieving protection for flammable liquid piping segments (i.e., refrigerants, liquid hydrocarbons, condensate products) that can be isolated by valves in the event of a fire.**

- **<u>Prior to construction of final design</u>, PALNG should specify that all ESD valves are to be equipped with open and closed position switches connected to the Distributed Control System (DCS)/SIS.**

- **<u>Prior to construction of final design</u>, PALNG should file a drawing showing the location of the ESD buttons. ESD buttons should be easily accessible, conspicuously labeled, and located in an area which would be accessible during an emergency.**

- **Prior to construction of final design, PALNG should file drawings and specifications for vehicle barriers at each facility entrance for access control.**

- **Prior to construction of final design, PALNG should file an evaluation on the need to install turning lanes to minimize the risk of hazardous material truck and other vehicle incidents entering and exiting the facility from SH 87.**

- **Prior to construction of final design, PALNG should file an evaluation on the need for installing internal road vehicle protections (e.g., guard rails, barriers, and bollards) to protect transfer piping, pumps, and compressors, etc. and to ensure that they are located away from roadway or protected from inadvertent damage from vehicles.**

- **Prior to construction of final design, PALNG should file a projectile analysis for review and approval to demonstrate that the outer concrete impoundment wall of a full-containment LNG tank could withstand windborne projectiles. The analysis should detail the projectile speeds and characteristics and method used to determine penetration or perforation depths.**

- **Prior to construction of final design, PALNG should file security camera, intrusion detection, and lighting drawings. The security camera drawings should show the location, areas covered, and features of the camera (fixed, tilt/pan/zoom, motion detection alerts, low light, mounting height, etc.) to verify camera coverage of the entire perimeter with redundancies for cameras interior to the facility to enable rapid monitoring of the LNG plant. The intrusion detection drawings should show or note the location of the intrusion detection to verify it covers the entire perimeter of the LNG plant. The lighting drawings should show the location, elevation, type of light fixture, and lux levels of the lighting system.**

- **Prior to construction of final design, PALNG should file the details of the ESD system, including whether a plant-wide ESD button with proper sequencing and reliability would be installed or whether another system would be installed that is demonstrated through a human reliability analysis to provide a means to quickly and reliably shutdown the entire plant.**

- **Prior to construction of final design, PALNG should file an updated fire protection evaluation of the proposed facilities. A copy of the evaluation, a list of recommendations and supporting justifications, and actions taken on the recommendations should be filed.**

- **Prior to construction of final design, PALNG should file spill containment system drawings with dimensions and slopes of curbing, trenches, impoundments, and capacity calculations considering any foundations and equipment within impoundments, as well as the sizing and design of the down-comer that would transfer spills from the tank top to the ground-level impoundment system. The spill containment drawings should show containment for all hazardous fluids from the largest flow from a single line for 10 minutes or from the largest vessel or otherwise demonstrate spill containment would not significantly reduce the flammable vapor dispersion or radiant heat consequences of a spill.**

- **<u>Prior to construction of final design</u>, PALNG should specify the material of construction for the curbed areas, trenches, and impoundments as insulated concrete or otherwise demonstrate insulated concrete would not significantly reduce the flammable vapor dispersion or radiant heat consequences of a spill.**

- **<u>Prior to construction of final design</u>, PALNG should file an analysis of the localized hazards to operators from a potential liquid nitrogen release and should also provide spill containment and low oxygen detectors to mitigate liquid nitrogen releases.**

- **<u>Prior to construction of final design</u>, PALNG 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 and demonstrate potential releases resulting in an offsite impact could be detected by at least two detectors to allow for shutdown in less than 10 minutes. 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 final design</u>, PALNG should file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas of the hazard detectors when determining the lower flammable limit set points for CH_4, propane, butane, ethane, and condensate.**

- **<u>Prior to construction of final design</u>, PALNG should file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas of hazard detectors when determining the set points for toxic components such as aqueous ammonia, natural gas liquids and H_2S.**

- **<u>Prior to construction of final design</u>, PALNG should file a technical review of facility design that:**

  a. identifies all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and

  b. demonstrates that these areas are adequately covered by hazard detection devices and indicates how these devices would isolate or shutdown any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency.

- **<u>Prior to construction of the final design,</u> PALNG should file a building siting assessment to ensure plant buildings that are occupied or critical to the safety of the LNG plant are adequately protected from potential hazards involving fires and vapor cloud explosions.**

- **<u>Prior to construction of final design</u>, PALNG should file a drawing that includes smoke detection in occupied buildings.**

- **<u>Prior to construction of final design</u>, PALNG should file a drawing that includes hazard detection equipment suitable to detect high temperatures and smoldering combustion products in electrical buildings and control room buildings.**

- **Prior to construction of final design, PALNG should file a drawing that includes clean agent systems in the electrical switchgear and instrumentation buildings**.

- **Prior to construction of final design, PALNG should file facility plan drawings and a list of the fixed and wheeled dry-chemical, hand-held fire extinguishers, and other hazard control equipment. Plan drawings should clearly show the location by tag number and elevation of all fixed, wheeled, and hand-held extinguishers and demonstrate travel distances are along normal paths of access and egress and in compliance with NFPA 10, 15, and 17. 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.**

- **Prior to construction of final design, PALNG should file facility plan drawings showing the proposed location of the firewater and any foam systems. Plan drawings should clearly show the location of firewater and foam piping, post indicator valves, and the location and area covered by, each monitor, hydrant, hose, water curtain, deluge system, foam system, water-mist system, and sprinkler. The drawings should demonstrate that each process area, fire zone, or other sections of piping with several users can be isolated with post indicator valves and that firewater coverage is provided by at least two monitors or hydrants with sufficient firewater flow to cool exposed surfaces subjected to a fire. Drawings should also include piping and instrumentation diagrams of the firewater and foam systems.**

- **Prior to construction of final design, PALNG should file detailed calculations to confirm that the final fire water volumes would be accounted for when evaluating the capacity of the impoundment system during a spill and fire scenario.**

- **Prior to construction of final design, PALNG 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.**

- **Prior to construction of final design, PALNG should specify that the firewater pump shelter is designed with a removable roof for maintenance access to the firewater pumps.**

- **Prior to construction of final design, PALNG should file calculations for the firewater spray systems sized to provide cooling for mitigation of boiling-liquid-expanding-vapor explosions.**

- **Prior to construction of final design, PALNG should evaluate the fire water required for foam generation in calculating the total fire water required for 2 hours of supply.**

- **Prior to construction of final design, PALNG should file drawings and specifications for the structural passive protection systems to protect equipment and supports from cryogenic releases.**

- **Prior to construction of final design, PALNG should file a detailed quantitative analysis to demonstrate that adequate thermal mitigation would be provided for each significant component within the 4,000 BTU/ft2-hr zone from an impoundment, or**

provide an analysis that evaluates the consequences of pressure vessel bursts and boiling liquid expanding vapor explosions. Trucks at the truck transfer station should be included in the analysis. 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 to mitigate the heat absorbed by the vessel.

- **<u>Prior to construction of final design</u>, PALNG should file an evaluation of the voting logic and voting degradation for hazard detectors.**

- **<u>Prior to commissioning</u>, PALNG 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. PALNG should file documentation certifying that each of these milestones has been completed before authorization to commence the next phase of commissioning and startup will be issued.**

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

- **<u>Prior to commissioning</u>, PALNG should file a plan for clean-out, dry-out, purging, and tightness testing. This plan should address the requirements of the American Gas Association's Purging Principles and Practice, and should provide justification if not using an inert or non-flammable gas for clean-out, dry-out, purging, and tightness testing.**

- **<u>Prior to commissioning</u>, PALNG should file the procedures for pressure/leak tests which address the requirements of ASME BPVC section VIII and ASME B31.3. The procedures should include a line list of pneumatic and hydrostatic test pressures.**

- **<u>Prior to commissioning</u>, PALNG should file the operation and maintenance procedures and manuals, as well as safety procedures, hot work procedures and permits, abnormal operating conditions reporting procedures, simultaneous operations procedures, and management of change procedures and forms.**

- **<u>Prior to commissioning</u>, PALNG 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>, PALNG should maintain a detailed training log to demonstrate that operating staff has completed the required training.**

- **<u>Prior to commissioning</u>, PALNG should equip the LNG storage tank and adjacent piping and supports with permanent settlement monitors to allow personnel to observe and record the relative settlement between the LNG storage tank and adjacent piping. The settlement record should be reported in the semi-annual operational reports.**

- **<u>Prior to introduction of hazardous fluids</u>, PALNG should develop and implement an alarm management program to reduce alarm complacency and maximize the effectiveness of operator response to alarms.**

- **<u>Prior to introduction of hazardous fluids</u>, PALNG should file results of the LNG storage tank hydrostatic test and foundation settlement results. At a minimum, foundation settlement results should be provided thereafter annually.**

- **<u>Prior to introduction of hazardous fluids</u>, PALNG should complete and document all pertinent tests (Factory Acceptance Tests, Site Acceptance Tests, Site Integration Tests) associated with the DCS and SIS that demonstrates full functionality and operability of the system.**

- **<u>Prior to introduction of hazardous fluids</u>, PALNG should complete and document 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 introduction of hazardous fluids</u>, PALNG should complete and document a pre-startup safety review to ensure that installed equipment meets the design and operating intent of the facility. The pre-startup safety review should include any changes since the last hazard review, operating procedures, and operator training. A copy of the review with a list of recommendations, and actions taken on each recommendation, should be filed.**

- **<u>Prior to unloading or loading the first LNG commissioning cargo</u>, PALNG should request and receive written authorization from the Director of OEP. After production of first LNG, PALNG 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 <u>weekly</u> reports should also include the latest commissioning schedule, including projected and actual LNG production by each liquefaction train, LNG storage inventories in each storage tank, and the number of anticipated and actual LNG commissioning cargoes, along with the associated volumes loaded or unloaded. Further, the weekly reports should include a status and list of all planned and completed safety and reliability tests, work authorizations, and punch list items. Problems of significant magnitude should be reported to the FERC <u>within 24 hours</u>.**

- **<u>Prior to commencement of service</u>, PALNG should label piping with fluid service and direction of flow in the field, in addition to the pipe labeling requirements of NFPA 59A (2001).**

- **<u>Prior to commencement of service</u>, PALNG should provide plans for any preventative and predictive maintenance program that performs periodic or continuous equipment condition monitoring.**

- **<u>Prior to commencement of service</u>, PALNG should develop procedures for offsite contractors' responsibilities, restrictions, and limitations and for supervision of these contractors by PALNG staff.**

- **<u>Prior to commencement of service</u>, PALNG 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>, PALNG should request and receive written authorization from the Director of OEP. Such authorization would only be granted following a determination by the USCG, under its authorities under the Ports and Waterways Safety Act, the Magnuson Act, the MTSA of 2002, and the Safety and Accountability For Every Port Act, that appropriate measures to ensure the safety and security of the facility and the waterway have been put into place by PALNG or other appropriate parties.**

In addition, the following recommendations should apply <u>throughout the life of the facility</u>:

- **The facility should be subject to regular FERC staff technical reviews and site inspections on at least an annual basis or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, PALNG should respond to a specific data request including information relating to possible design and operating conditions that may have been imposed by other agencies or organizations. Up-to-date detailed P&IDs reflecting facility modifications and provision of other pertinent information not included in the semi-annual reports described below, including facility events that have taken place since the previously submitted semi-annual report, should be submitted.**

- **Semi-annual operational reports should be filed 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); and plant modifications, including future plans and progress thereof. Abnormalities should include, but not be limited to, unloading/loading/shipping problems, potential hazardous conditions from offsite vessels, storage tank stratification or rollover, geysering, storage tank pressure excursions, cold spots on the storage tanks, storage tank vibrations and/or vibrations in associated cryogenic piping, storage tank settlement, significant equipment or instrumentation malfunctions or failures, non-scheduled maintenance or repair (and reasons therefore), relative movement of storage tank inner vessels, hazardous fluids releases, fires involving hazardous fluids and/or from other sources, negative pressure (vacuum) within a storage tank, and higher than predicted boil off rates. Adverse weather conditions and the effect on the facility also should be reported. Reports should be submitted within 45 days after each period ending June 30 and December 31. In addition to the above items, a section entitled "Significant Plant Modifications Proposed for the Next 12 Months (dates)" should be included in the semi-annual operational reports. Such information would provide the FERC staff with early notice of anticipated future construction/maintenance at the LNG facilities.**

- **In the event the temperature of any region of any secondary containment, including imbedded pipe supports, becomes less than the minimum specified operating temperature for the material, the Commission should be notified <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 the FERC staff. In the event that an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification 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 the FERC staff within 24 hours. This notification practice should be incorporated into the liquefaction facility's emergency plan. Examples of reportable hazardous fluids-related incidents include:

a. fire;

b. explosion;

c. estimated property damage of $50,000 or more;

d. death or personal injury necessitating in-patient hospitalization;

e. release of hazardous fluids for 5 minutes or more;

f. unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of 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 from hazardous fluids transportation occurring at or en route to and from the LNG facility; or

m. **an event that is significant in the judgment of the operator and/or management even though it did not meet the above criteria or the guidelines set forth in an LNG 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 liquefaction facility to cease operations. Following the initial company notification, the FERC staff would determine the need for a separate follow-up report or follow up in the upcoming semi-annual operational report. All company follow-up reports should include investigation results and recommendations to minimize a reoccurrence of the incident.

4.12.7 Conclusions on LNG Facility and Carrier Reliability and Safety

As part of the NEPA review and NGA determinations, Commission staff assesses the potential impact to the human environment in terms of safety and whether the proposed facilities would be in the public interest based on whether it would operate safely, reliably, and securely.

As a cooperating agency, the DOT assists the FERC by determining whether PALNG's proposed design would meet the DOT's 49 CFR 193 Subpart B siting requirements. The DOT reviewed information submitted by PALNG and on March 20, 2018, provided a letter to FERC staff stating that the DOT had no objection to PALNG's methodology to comply with the 49 CFR 193 Subpart B siting requirements for the proposed LNG liquefaction facilities, but would need to resolve legal control of exclusion zones. DOT would provide a LOD on the project's compliance with 49 CFR 193 Subpart B, which includes legal control of exclusion zones. This would be provided to the Commission as further consideration to the Commission on its decision and final action on the project application. If the facility is authorized and constructed, the facility would be subject to the DOT's inspection and enforcement program and final determination of whether a facility is in compliance with the requirements of 49 CFR 193 would be made by the DOT staff.

As a cooperating agency, the USCG also assisted the FERC staff by reviewing the proposed LNG terminal and the associated LNG vessel traffic. The USCG reviewed a WSA submitted by PALNG that focused on the navigation safety and maritime security aspects of LNG vessel transits along the affected waterway. On September 11, 2015, the USCG issued a LOR to FERC staff indicating the Sabine Neches Ship Channel would be considered suitable for accommodating the type and frequency of LNG marine traffic associated with the Liquefaction Project, based on the WSA and in accordance with the guidance in the USCG's NVIC 01-11. If the Liquefaction Project is authorized and constructed, the facilities would be subject to the USCG's inspection and enforcement program to ensure compliance with the requirements of 33 CFR 105 and 33 CFR 127.

FERC staff conducted a preliminary engineering and technical review of the PALNG design, including potential external impacts based on the site location. Based on FERC staff review, FERC staff recommends the Commission consider incorporating into the order a number of proposed mitigation measures and continuous oversight prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout life of the facility to enhance the reliability and safety of the facility to mitigate the risk of impact on the public. With the incorporation of these mitigation measures and oversight, FERC staff believe that the PALNG Terminal design would include acceptable layers of protection or safeguards that would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public.

4.12.8 Pipeline Safety Standards

The transportation of natural gas by pipeline involves some incremental risk to the public due to the potential for an 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. To increase safety and make the CH_4 detectable by odor, PAPL would add a chemical odorant, such as Mercaptan, that produces the familiar "natural gas smell."

CH_4 has an auto-ignition temperature of 1,000 °F and is flammable at concentrations between 5.0 percent and 15.0 percent in air. At atmospheric temperatures, CH_4 is buoyant and disperses rapidly in air. An unconfined mixture of CH_4 and air is 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.

The DOT is mandated to provide pipeline safety under 49 U.S.C. 601. The DOT's PHMSA administers the national regulatory program to ensure the safe transportation of natural gas and other hazardous materials by pipeline. PHMSA develops safety regulations and other approaches to risk management that ensure safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Many of the regulations are written as performance standards that set the level of safety to be attained and allow the pipeline operator to use various technologies to achieve safety. The DOT pipeline standards are published in 49 CFR 190-199. PAPL has stated each project's facilities would be designed, constructed, operated, and maintained in accordance with Part 192, which specifically addresses the minimum federal safety standards for transportation of natural gas by pipeline.

PHMSA ensures that people and the environment are protected from the risk of pipeline incidents. This work is shared with state agency partners and others at the federal, state, and local level. The DOT provides for a state agency to assume all aspects of the safety program for intrastate facilities by adopting and enforcing, at a minimum, the federal standards. A state may also act as DOT's agent to inspect interstate facilities within its boundaries; however, DOT is ultimately responsible for enforcement actions.

Under a *Memorandum of Understanding on Natural Gas Transportation Facilities* (Memorandum) dated January 15, 1993, between the DOT and FERC, the DOT has the exclusive authority to promulgate federal safety standards used in the transportation of natural gas. Section 157.14(a)(9)(vi) of FERC's regulations require that an applicant certify that it 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 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 DOT standards. If the Commission becomes aware of an existing or potential safety problem, there is a provision in the Memorandum to promptly alert the DOT. The Memorandum also provides for referring complaints and inquiries made by state and local governments and the public involving safety matters related to pipelines under the Commission's jurisdiction. FERC also participates as a member of DOT's Technical Pipeline Safety Standards Committee, which determines if proposed safety regulations are reasonable, feasible, and practicable.

The DOT also defines area classifications, based on population density near pipeline facilities, and specifies more rigorous safety requirements for populated areas. The class location unit is an area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. The four area classifications are defined below:

Class 1 – Location with 10 or fewer buildings intended for human occupancy.

Class 2 – Location with more than 10 but less than 46 buildings intended for human occupancy.

Class 3 – Location with 46 or more buildings intended for human occupancy or where the pipeline lies within 100 yards of any building, or small well-defined outside area occupied by 20 or more people on at least 5 days a week for 10 weeks in any 12-month period.

Class 4 – Location where buildings with four or more stories aboveground are prevalent.

Class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. For example, pipelines constructed on land in Class 1 locations must be installed with a minimum depth of cover of 30 inches in normal soil and 18 inches in consolidated rock. Class 2, 3, and 4 locations, as well as drainage ditches of public roads and railroad crossings, require a minimum cover of 36 inches in normal soil and 24 inches in consolidated rock.

Class locations also specify the maximum distance to a sectionalizing block valve (i.e., 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 locations). Part 192.179 specifies the maximum distance from a point on a pipeline to a sectionalizing block valve: each point on a pipeline in a Class 1 location must be within 10 miles of a block valve. In Class 2 locations, the distance is 7.5 miles; in Class 3 and 4 locations, the distance is 4 and 2.5 miles respectively. Pipe wall thickness and pipeline design pressures, hydrostatic test pressures, MAOP, inspection and testing of welds, and frequency of pipeline patrols and leak surveys also must conform to higher standards in more 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. Class locations for the pipeline projects have been determined based on the relationship of the pipeline centerline to other nearby structures and manmade features (see table 4.12.1-1).

TABLE 4.12.1-1

Lengths of Area Classifications Crossed by the Texas Connector and Louisiana Connector Projects

Project/Facility	Class 1 (miles)	Class 2 (miles)	Class 3 (miles)
TEXAS CONNECTOR PROJECT			
Northern Pipeline	0.0-15.4	25.6-26.6	15.4-15.5
	15.5-20.3		20.3-20.5
	20.5-25.6		
Southern Pipeline	0.0-2.3		2.3-2.6
	2.6-6.9		6.9-7.6
FGT Lateral	1.0-1.8	0.0-1	1.8-1.8
GTS Lateral	0.0-0.9		0.9-1.0
	1.0-1.3		
HPL Lateral	0.0-1.0		
KMLP Lateral			0.0-0.1
NGPL Lateral	0.0-0.2		

TABLE 4.12.1-1 (cont'd) **Lengths of Area Classifications Crossed by the Texas Connector and Louisiana Connector Projects**			
Project/Facility	Class 1 (miles)	Class 2 (miles)	Class 3 (miles)
NGPL Lateral to Existing Meter Station	0.0-<0.1		
TETCO Lateral	<0.1-0.1	0.0-<0.1	
Texas Connector Project Total	**35.2**	**2.0**	**1.5**
LOUISIANA CONNECTOR PROJECT			
Mainline	0.0-40.1	40.1-42.1	44.9-46.0
	42.1-44.2	44.2-44.9	51.6-51.9
	48.9-50.3	46.0-48.9	
	53.2-54.6	50.3-51.6	
	57.7-59.8	51.9-53.2	
	60.3-75.5	54.6-57.7	
	77.5-79.2	59.8-60.3	
	80.6-88.6	75.5-77.5	
	91.2-96.1	79.2-80.6	
	98.1-98.7	88.6-91.2	
	100.8-102.8	96.1-98.1	
	104.4-120.0	98.7-100.8	
	122.0-122.8	102.8-104.4	
	124.6-130.9	120.0-122.0	
		122.8-124.6	
Centana Tie-In	0.0-0.1		
CS Lateral		0.0-<0.1	
TETCO Tie-In		0.0-<0.1	
TGP Lateral and Tie-In	0.0-<0.0		
EGAN Lateral and Tie-In	0.0-0.1		
Pine Prairie Lateral and Tie-In	0.0-0.1		
Texas Gas Lateral and Tie-In	0.0-0.1		
ANR Lateral and Tie-In	0.0-<0.1		
CGT Tie-In	0.0-<0.1		
Louisiana Connector Project Total	**102.6**	**27.3**	**1.4**

[a] The straight-line distance between consecutive mileposts may be greater than or less than 5,280 feet due to the adoption of route alternatives and variations. The mileposts should be considered as reference points only.

Most of the pipeline routes would be within a Class 1 area. Therefore, in these locations for example, the pipeline would be constructed to meet the Class 1 standards of a minimum coverage of 30 inches in normal soil and 18 inches in consolidated rock. If a subsequent increase in population density adjacent to the right-of-way results in a change in class location for the pipelines, PAPL would reduce the MAOP or replace the segment with pipe of sufficient grade and wall thickness, if required to comply with DOT requirements for the new class location.

In 2002, Congress passed an act to strengthen the nation's pipeline safety laws. The Pipeline Safety Improvement Act of 2002 (HR 3609) was passed by Congress on November 15, 2002 and signed into law by the President in December 2002. Since December 17, 2004, gas transmission operators are required to develop and follow a written integrity management program that contains all the elements described in 49 CFR 192.911 and addresses the risks on each covered transmission pipeline segment.

Specifically, the law requires pipeline operators to establish an integrity management program which applies to all high consequence areas (HCA). The DOT (68 FR 69778, 69 FR 18228, and 69 FR 29903) defines HCAs as they relate to the different class zones, potential impact circles, or areas containing an identified site as defined in 49 CFR 192.903.

The OPS published a series of rules from August 6, 2002, to May 26, 2004, (69 FR 29903) that defines HCAs where a gas pipeline accident could do considerable harm to people and their property and require an integrity management program to minimize the potential for an accident. This definition satisfies, in part, the Congressional mandate in 49 USC 60109 for OPS to prescribe standards that establish criteria for identifying each gas pipeline facility in a high-density population area.

The HCAs may be defined in one of two ways. In the first method, an HCA includes any of the following:

- Current Class 3 and 4 locations.
- Any area in Class 1 or 2 where the potential impact radius[69] is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle.[70]
- Any area in Class 1 or 2 where the potential impact circle includes an identified site.

An "identified site" is an outside area or open structure that is occupied by 20 or more persons on at least 50 days in any 12-month period; a building that is occupied by 20 or more persons on at least 5 days a week for any 10 weeks in any 12-month period; or a facility that is occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate.

In the second method, an HCA includes any area within a potential impact circle that contains either of the following:

- 20 or more buildings intended for human occupancy.
- An identified site.

Once a pipeline operator has determined the HCAs along its pipeline, it must apply the elements of its integrity management program to those sections of the pipeline within HCAs. DOT regulations specify the requirements for the integrity management plan in Subpart O of Part 192, Gas Transmission Pipeline Integrity Management.

Table 4.12.1-2 lists the HCAs for the pipeline projects, which have been determined based on the relationship of the pipeline centerline to nearby structures and identified sites. No HCAs are found along the HPL Lateral associated with the Texas Connector Project or any lateral associated with the Louisiana Connector Project.

69 The potential impact radius is calculated as the product of 0.69 and the square root of the MAOP of the pipeline in pisg multiplied by the square of the pipeline diameter in inches.

70 The potential impact circle is a circle of radius equal to the potential impact radius.

TABLE 4.12.1-2

High Consequence Areas Crossed by the Texas Connector and Louisiana Connector Projects

Project/Facility	Begin Milepost	End Milepost	Length (miles)
TEXAS CONNECTOR PROJECT			
Northern Pipeline	15.4	16.0	0.6
	20.2	21.2	1.0
	21.5	21.7	0.2
	21.7	22.2	0.5
Southern Pipeline	2.3	2.7	0.4
	3.2	3.7	0.5
	6.8	7.6	0.8
FGT Lateral	1.5	1.6	0.1
	1.8	1.8	<0.1
GTS Lateral	0.0	0.1	0.1
	0.8	1.3	0.5
KMLP Lateral	0.0	0.1	0.1
NGPL Lateral	0.1	0.2	0.1
NGPL Lateral to Existing Meter Station	0.0	<0.1	<0.1
TETCO Lateral	0.0	0.1	0.1
Texas Connector Project Total			**5.0**
LOUISIANA CONNECTOR PROJECT			
Mainline	44.9	46.0	1.1
	51.6	51.9	0.3
Louisiana Connector Project Total			**1.4**

[a] The straight-line distance between consecutive mileposts may be greater than or less than 5,280 feet due to the adoption of route alternatives and variations. The mileposts should be considered as reference points only.

The pipeline and aboveground facilities would be designed, constructed, operated, and maintained in accordance with the DOT's Minimum Federal Safety Standards in 49 CFR 192. The general construction methods that PAPL would implement to ensure the safety of the projects are described in section 2.4, including welding, inspection, and integrity testing procedures.

Under 49 CFR 192.615, each pipeline operator also must establish an emergency plan that includes procedures to minimize the hazards in a natural gas pipeline emergency. PAPL would develop and implement an ERP that would be used for the entire system. Key elements of the plan would include procedures for the following:

- Receiving, identifying, and classifying emergency events, gas leakage, fires, explosions, and natural disasters.
- Establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response.
- Emergency system shutdown and safe restoration of service.
- Making personnel, equipment, tools, and materials available at the scene of an emergency.
- Protecting people first and then property, and making them safe from actual or potential hazards.

In accordance with DOT regulations, the proposed pipelines would be regularly inspected for leakage as part of scheduled operations and maintenance, including the following:

- Physically walking and inspecting the pipeline corridors periodically.

- Conducting fly-over inspections of the right-of-way as required.
- Inspecting valves and maintaining compressor engines.
- Conducting leak surveys at least once every calendar year or as required by regulations.

During inspections, employees would look for signs of unusual activity on the right-of-way and would immediately respond to assess the nature of the activity and remedy with prescribed corrective action.

In addition to the DOT-required surveys described previously, PAPL would monitor its pipeline system from its existing Gas Control Center. This control center monitors the pipeline system with sophisticated computer and telecommunications equipment that can detect fluctuations and control flows. Using this equipment, the control center can detect pressure drops along the pipelines and stop the flow of gas to the problem area by isolating sections along the pipe. The control center operates 24 hours a day, 7 days a week.

To prevent corrosion, the new pipelines and laterals would be cathodically protected[71] through a rectifier with a deep well anode system (see section 2.6). PAPL personnel would check the voltage and amperage at regular intervals as well as the pipe-to-soil potentials and rectifiers. In addition, annual surveys would be completed, as described above.

Pipeline markers identifying the owner of the pipe and a 24-hour telephone number would be placed for "line of sight" visibility along the entire pipeline length, except in active agricultural crop locations and in waterbodies in accordance with DOT requirements.

Safety standards specified in Part 192 require that each operator establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a natural gas pipeline emergency, and to coordinate mutual assistance in responding to emergencies. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public officials.

PAPL's operating personnel would also attend training for emergency response procedures and plans. During construction of the pipelines, PAPL would continue to implement the measures in its ERP associated with the existing pipelines. PAPL would review and revise its ERP prior to placing the new facilities in operation.

PAPL would also meet with public authorities and local emergency planning entities, which include fire departments, police departments, first responders, excavators, and public officials, to review plans and would work with these entities to communicate the specifics about the pipeline facilities in the area and the need for emergency response including community notification in the event of an incident. PAPL would also meet periodically with the groups to review the plans and revise its plans when necessary. Key components of this liaison program consist of the following:

1. Periodic safety training.
2. Special informational meetings and training at the request of the Parish or County.

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71 Cathodic protection is a technique to reduce corrosion (rust) of the natural gas pipeline that includes the use of an induced current and/or a sacrificial anode that corrodes preferentially.

3. Periodic literature distribution listing emergency telephone numbers and other pertinent data.

To enable PAPL to quickly establish contact with police or fire departments and public officials in the event of an emergency at any location on the pipeline system, a current listing of their telephone numbers will be maintained. This listing is reviewed on a periodic basis and necessary revisions are made. Local emergency planning personnel would be involved in any operator-simulated emergency exercises and post-exercise critiques, if conducted. PAPL would use all available, reasonable, and relevant means to support the pipeline and facilities if an emergency occurs.

PAPL would establish and maintain liaison with appropriate fire, police, and public officials in a variety of ways. PAPL's annual communications would accomplish the following:

- Ascertain how the officials may be able to assist PAPL during an emergency, including the determination of jurisdiction and/or responsibility with resources that may be involved in a response to an emergency.
- Acquaint the officials with how PAPL responds to an emergency on its pipeline system.
- Notify the officials of the types of pipeline emergencies for which they may be contacted.
- Inform them how PAPL, in working with their departments, will cooperate in mutually assisting in protecting life or property during an emergency.
- Inform them of the purpose of pipeline markers and the information contained on them.
- Inform them of the pipeline location information and the availability of the National Pipeline Mapping System;

PAPL's communications with local emergency responders may involve individual meetings, group meetings, or direct mailings.

4.12.9 Pipeline Accident Data

The DOT requires all operators of natural gas transmission pipelines to notify the National Response Center at the earliest practicable moment following the discovery of an incident and to submit a report within 20 days to the PHMSA. Incidents are defined as any leaks that involve any of the following:

- Death or personal injury requiring hospitalization.
- Property damage, including cost of gas lost, of more than $50,000, in 1984 dollars.[72]
- A release of 5 barrels or more of a highly volatile liquid or 50 barrels or more of other liquid.
- An unintended fire or explosion.

Incidents may also include events that are significant in the judgment of the operator, even though they did not meet the criteria above. During the 20-year period from 1997 through 2016, a total of 1,035

72 $50,000 in 1984 dollars is equivalent to $120,111 in 2017 (Bureau of Labor Statistics, 2017).

significant incidents were reported on the more than 315,000 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 4.12.2-1 provides a distribution of the causal factors as well as the number of each incident by cause from 1997 to 2016.

The dominant causes of pipeline incidents from 1997 to 2016 were corrosion, excavation, and pipeline material, weld, or equipment failure, constituting 69.0 percent of all significant incidents. The pipelines included in the data set in table 4.12.2-1 vary widely in terms of age, diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline.

TABLE 4.12.2-1

Natural Gas Transmission Pipeline Significant Incidents by Cause (1997-2016) [a]

Cause	Number of Incidents	Percentage
Corrosion [b]	183	17.7
Excavation	193	18.6
Pipeline material, weld, or equipment failure	338	32.7
Natural force damage	86	8.3
Outside Force [c]	63	6.1
Incorrect operation	42	4.1
All other causes [d]	130	12.6
Total	**1,035**	**100**

[a] All data gathered from PHMSA Serious Incident files, February 2017.
[b] Includes third-party damage.
[c] Fire, explosion, vehicle damage, previous damage, intentional damage.
[d] Miscellaneous causes or other unknown causes.
Source: DOT, 2016a.

The frequency of significant incidents is strongly dependent on pipeline age. Older pipelines have a higher frequency of corrosion incidents because corrosion is a time-dependent process. Jones et al. (1986) compared reported incidents with the presence or absence of cathodic protection and protective coatings. The results of that study, summarized in table 4.12.2-2, indicated that corrosion control was effective in reducing the incidence of failures caused by external corrosion. The use of both an external protective coating and a cathodic protection system, required on all pipelines installed after July 1971, significantly reduces the corrosion rate compared to unprotected or partially protected pipe. The data also indicate that cathodically protected pipe without a protective coating has a higher corrosion rate than unprotected pipe. This anomaly reflects the retrofitting of cathodic protection to actively corroding spots on pipes.

TABLE 4.12.2-2

Incidents Caused by External Corrosion and Level of Protection (1970 through June 1984)

Corrosion Control	Incidents per 1,000 Miles per Year (percent)
None – bare pipe	0.42
Cathodic protection only	0.97
Coated only	0.40
Coated and cathodic protection	0.11

Source: Jones et al., 1986

Older pipelines also 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 are more easily crushed or broken by mechanical equipment or earth movements.

According to the data in table 4.12.2-1, outside force, excavation, and natural forces were the causes in 33.0 percent of significant pipeline incidents from 1997 to 2016. These result from the encroachment of mechanical equipment such as bulldozers and backhoes; earth movements due to soil settlement, washouts, or geological hazards; and weather effects such as winds, storms, and thermal strains; and willful damage. Table 4.12.2-3 provides a breakdown of outside force incidents by cause.

TABLE 4.12.2-3

Outside Forces Incidents by Cause [a] (1997-2016)

Cause	Number of Incidents	Percent of All Incidents
Third party excavation damage	154	47.0
Operator/Contractor excavation damage	24	7.3
Unspecified excavation damage/Previous damage	4	1.2
Heavy Rain/Floods	25	7.6
Earth Movement	28	8.5
Lightning/Temperature/High Winds	24	7.3
Natural force	9	2.7
Vehicle (not engaged with excavation)	34	10.4
Fire/Explosion	9	2.7
Previous mechanical damage	5	1.5
Fishing or maritime activity	1	0.3
Intentional damage	1	0.3
Unspecified/Other outside force	10	3.0
Total	**328**	**100**

[a] Excavation, Outside Force, and Natural Force from table 4.12.2-1.
Source: DOT, 2016a.

Since 1982, operators have been required to participate in "One Call" public utility programs in populated areas to minimize unauthorized excavation activities near 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. PAPL would participate in the One Call systems for both Texas and Louisiana.

4.12.10 Impact on Public Safety

The service incident data summarized in table 4.12.2-1 include pipeline failures of all magnitudes with widely varying consequences. Table 4.12.3-1 presents the average annual fatalities that occurred on natural gas transmission lines between 2005 and 2016. The data have been separated into employees and nonemployees to better identify a fatality rate experienced by the public. Fatalities among the public averaged one per year over the 12-year period from 2005 to 2016.

Most fatalities from natural gas pipelines are associated with local distribution pipelines. These pipelines are not regulated by FERC; they distribute natural gas to homes and businesses after transportation through interstate transmission pipelines. In general, these distribution lines are smaller-diameter pipes and/or plastic pipes that are more susceptible to damage. In addition, local distribution systems do not have large rights-of-way and pipeline markers common to FERC-regulated interstate natural gas transmission pipelines.

TABLE 4.12.3-1

Injuries and Fatalities – Natural Gas Transmission Pipelines (2005-2016)

Year	Injuries		Fatalities	
	Employees	Public	Employees	Public
2005	3	2	0	0
2006	2	1	2	1
2007	6	1	1	1
2008	3	2	0	0
2009	4	7	0	0
2010 [a]	3	58	0	10
2011	1	0	0	0
2012	1	6	0	0
2013	0	2	0	0
2014	1	0	1	0
2015	1	13	4	2
2016	2	1	2	1

[a] All of the public injuries and fatalities in 2010 were due to the Pacific Gas and Electric pipeline rupture and fire in San Bruno, California on September 9, 2010.

Source: DOT, 2016b.

The nationwide totals of accidental fatalities from various anthropogenic and natural hazards are listed in table 4.12.3-2 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. As indicated in table 4.12.3-2, the number of fatalities associated with natural gas facilities is much lower than the fatalities from natural hazards such as lightning, tornados, floods, earthquakes, etc.

TABLE 4.12.3-2

Nationwide Accidental Deaths [a]

Type of Accident	Annual No. of Deaths
All accidents	136,053
Motor vehicle	35,398
Poisoning	42,032
Falls	31,959
Drowning	3,406
Fire, smoke inhalation, burns	2,701
Floods [b]	176
Lightning [b]	27
Tornado [b]	36
Natural gas distribution lines [c]	11
Natural gas transmission pipelines [c]	2

[a] All data, unless otherwise noted, reflects 2014 statistics from: U.S. Department of Health and Human Services, CDC, National Center of Health Statistics, National Vital Statistics System, 2017.

[b] Reflects 2015 statistics from: U.S. Department of Commerce, NOAA, National Weather Service, 2017.

[c] 20-year average, 1997-2016. DOT, 2016c; d.

The available data show that natural gas transmission pipelines continue to be a safe, reliable means of energy transportation. From 1997 to 2016, there were an average of 52 significant incidents and 2 fatalities per year. The number of significant incidents distributed over the more than 315,000 miles of natural gas transmission pipelines indicates the risk is low for an incident at any given location. The rate of total fatalities for the nationwide natural gas transmission lines in service is 0.01 per year per 1,000 miles of pipeline. Using this rate, implementing the proposed 38.8-mile-long project might result in a fatality (either an industry employee or a member of the public) on the pipeline every 2,578 years. The operation of the project would represent only a slight increase in risk to the nearby public.

4.12.11 Terrorism and Security Issues

Safety and security concerns have changed the way pipeline operators as well as regulators must consider terrorism, both in approving new projects and in operating existing facilities. The DHS is tasked with the mission of coordinating the efforts of all executive departments and agencies to detect, prepare for, prevent, protect against, respond to, and recover from terrorist attacks within the United States. Among its responsibilities, the DHS oversees the Homeland Infrastructure Threat and Risk Analysis Center, which analyzes and implements the National Critical Infrastructure Prioritization Program that identifies and lists Tier 1 and Tier 2 assets. The Tier 1 and Tier 2 lists are key components of infrastructure protection programs and are used to prioritize infrastructure protection, response, and recovery activities. The Commission, in cooperation with other federal agencies, industry trade groups, and interstate natural gas companies, is working to improve pipeline security practices, strengthen communications within the industry, and extend public outreach in an ongoing effort to secure pipeline infrastructure.

The Commission, like other federal agencies, is faced with a dilemma in how much information can be offered to the public while still providing a significant level of protection to the facility. Consequently, the Commission has taken measures to limit the distribution of information to the public regarding facility design to minimize the risk of sabotage. Facility design and location information has been removed from FERC's website to ensure that sensitive information filed as Critical Energy Infrastructure Information is not readily available to the public (Docket No. RM06-23-000, issued October 30, 2007 and effective as of December 14, 2007).

The likelihood of future acts of terrorism or sabotage occurring at the PAPL facilities, or at any of the myriad natural gas pipeline or energy facilities throughout the United States, is unpredictable given the disparate motives and abilities of terrorist groups. Further, the Commission, in cooperation with other federal agencies, industry trade groups, and interstate natural gas companies, is working to improve pipeline security practices, strengthen communications within the industry, and extend public outreach in an ongoing effort to secure pipeline infrastructure.

In accordance with the DOT surveillance requirements, PAPL would incorporate air and ground inspection of its proposed facilities into its inspection and maintenance program. Security measures at the new aboveground facilities would include secure fencing.

Despite the ongoing potential for terrorist acts along any of the nation's natural gas infrastructure, the continuing need for the construction of these facilities is not eliminated. Given the continued need for natural gas conveyance and the unpredictable nature of terrorist attacks, the efforts of the Commission, the DOT, and the Office of Homeland Security to continually improve pipeline safety would minimize the risk of terrorist sabotage of the project to the maximum extent practical, while still meeting the nation's natural gas needs. Moreover, the unpredictable possibility of such acts does not support a finding that these particular projects should not be constructed.

4.13 CUMULATIVE IMPACTS

In accordance with NEPA, we considered the cumulative impacts of the Projects when combined with other projects or actions in the area. Cumulative impacts represent the incremental effects of a proposed action when added to impacts associated with past, present, or reasonably foreseeable future projects, regardless of what agency or person undertakes such other actions. Although the individual impact of each separate project may be minor, the additive or synergistic effects of multiple projects could be significant. Consistent with CEQ guidelines, we have aggregated past actions that helped shape the environment into what it is today into our discussion of the affected environment in section 4.0. Therefore, present and reasonably foreseeable future actions are discussed in this section.

This cumulative impacts analysis uses an approach consistent with the methodology set forth in relevant guidance (CEQ, 1997, 2005; EPA, 1999). Under these guidelines, inclusion of actions within the analysis is based on identifying commonalities between the impacts that would result from the Projects and the impacts likely to be associated with other potential projects.

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 Projects is a major predictor of where cumulative impacts would most likely result. In general, the closer another action is to the Projects, 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 Projects.

TABLE 4.13-1

Geographic Scope by Resource for Cumulative Impacts Associated with the Projects

Resource	Geographic Scope	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 Projects.
Groundwater, Surface Water, Wetlands, Aquatic Resources, Essential Fish Habitat	Hydrologic unit code (HUC) 10 watersheds	Impacts on groundwater and surface water resources could reasonably extend throughout a HUC-10 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, as could the related impacts on aquatic resources and fisheries.
Vegetation, Wildlife, Special Status Species	HUC-10 watersheds	Consideration of impacts within a HUC-10 watershed sufficiently accounts for impacts on vegetation and wildlife (including special status species) that would be directly affected by construction activities and for indirect impacts such as changes in habitat availability and displacement of transient species.
Land Use	Construction workspaces (land use) and within 0.25 mile of the Projects (recreation)	Impacts on general land uses would be restricted to the construction workspaces and the immediate surrounding vicinity up to 0.25 mile where indirect impacts could occur.
Visual Resources	Within 5 miles of the Liquefaction Project and within 0.5 mile of the Texas Connector and Louisiana Connector Projects	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.

TABLE 4.13-1 (cont'd)		
Geographic Scope by Resource for Cumulative Impacts Associated with the Projects		
Resource	Geographic Scope	Justification for Geographic Scope
Socioeconomics	County and/or Parish	The geographic scope of potential impact for socioeconomics was considered to include the counties and parishes affected by the Projects where most workers would be expected to reside during construction and operation of the Projects. Affected counties and parishes would experience the greatest impacts associated with employment, housing, public services, transportation, traffic, property values, economy and taxes, and environmental justice.
Cultural Resources	Overlapping impacts within the project footprint (direct) and within 164 feet of Projects (indirect)	The impact area for direct effects (physical) includes areas subject to ground disturbance, while for indirect effects (visual or audible) it includes aboveground ancillary facilities or other project elements that are visible from historic properties in which the setting contributes to their NRHP eligibility.
Air Quality - Construction	Within 0.25 mile of the Projects pipeline components, and AQCR focused around the liquefaction facility and compressor stations	Air emissions during construction would be limited to vehicle and construction equipment emissions and dust, and would be localized to the Projects construction sites.
Air Quality – Operations	50 kilometers (about 31.1 miles) from the Liquefaction Project, the Texas Connector South Compressor Station, and the Louisiana Connector Project's compressor station	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*.
Noise – Construction	NSAs within 0.25 mile of any construction and within 0.5 mile of the liquefaction facility, compressor stations, HDDs, and pile driving.	Areas in the immediate proximity of pipeline or aboveground facility construction activities would have the potential to be affected by construction noise. NSAs within 0.5 mile of an HDD or pile driving could be cumulatively affected if other projects had a concurrent impact on the NSA.
Noise – Operations	NSAs within 1 mile of a noise-emitting permanent aboveground facility.	Noise from the Projects' permanent aboveground facilities could result in cumulative noise impacts on NSAs within 1 mile.
Reliability and Safety	Area adjacent to and vicinity of Liquefaction Project. Within 660 feet of the pipeline centerline. General vicinity of the Projects 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 Projects.

To avoid unnecessary discussions of insignificant impacts and projects, and to adequately address and accomplish the purposes of this analysis, the cumulative impacts analysis for the Projects was conducted using the following guidelines.

Projects and activities included in this analysis are generally those of comparable magnitude or nature of impact as the Projects and impact the same resources as the Projects. As such, this would include other utility projects of a similar linear nature. For the most part, this is possible when other projects are within the same general location as the Projects (i.e., within one or more of the cumulative impacts area listed in table 4.13-1). The effects of more distant projects generally are not assessed because their impacts would typically diminish with distance and, thus, would not significantly contribute to impacts in the Projects area. Certain exceptions may be made where a resource is regionally or nationally rare or unique and where concern for a cumulative impact is substantial. For example, an exception is air quality, which can affect larger areas; thus, the geographic scope for air quality is larger than that of other resources (see table 4.13-1 and the associated discussion regarding resource-specific geographic scopes). Per EPA guidelines, project-specific analyses are usually conducted on the scale of counties, forest management units, or installation boundaries, whereas cumulative effects analysis should be conducted on the scale of human communities, landscapes, watersheds, or airsheds. The analysis also includes the proposed nonjurisdictional facilities associated with the Projects (see section 2.1.4).

The future timeframe within which another planned or proposed project could result in a cumulative impact relative to the Projects depends in part on whether the impacts are temporary, short term, long term, or permanent. Once the effects cease, there is no longer a cumulative effect associated with the Projects. As discussed in the preceding environmental analysis, most Projects impacts are temporary or short term. Notable exceptions are forest clearing and operational air emissions, which may be long term or permanent. PALNG and PAPL would request to place the facilities into service following a determination that restoration is proceeding satisfactorily. Past projects, including roads and waterways, electric transmission lines, pipelines, agriculture, and commercial and residential development, have and continue to cumulatively affect the lands that would be affected by the Projects. 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.

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 Projects. The potential for cumulative impacts associated with the Project would be greatest during the construction phase for the pipelines and throughout construction and operation for the liquefaction facilities. 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 liquefaction 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, which may be contingent on economic conditions, availability of financing and/or the issuance of permits; or projects for which there is a lack of available information.

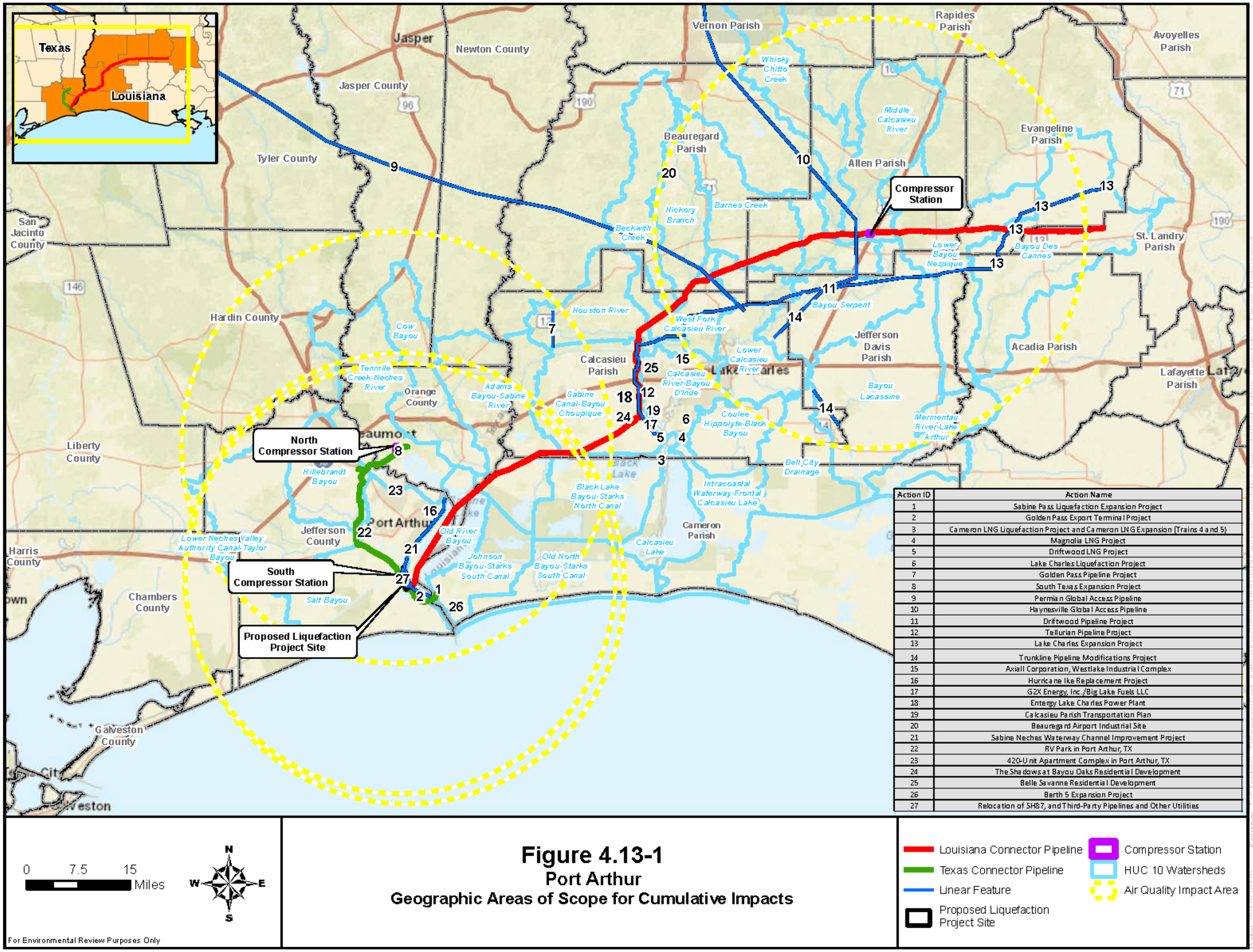
Regarding the cumulative impacts area, the United States is divided and subdivided into successively smaller hydrologic units that are a geographic area representing part of all of a surface drainage basin, a combination of drainage basins, or a distinct hydrologic feature. The unit used for our analysis in this EIS is referred to as HUC-10, or watershed (USGS, 2016; USGS, 2017). A HUC-10 level watershed is an area of land where all streams and rainfall drain into a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel. The watershed consists of surface water (e.g., lakes, streams, reservoirs, wetlands) and all the underlying groundwater. Watersheds are important because the flow and quality of water are affected by natural and human-induced activities happening in the surface land above. Each watershed tends to be 40,000 to 250,000 acres in size. While there are other hydrologic units, such as HUC-8 (or a sub-basin), we determined the HUC-8 was too large in scope (448,000-acre areas) relative to the impacts associated with the Projects. The HUC-12 (or a sub-watersheds) is more discrete (10,000- to 40,000-acre areas) and generally is an appropriate scope for evaluation of cumulative impacts for most natural gas infrastructure projects; however, for the proposed Projects, we opted to use the larger HUC-10 watershed conservatively.

Because surface activities can affect the connectivity of resources within a watershed, we determined that HUC-10 level watersheds crossed by the Projects are appropriate to determine the suitable geographic scope for several resources including groundwater, surface water, wetlands, vegetation, wildlife, aquatic resources, EFH, and special status species. As such, other past, present, and reasonably foreseeable projects that fit the criteria discussed above (comparable magnitude, timeframe, and resource impacts) and overlap with the HUC-10 watersheds crossed by the Projects could contribute to cumulative impacts on these resources.

As shown on figure 4.13-1, the Liquefaction Project would be within the Salt Bayou HUC-10 watershed. The Texas Connector Project would cross the Salt Bayou, Old River Bayou, Johnson Bayou Starks South Canal, LNVA Canal-Taylor Bayou, Hillebrandt Bayou, and Tenmile Creek-Neches River HUC-10 watersheds. The Louisiana Connector Project would cross the Salt Bayou, Old River Bayou, Adams Bayou-Sabine River, Sabine Canal-Bayou Choupique, Houston River, West Fork Calcasieu River, Lower Calcasieu River, Barnes Creek, Whisky Chitto Creek, Middle Calcasieu River, Lower Bayou Nezpique, and Bayou Des Cannes HUC-10 watersheds.

The relatively large geographic scope used in this analysis, such as HUC-10 watersheds, was based on scaling to the size of the Projects, which extend for a combined 165.0 miles of new pipeline across two states (Texas and Louisiana). The area associated with the 19 HUC-10 watersheds crossed by the Projects represent a combined total of about 2.6 million acres. The Projects account for about 6,919.7 acres of impacts on these watersheds. This equates to the Projects impacting a small percentage (less than 1 percent) of the total area associated with the HUC-10 watersheds.

Our cumulative impacts analysis takes a hard look at the potential impacts of other actions as described in relevant guidance. NEPA requires reasonable forecasting, but an agency is not required to engage in speculative analysis or to do the impractical, if not enough information is available to permit meaningful consideration. The scope of the cumulative impact assessment depends in part on the availability of information about other projects. For this assessment, other projects were identified from information provided by the PALNG and PAPL; field reconnaissance; internet research; FERC staff's knowledge of other planned, pending, and ongoing jurisdictional natural gas projects; and communications with federal, state, and local agencies. The impacts were quantified to the extent practicable where cumulative impacts were potentially indicated. In most cases, the potential impacts could be described qualitatively but not quantitatively. These estimates were typically derived from our approximation of project boundaries as interpreted from publicly available project descriptions, maps, and aerial photography. Much of the publicly available information identified only the parcels on which development would or may occur, and did not include details about how each site would be developed (i.e., which portions of a parcel would be affected, and which portions would remain unchanged). Therefore, for the purpose of our analysis, we assumed the entire parcel would be developed. In many cases, estimating quantities is not reasonable and the impact can only be described qualitatively. This is particularly the case where there is a lack of publicly available information concerning other actions, for projects that are in the planning stage or are contingent upon economic conditions, availability of financing, publicly available information, or the issuance of permits.



Action ID	Action Name
1	Sabine Pass Liquefaction Expansion Project
2	Golden Pass Export Terminal Project
3	Cameron LNG Liquefaction Project and Cameron LNG Expansion (Trains 4 and 5)
4	Magnolia LNG Project
5	Driftwood LNG Project
6	Lake Charles Liquefaction Project
7	Golden Pass Pipeline Project
8	South Texas Expansion Project
9	Permian Global Access Pipeline
10	Haynesville Global Access Pipeline
11	Driftwood Pipeline Project
12	Tellurian Pipeline Project
13	Lake Charles Expansion Project
14	Trunkline Pipeline Modifications Project
15	Axiall Corporation, Westlake Industrial Complex
16	Hurricane Ike Replacement Project
17	G2X Energy, Inc./Big Lake Fuels LLC
18	Entergy Lake Charles Power Plant
19	Calcasieu Parish Transportation Plan
20	Beauregard Airport Industrial Site
21	Sabine Neches Waterway Channel Improvement Project
22	RV Park in Port Arthur, TX
23	420-Unit Apartment Complex in Port Arthur, TX
24	The Shadows at Bayou Oaks Residential Development
25	Belle Savanne Residential Development
26	Berth 5 Expansion Project
27	Relocation of SH87, and Third-Party Pipelines and Other Utilities

Figure 4.13-1
Port Arthur
Geographic Areas of Scope for Cumulative Impacts

4.13.1 Projects and Activities Considered

With respect to past actions, CEQ guidance (2005) allows agencies to adopt a broad, aggregated approach without "delving into the historical details of individual past actions," which is the approach we have taken here. The current regional landscape in the Projects area, which supports significant industrial and commercial components as well as existing infrastructure, forms the environmental baseline described in other sections of this EIS and against which the impacts of reasonably foreseeable future actions are considered. Reasonably foreseeable projects that might cause cumulative impacts in combination with the Projects include projects that are approved, proposed, or planned. For FERC-regulated projects, proposed projects are those for which the proponent has submitted a formal application to FERC, and planned projects are projects that are either in pre-filing or have been announced, but have not been formally proposed or filed at FERC. Planned projects also include projects not under FERC's jurisdiction that have been identified through publicly available information such as press releases, internet searches, and PALNG's and PAPL's communications with local agencies.

Table 4.13.1-1 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 nearest aspect of the Projects, status or timeframe, and resources cumulatively affected in conjunction with the proposed Projects. 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. In cases where quantitative information is not available for projects considered in this analysis (e.g., projects in the planning stages, or those contingent on economic conditions, availability of financing, or the issuance of permits), the potential impacts of those projects are considered qualitatively.

TABLE 4.13.1-1

Present and Reasonably Foreseeable Activities and Projects Considered in the Cumulative Impact Analysis for the Projects

Activity/Project	Counties/ Parishes Shared with Projects	Approximate Distance from Projects [b]	Watershed(s) Shared with Projects	Description	Status or Timeframe	Resources Potentially Cumulatively Affected [c]
INDUSTRIAL DEVELOPMENTS						
LNG Export Projects						
Sabine Pass Liquefaction Expansion Project FERC Dockets CP13-552 and CP13-553	Cameron Parish, LA	3 miles from Liquefaction Project	Johnson Bayou-Starks South Canal	The Sabine Pass LNG Terminal is in Cameron Parish, LA. The facility was built between 2012 and 2016 (trains 1 through 4). On April 6, 2015, FERC approved the Sabine Pass Liquefaction Expansion Project, which authorized Sabine Pass LNG to construct and operate two additional trains (Trains 5 and 6) at the Sabine Pass LNG Terminal (Docket No. CP13-552). The additional trains will add 9 mtpy of capacity to the 20 mtpy already authorized for the Sabine Pass Liquefaction Project.	Two liquefaction trains were put into service in 2016, and two additional trains would be put into service in 2018. As of August 2018, construction of Trains 5 and 6 continues. An in-service date of 2019 is anticipated.	GW, SW, W, EFH, VG, WL, PS, V – LNG, S, A – Ops
Golden Pass Export Terminal Project FERC Docket CP14-517	Jefferson and Orange Counties, TX and Calcasieu Parish, LA	1 mile from Liquefaction Project	Salt Bayou	The Golden Pass Export Terminal Project is in Jefferson County, TX. The export terminal and associated Golden Pass Pipeline were constructed between 2006 and 2010, and placed into service between 2009 and 2010. In July 2014, Golden Pass Products LLC and Golden Pass Pipeline LLC filed an application with FERC to construct the Golden Pass LNG Export Project, which consists of the Golden Pass Export Terminal Expansion and the Golden Pass Export Pipeline Expansion (see description under Pipeline Projects).	As of August 2018, construction of the expansion has not yet begun. Export of LNG is anticipated to begin in 2021; and full production is anticipated in 2022.	GW, SW, W, EFH, VG, WL, PS, V – LNG, S, A - Ops, N – Ops
Cameron LNG Liquefaction Project and Cameron LNG Expansion (Trains 4 and 5) FERC Dockets CP13-25 and CP15-560	Cameron, Calcasieu, and Beauregard Parishes, LA	6 miles from Louisiana Connector Project	None	The Cameron LNG Terminal is in Calcasieu and Cameron Parishes, LA. In 2013, Cameron LNG, LLC filed an application with FERC to expand the existing Cameron LNG Terminal in Cameron Parish, Louisiana. In 2015, Cameron LNG, LLC requested approval to further expand the Cameron LNG Terminal by adding Trains 4 and 5.	Construction began in July 2014; as of August 2018, construction of Trains 1, 2, and 3 continues; an in-service date of 2018 was anticipated. In May 2016, FERC issued an Order granting authorization to site, construct, and operate Trains 4 and 5. While Trains 4 and 5 were anticipated be operational in 2019, construction has not yet begun as of August 2018.	S
Magnolia LNG Project FERC Docket CP14-347	Calcasieu Parish, LA	5.5 miles from Louisiana Connector Project	None	Magnolia LNG, LLC submitted an application to FERC seeking authorization to construct and operate various liquefaction facilities in Calcasieu Parish, LA near Lake Charles, Louisiana.	In May 2016, FERC issued an Order granting authorization to site, construct, and operate the project. Initial site preparation activities began in early 2017. While the planned in-service date for the first train was December 2018, construction has not yet begun as of August 2018.	S

TABLE 4.13.1-1 (cont'd)

Present and Reasonably Foreseeable Activities and Projects Considered in the Cumulative Impact Analysis for the Projects

Activity/Project	Counties/ Parishes Shared with Projects	Approximate Distance from Projects [b]	Watershed(s) Shared with Projects	Description	Status or Timeframe	Resources Potentially Cumulatively Affected [c]
Driftwood LNG Project FERC Docket CP17-117	Calcasieu Parish, LA	7 miles from Louisiana Connector Project	Sabine Canal-Bayou Choupique	Driftwood LNG LLC and DWPL propose to construct and operate LNG export facilities on the west bank of the Calcasieu River near Carlyss, Louisiana; and a new 96-mile-long pipeline system in Evangeline, Acadia, Jefferson Davis, and Calcasieu Parishes, Louisiana (see Pipeline System Projects).	While construction was anticipated to begin in 2018, an EIS or Order has not yet been issued as of August 2018. A draft EIS was issued in September 2018. The anticipated in-service date is 2025.	GW, SW, W, EFH, VG, WL, PS, S, A – Ops
Lake Charles Liquefaction Project FERC Dockets CP14-119 and CP14-120	Calcasieu Parish, LA	6 miles from Louisiana Connector Project	None	Trunkline LNG Company, LLC/Trunkline LNG Export, LLC and Trunkline Gas Company, LLC submitted an application to FERC in 2014 seeking authorization to construct and operate new liquefaction facilities about 0.5 mile from the existing Lake Charles LNG Terminal and modify the existing Trunkline LNG Terminal in Calcasieu Parish, Louisiana.	As of August 2018, construction was ongoing. The facility is expected to be fully operational by 2020.	S
Pipeline System Projects						
Golden Pass Pipeline Project FERC Docket CP14-518	Jefferson and Orange Counties, TX; Calcasieu Parish, LA	0 miles from FGT Lateral; 12 miles from Louisiana Connector Project	Houston River	The Golden Pass Pipeline was constructed between 2006 and 2009, and placed into service in 2009. In July 2014, Golden Pass Pipeline LLC filed an application, along with Golden Pass Products LLC, with FERC to construct the Golden Pass LNG Export Project, which consists of the Golden Pass Export Terminal Expansion and the Golden Pass Export Pipeline Expansion. The Golden Pass Pipeline system would be expanded by constructing 2.6 miles of 24-inch-diameter pipeline loop in Calcasieu Parish, Louisiana; three new compressor stations in Jefferson and Orange Counties, Texas, and Calcasieu Parish, Louisiana; and modifying existing interconnections and metering facilities.	As of August 2018, construction has not yet begun. Construction of pipeline facilities is scheduled to begin in 2019 with an in-service date of 2020.	GE, SL, GW, SW, W, EFH, VG, WL, PS, S, CR, A - Ops
South Texas Expansion Project FERC Docket CP15-499	Chambers, Orange, and Brazoria Counties, TX	<1 mile from Texas Connector Project; 11 miles from Louisiana Connector Project	Tenmile Creek-Neches River	TETCO filed an application with FERC for authorization to construct, own, and operate the South Texas Expansion Project, which includes piping modifications at its existing Vidor Compressor Station in Orange County, Texas.	Construction began in 2017 and the anticipated in-service date is October 2018.	GW, SW, W, EFH, VG, WL, PS, V – LNG, S, A – Ops, N – Ops

TABLE 4.13.1-1 (cont'd)

Present and Reasonably Foreseeable Activities and Projects Considered in the Cumulative Impact Analysis for the Projects

Activity/Project	Counties/ Parishes Shared with Projects	Approximate Distance from Projects [b]	Watershed(s) Shared with Projects	Description	Status or Timeframe	Resources Potentially Cumulatively Affected [c]
Driftwood Pipeline Project FERC Docket CP17-118	Evangeline, Acadia, Jefferson Davis, and Calcasieu Parishes, LA	Collocated with Louisiana Connector Project	Bayou Des Cannes	DWPL submitted an application to FERC seeking authorization to construct and operate a new 96-mile-long pipeline system in Evangeline, Acadia, Jefferson Davis, and Calcasieu Parishes, Louisiana that would supply natural gas to the Driftwood LNG Terminal. The project also includes construction of 3 new compressor stations and up to 15 meter stations.	Construction is anticipated to begin in 2019. A draft EIS was issued in September 2018. The in-service date is anticipated to be 2022.	All
Tellurian Pipeline Project [d]	Calcasieu Parish, LA	Potentially less than 2 miles from Louisiana Connector Project	Sabine Canal-Bayou Choupique	As of August 2018, currently planned to be 96 miles of 48-inch-diameter pipeline to serve the proposed Driftwood LNG Project.	Proposed in-service by mid-2021.	GW, SW, W, EFH, VG, WL, PS, V – LNG, S, A - Ops
Permian Global Access Project [d]	Beauregard, Allen, Jefferson Davis Parishes, LA	Potentially intersects Louisiana Connector Project	Lower Calcasieu River, Barnes Creek	Permian Global Access Pipeline is proposing to construct, own, and operate the project, a 625-mile-long, 42-inch-diameter interstate natural gas pipeline originating at the Waha Hub, the gateway for Permian gas heading to market, and terminating near Lake Charles, Louisiana. The investment is incremental to Driftwood LNG Project near Lake Charles, Louisiana (see description under LNG Export Projects).	As of August 2018, a FERC application would be submitted in 2019; construction would occur between 2020 and 2021; and the proposed in-service date is 2022.	All
Haynesville Global Access Project [d]	Beauregard, Allen, Jefferson Davis Parishes, LA	Potentially intersects Louisiana Connector Project	Barnes Creek, Whisky Chitto Creek, Middle Calcasieu River, Lower Bayou Nezpique	Haynesville Global Access Pipeline LLC is proposing to construct, own, and operate the project, a 200-mile-long, 42-inch-diameter pipeline capable of transporting upwards of 2 bcfd from supply sources originating in the Haynesville / Bossier Shale area. The project would include a compressor station and 18 meter stations.	As of August 2018, a FERC application would be submitted in 2019; construction would occur between 2020 and 2021; and the proposed in-service date is 2022.	All
Lake Charles Expansion Project FERC Docket CP14-511	Acadia, Calcasieu, and Evangeline Parishes, LA	<1 mile from Louisiana Connector Project	Bayou Des Cannes	Kinder Morgan Louisiana Pipeline LLC submitted an application to FERC seeking authorization to reconfigure its existing pipeline system by constructing new interconnects, a compressor station, and approximately 6,400 feet of 36-inch and 700 feet of 24-inch-diameter natural gas header pipelines, as well as modifying existing meter stations in Acadia, Calcasieu, and Evangeline Parishes, Louisiana to supply natural gas to the Magnolia LNG Terminal.	The project was approved by FERC in May 2016; however, as of August 2018, construction has not yet begun.	All

TABLE 4.13.1-1 (cont'd)

Present and Reasonably Foreseeable Activities and Projects Considered in the Cumulative Impact Analysis for the Projects

Activity/Project	Counties/ Parishes Shared with Projects	Approximate Distance from Projects [b]	Watershed(s) Shared with Projects	Description	Status or Timeframe	Resources Potentially Cumulatively Affected [c]
Trunkline Pipeline Modifications Project FERC Docket CP14-119	Calcasieu and Jefferson Davis Parishes, LA	6.9 miles from Louisiana Connector Project	None	Trunkline Gas Company, LLC submitted an application to FERC seeking authorization to construct and operate 11.4 miles of new pipeline, 6.5 miles of looping pipeline along its existing mainline system, one new compressor station, and modify existing compressor and metering stations and other existing ancillary facilities to supply natural gas to liquefaction facilities in the Louisiana Gulf Coast area.	The project was approved by FERC in December 2015; however, as of August 2018, construction had been limited to the LNG project. The anticipated in-service date for the pipeline has yet to be determined.	S
Other Industrial Facilities						
Axiall Corporation, Westlake Industrial Complex	Calcasieu Parish, LA	5 miles from Louisiana Connector Project	None	Axiall Corporation plans to construct and operate an ethylene production facility with a capacity of 2 billion pounds/year. If approved, the project would be a joint venture with Lotte Chemical of South Korea. Lotte Chemical also is evaluating a wholly owned derivatives plant on that would be constructed directly adjacent to the preferred site for the ethylene production facility.	Construction start date is unknown. As of August 2018, anticipated in-service date is 2019.	S
G2X Energy, Inc. / Big Lake Fuels LLC	Lake Charles, LA (Calcasieu Parish)	5 miles from Louisiana Connector Project	None	G2X Energy's subsidiary, Big Lake Fuels LLC, is constructing a natural gas-to-gasoline plant along the Industrial Canal of the Port of Lake Charles. The plant is on a 200-acre site owned by the Lake Charles Harbor and Terminal District. The project is designed to convert domestic natural gas into about 12,500 barrels per day of sulfur, gasoline, and/or methanol, which would be shipped to customers by marine vessels or by pipeline.	Construction began in 2016 and is expected to last for 3 years.	S
Utilities and Transportation						
Entergy Louisiana LLC, Lake Charles Power Plant	Calcasieu Parish, LA	2 miles from Louisiana Connector Project	Sabine Canal-Bayou Choupique	Entergy Louisiana LLC plans to operate a 994-MW electricity generation plant in Westlake, near Lake Charles, Louisiana. The Louisiana Public Service Commission approved the Lake Charles project in June 2017.	Construction began January 2018. Facility planned to be operational in 2020.	GW, SW, W, EFH, VG, WL, PS, S

TABLE 4.13.1-1 (cont'd)

Present and Reasonably Foreseeable Activities and Projects Considered in the Cumulative Impact Analysis for the Projects

Activity/Project	Counties/ Parishes Shared with Projects	Approximate Distance from Projects [b]	Watershed(s) Shared with Projects	Description	Status or Timeframe	Resources Potentially Cumulatively Affected [c]
Calcasieu Parish Transportation Plan	Calcasieu Parish, LA	1 mile from Louisiana Connector Project	None	According to the Calcasieu Parish Transportation Plan, the Parish plans to conduct the following road improvement projects: I-10 Widening to Six Lanes; LA 27 Widening from Lewis St to Bankens to LA 12; LA 378 Corridor Improvements – John Stine to LA 378 Spur; US 90 Corridor Improvements in Sulphur Area – From I-10 to Post Oak Ave; Houston River Rd Improvements – LA 378 to LA 27 / N Beglis Pkwy; Enterprise Blvd Extension to Fitzenreiter Rd to US 171; Nelson RD Ext from Avenue L'Auberge to Sallier St. - New 4 Lane Road and Bridge (Committed Project); Cities Service Hwy Extension (Sasol Project); and New I-10 Interchange West of Ruth St / LA 1256 Interchange. Municipalities impacted by the road improvement projects include Lake Charles, Westlake, Sulphur, and DeQuincy; the towns of Iowa and Vinton; and unincorporated communities of Moss Bluff and Carlyss.	Projects are being or will be constructed in three stages between 2015 and 2040.	S
Beauregard Airport Industrial Site	Beauregard Parish, LA	28 miles from Louisiana Connector Project	None	Beauregard Airport plans to construct and operate a new development-ready, industrial site near the Intersection of U.S. Highways 171 and 90 in Beauregard Parish, LA. Approximately 1,200 acres of Parish-owned airport property with access to a railroad spur, major highways, a 5,495-foot airport runway, and onsite utilities.	Unknown. Based on the project's website (most recent update was March 2018), the property is still available for development.	S
GOVERNMENT FACILITIES/ACTIVITIES						
SNWW Channel Improvement Project (CIP)	Jefferson and Orange Counties, TX	0 miles from Projects	Salt Bayou	The CIP is a large-scale transportation infrastructure project sponsored by the federal government and managed by the USACE to deepen the SNWW from 40 feet to 48 feet (SNND). The USACE approved the project in 2011. In 2013, the U.S. Senate and Congress both approved versions of the Water Resource Development Act (S.601) and the Water Resources Reform and Development Act (H.R.3080) that would allow the CIP to move forward. President Obama signed the House version of the Act (H.R.3080) into law in 2014, thereby authorizing the USACE to move forward with development of the CIP.	Construction start date is unknown. After construction begins, it is expected to take 7 to 10 years to complete the project.	GW, SW, W, EFH, VG, WL, PS, LU, Rec, V – LNG, V – PL, S, CR, A – Con, N – Con, R&S

TABLE 4.13.1-1 (cont'd)

Present and Reasonably Foreseeable Activities and Projects Considered in the Cumulative Impact Analysis for the Projects

Activity/Project	Counties/ Parishes Shared with Projects	Approximate Distance from Projects [b]	Watershed(s) Shared with Projects	Description	Status or Timeframe	Resources Potentially Cumulatively Affected [c]
Berth 5 Expansion Project	Jefferson County, TX	1 mile from Projects	Salt Bayou	The Port of Port Arthur Navigation District has proposed the construction of wharf deck, new bulkhead wall, existing bulkhead wall improvements, anchor wall, bulkhead return wall, low mast light poles and associated foundations, shoreline stabilization, dredging, filling of the Grannis Ditch, site fill, fencing, hydromulching, and other work associated with the extension of the existing dock located at the Port of Port Arthur.	Bid package issued by Port of Port Arthur in January 2018. As of August 2018, status of project is unknown.	GW, SW, W, EFH, VG, WL, PS, V – LNG, S
COMMERCIAL AND RESIDENTIAL DEVELOPMENTS						
RV Park in Port Arthur, TX	Port Arthur, TX	2.8 miles from Texas Connector Project	Salt Bayou	Proposed RV park in Port Arthur, TX.	As of August 2018, construction status is unknown.	GW, SW, W, EFH, VG, WL, PS, V – LNG, S, A - Ops
Hurricane Ike Replacement Home Project	Port Arthur, TX	Variable distance from Texas Connector Project	Salt Bayou	Construction of new homes in Port Arthur, TX to replace homes damaged by Hurricane Ike. Locations unknown other than generally in the Port Arthur, TX area.	As of August 2018, construction status is unknown.	GW, SW, W, EFH, VG, WL, PS, V – LNG, S, A - Ops
420-unit apartment complex in Port Arthur, TX	Port Arthur, TX	3.7 miles from Texas Connector Project	Salt Bayou	Proposed 420-unit apartment complex in Port Arthur, TX.	As of August 2018, construction status is unknown.	GW, SW, W, EFH, VG, WL, PS, V – LNG, S, A - Ops
The Shadows at Bayou Oaks Residential Development	Calcasieu Parish, LA	1.5 miles from Louisiana Connector Project	Sabine Canal-Bayou Choupique	A planned residential community development east of Choupique Bayou in the town of Carlyss that is pre-selling lots.	As of August 2018, some homes had been developed. Completion date is unknown.	GW, SW, W, EFH, VG, WL, PS, V – LNG, S, A - Ops
Belle Savanne Residential Development	Calcasieu Parish, LA	0.7 mile from Louisiana Connector Project	Sabine Canal-Bayou Choupique	The proposed Belle Savanne Development is a new residential and commercial development in Sulphur, Calcasieu Parish, LA. The development offers multiple shopping, dining, and entertainment options, as well as access to I-10. The Master plan for the entire property includes over 12 acres of commercial and 15 acres of multifamily development. The remaining 174 lots are being designed; the first 40 of these designed lots delivered in November of 2017.	Construction completed in 2016; future phase approved and planned for 2018.	GW, SW, W, EFH, VG, WL, PS, V – LNG, S, A - Ops

TABLE 4.13.1-1 (cont'd)

Present and Reasonably Foreseeable Activities and Projects Considered in the Cumulative Impact Analysis for the Projects

Activity/Project	Counties/ Parishes Shared with Projects	Approximate Distance from Projects [b]	Watershed(s) Shared with Projects	Description	Status or Timeframe	Resources Potentially Cumulatively Affected [c]
NONJURISDICTIONAL FACILITIES						
Relocation of SH 87, and Third-party Pipelines and Other Utilities	Jefferson County, TX	0 miles from Liquefaction Project	Salt Bayou	PALNG's proposed location for its marine berth on the Port Arthur Canal would require 3.3 miles of existing utilities to be relocated around the western side of the liquefaction site prior to construction of the liquefaction facilities. Following relocations, the respective owners of each utility would be responsible for interconnecting the new facilities with the old, abandoning the unused utility and pipeline segments per industry and regulatory requirements, and future operations of the facilities.	Relocation of SH 87 and its collocated utilities would begin once all permit approvals are received, which is contingent on the final EIS for the Projects. Construction is anticipated to take about 6 months, with operations resuming after.	All; included with impacts analyses in section 4.
Louisiana Connector – Electric distribution line to proposed Compressor Station	Allen Parish, LA	0 miles from Louisiana Connector Project	Salt Bayou	The nonjurisdictional facilities associated with the Louisiana Connector Project include an electric power supply line to serve the proposed compressor station. The power line would be built by CLECO and BECi in Allen Parish, LA. PAPL, CLECO, and BECi are currently investigating two options. Option One would tap into the existing CLECO distribution line at the intersection of SH 165 and Green Oak Cemetery Road and extend about 0.25 mile along the north side of Green Oak Cemetery Road to the compressor station site. Option Two would tap into the existing BECi three phase distribution line at the intersection of Green Oak Cemetery Road and Green Oak Road and extend about 0.75 mile along the south side of Green Oak Cemetery Road before crossing Green Oak Cemetery Road to the compressor station site. Both options have been assessed for impacts on resources.	Construction of the electric distribution line expected to occur concurrently with construction of the Compressor Station, between 2021 and 2023.	GW, SW, W, EFH, VG, WL, PS, V – LNG, S, A - Ops

[a] This table lists those projects that are most likely to contribute to the cumulative impacts within the vicinity of the proposed Liquefaction Project, Texas Connector Project, and Louisiana Connector Project; it is not intended to provide an all-inclusive listing of projects in the region.

[b] Approximate distance listed represents the feature or facility closest to the Projects.

[c]

All – all resources	W – Wetlands	LU – Land Use	A – Con – Air, Construction
GE – Geology	EFH – Essential Fish Habitat	Rec – Recreation	A – Ops – Air, Operations
SL – Soils	VG – Vegetation	V – LNG – Visual LNG	N – Con – Noise, Construction
GW – Groundwater	WL – Wildlife	V – PL – Visual Pipeline S – Socioeconomics	N – Ops – Noise, Operations
SW – Surface Waters	PS – Protected Species	CR – Cultural Resources	R&S – Reliability & Safety

[d] As of August 2018, the Tellurian Pipeline Project, Permian Global Access Project, and Haynesville Global Access Project had not yet requested to participate in the FERC's pre-filing process or filed an application with FERC. As such, these projects are speculative and, because NEPA does not require a speculative analysis if not enough information is available to permit meaningful consideration, they are not discussed in detail in our analysis below.

As listed in table 4.13.1-1, the Tellurian Pipeline Project, Permian Global Access Project, and Haynesville Global Access Project would potentially intersect the Louisiana Connector Project. As of August 2018, none of these projects have requested to participate in the FERC's pre-filing process or filed an application with FERC. As such, these projects are speculative and, because NEPA does not require a speculative analysis if not enough information is available to permit meaningful consideration, they are not discussed in detail in our analysis below.

Likewise, the nonjurisdictional facilities associated with the Liquefaction Project (i.e., highway, utility, and pipeline relocation) would take place within the same area of effect, be conducted by the applicant (i.e., PALNG, as opposed to another entity), and generally occur within the same timeframe. Therefore, the cumulative effects of these activities are already captured in the environmental analysis in section 4 and not discussed further in the analyses below.

4.13.2 Potential Cumulative Impacts by Resource

The following sections address the potential cumulative impacts of the Projects and the other projects identified within the cumulative geographic scope area on specific environmental resources. Of the projects that are within the cumulative impacts area for potential cumulative effects, table 4.13.2-1 lists the general environmental impacts associated with each FERC-regulated project based on FERC-issued environmental documents (i.e., EIS or EA) or applicant-prepared reports provided as part of the application or pre-filing materials, which can be quantified. The impacts listed reflect those associated with the entire project and not just those associated with impacts within the cumulative impacts area (e.g., HUC-10 watershed).

All of the FERC-jurisdictional projects would be constructed and maintained in accordance with general measures that are similar to those that are described throughout section 4 of this EIS; our additional recommended mitigation measures for each project, as applicable; and other construction, operation, and mitigation measures that may be required by federal, state, or local permitting authorities (see tables 1.5-1, 1.5-2, and 1.5-3), further reducing the potential for cumulative impacts.

TABLE 4.13.2-1

Environmental Impacts Associated With FERC-Regulated Projects Within the HUC-10 Cumulative Impacts Area [a]

	Impacts (acres) – *Soils, Vegetation, Land Use*		Prime Farmland Impacts – Permanent	Number of Waterbodies	Wetland Impacts (acres)		Forest Impacts (acres) [b]		No. of Likely to Adversely Affect	EFH
Project Name	Con.	Op.	(acres)	Crossed	Temp.	Perm.	Temp.	Perm.	Species	Impacts
Sabine Pass Liquefaction Expansion Project [d]	401.2	156.3	None (Expansion)	None	153.5	153.5	N/A	N/A	None	No effect
Golden Pass Export Terminal Project [c]	918.7	782.8	None (Expansion)	1	387.7	376.0	63.0	58.7	None	No adverse effect
Golden Pass Pipeline Project [e]	98.7	55.6	37.4	3	13.1	9.7	34.1	26.5	None	None
South Texas Expansion Project [f]	17.1	1.1	15.7	0	0.0	0.0	0.0	0.0	None	None
Driftwood LNG Project [g]	790.0	718.0	384.5	1	330.6	318.7	181.4	179.3	None	No adverse effect
Driftwood Pipeline Project [g]	1,948.8	569.7	92.5	383	454.1	89.2	596.6	171.2	None	No adverse effect

TABLE 4.13.2-1 (cont'd)											
Environmental Impacts Associated With FERC-Regulated Projects Within the HUC-10 Cumulative Impacts Area [a]											
	Impacts (acres) – *Soils, Vegetation, Land Use*		Prime Farmland Impacts – Permanent (acres)	Number of Waterbodies Crossed	Wetland Impacts (acres)		Forest Impacts (acres) [b]		No. of Likely to Adversely Affect Species	EFH Impacts
Project Name	Con.	Op.			Temp.	Perm.	Temp.	Perm.		
Lake Charles Expansion Project [h]	75.8	20.8	20.8	10	15.3	15.3	0.0	0.0	None	None

[a] Quantitative data are approximate and based on information presented in a FERC-issued EIS or EA, or information presented in the proponent's FERC application.
[b] Acres of forest impacts include managed tree plantations.
[c] Impacts for the Golden Pass Export Terminal Project include the terminal expansion, supply dock, and access road.
[d] Impacts for the Sabine Pass Liquefaction Expansion Project include Trains 5 and 6 and existing Sabine Pass LNG Terminal access roads.
[e] Impacts for the Golden Pass Pipeline Project include interconnects, looping pipelines, aboveground facilities, and all appurtenances.
[f] Impacts for the South Texas Expansion Project include the Vidor Compressor Station only, which is the only facility within the region of influence for cumulative impacts.
[g] Impacts for the Driftwood LNG Project include the liquefaction terminal; impacts for the Driftwood Pipeline Project include the pipeline facilities, aboveground facilities, and all appurtenances.
[h] Impacts for the Lake Charles Expansion Project include the pipeline facilities, aboveground facilities, and all appurtenances.

4.13.2.1 Geologic Resources

Projects from table 4.13.1-1- that are within the cumulative impacts area for geologic resources include the following locations:

- The portion of the Louisiana Connector Project between MPs 45.3 and 55.8 that would be collocated with the proposed Driftwood Pipeline Project;
- The portion of Northern Pipeline of the Texas Connector Project between MPs 23.0 and 26.6 that would be collocated with the pipeline portion of the Golden Pass Pipeline Project;
- The pipeline portion of the Golden Pass Pipeline Project that would intersect the FGT Lateral at about MP 1; and
- The pipeline portion of Lake Charles Expansion Project that would intersect the Louisiana Connector Project pipeline at about MP 118.

The impacts at these areas would be both incremental and repeated. Incremental because they would expand the impacts already experienced at the given location and repeated because they would occur within the same relative timeframe (within a few months before or after) as the proposed Projects. While each project proponent would be responsible for restoration of an area, the restoration timeframe could be extended because of ground disturbance associated with the next project in any given area.

With the exception of the nonjurisdictional facilities, whose impacts are assessed in section 4 of this EIS, there are no current or reasonably foreseeable projects within the cumulative impacts area for geologic resources resulting from the Liquefaction Project. As such, cumulative impacts would not occur.

The primary cumulative impacts on existing geologic conditions resulting from the Louisiana Connector and Texas Connector Projects and the other pipeline projects listed above would be limited to construction activities and would include disturbance of slopes within the work areas, which would be permanent where grading and filling is required to create a safe and stable land surface to support the facilities. Project activities such as grading, trenching, and backfilling would result in minor alteration of surficial geology within the pipeline projects workspace, and HDD activities would physically alter geologic materials along a very narrow subsurface drill path. Where they overlap, the Louisiana Connector Project and Driftwood Pipeline Project would be largely within previously disturbed areas adjacent to an existing pipeline system, and the proposed new aboveground facilities would occupy relatively small footprints at various locations. PAPL does not anticipate that any blasting would be required for the construction of the pipeline facilities and, following construction, it would restore topographic contours along the pipeline rights-of-way to preconstruction conditions. In general, the Louisiana Connector and Texas Connector Projects, Driftwood Pipeline Project, Golden Pass Pipeline Project, and Lake Charles Expansion Project facilities would not materially impact (i.e., permanently curtail or preclude the extraction of) marketable mineral resources in the projects area. As such, construction and operation of the Projects, when considered with the other projects in the cumulative impacts area, would not contribute significantly to cumulative impacts on geologic resources.

4.13.2.2 Soils

Projects from table 4.13.1-1 that are within the cumulative impacts area for soil resources include the same ones discussed above for geologic resources.

Cumulative impacts on soils from the Projects and other actions in the cumulative impacts area could occur from overlapping construction activities such as clearing, grading, trench excavation, backfilling, and the movement of construction equipment may affect soil resources.

With the exception of the nonjurisdictional facilities, whose impacts are assessed in section 4 of this EIS, there are no current or reasonably foreseeable projects within the cumulative impacts area for soil resources resulting from the Liquefaction Project. However, it should be noted that the proposed dredging in the Port Arthur Canal could contribute to the disruption of sediments in combination with the ongoing USACE maintenance dredging of the Port Arthur Canal and SNWW that could then cumulatively contribute to water quality impacts, as discussed in section 4.13.2.4.

Regarding potential cumulative impacts within the Texas Connector and Louisiana Connector Projects, we note that PAPL, Driftwood, Golden Pass Pipeline LLC, and KMLP would implement FERC's Plan and Procedures, or alternative measures when justified, to protect soil resources and minimize soil impacts. This would include applying measures to control erosion and sedimentation during construction and ensuring proper restoration and revegetation of disturbed areas. As a result, most project-related impacts on soils due to construction of the Louisiana Connector and Texas Connector Projects, Driftwood Pipeline Project, Golden Pass Pipeline Project, and Lake Charles Expansion Project would be temporary to short term. The area affected by the permanent conversion of existing surfaces to impervious ground for these projects would result in a permanent impact on over 415 acres of soils (about 210 acres at aboveground facilities associated with the Louisiana Connector and Texas Connector Projects; about 96 acres at aboveground facilities associated with the Driftwood Pipeline Project; about 36 acres at aboveground facilities associated with the Golden Pass Pipeline Project; and about 73 acres at aboveground facilities associated with the Lake Charles Expansion Project), which is about 0.03 percent of the undeveloped land in the affected counties and parishes shared between the projects (Orange County, Texas and Calcasieu and Evangeline Parishes, Louisiana). As such, construction and operation of the Projects, when considered with the other projects in the cumulative impacts area, would not contribute significantly to cumulative impacts on soils.

4.13.2.3 Groundwater

Projects from table 4.13.1-1 that are within the cumulative impacts area for groundwater resources include all those within the same HUC-10 watershed(s) crossed by the proposed Projects. However, the majority of the listed projects are over 0.5 mile from the Projects and/or have undetermined timing (e.g., many of the commercial and residential developments). As such, cumulative impacts from these projects would be minor and would be dissipated the further they occur from the Projects. We have determined that potential cumulative impacts on groundwater resources would be relatively greater at the following locations, due to proximity:

- The portion of the Louisiana Connector Project between MPs 45.3 and 55.8 that would be collocated with the proposed Driftwood Pipeline Project;
- The portion of Northern Pipeline of the Texas Connector Project between MPs 23.0 and 26.6 that would be collocated with the pipeline portion of the Golden Pass Pipeline Project;
- The pipeline portion of the Golden Pass Pipeline Project that would intersect the FGT Lateral at about MP 1;
- The pipeline portion of Lake Charles Expansion Project that would intersect the Louisiana Connector Project pipeline at about MP 118; and
- Modifications to the existing Vidor Compressor Station associated with the South Texas Expansion Project, which would be about 0.5 mile from the North Compressor Station along the Texas Connector Project.

Because the Projects generally involve surficial and shallow earthwork, we assumed that the Projects' effects on groundwater would be confined to the local water tables within the watersheds crossed by the Projects and shared with other projects in the area. Project activities such as clearing, grading, trenching, backfilling, drilling, dewatering, and refueling could result in minor impacts on groundwater quality, quantity, and flow.

Construction activities associated with the LNG projects that could potentially affect groundwater resources include foundation excavation and installation, installation of piles for LNG vessel loading facilities and LNG tanks, and accidental release of fuels, lubricants, and/or hazardous materials during construction.

Construction of the pipeline and other project types such as residential developments would occur mostly above the water table; however, where the water table is within the trench or grading depth, shallow groundwater resources could be temporarily affected by minor fluctuations of water level, flow characteristics, and/or increased turbidity in localized areas adjacent to the trench, which could also affect the hydrology of nearby wetland areas. Given the relatively shallow (typically less than about 8 feet) nature of pipeline trenching and the often deep depths at which water wells are drilled to reach aquifers, it is generally unlikely that pipeline activities would negatively affect groundwater supplies from wells, although springs may be more subject to disruption. Additionally, new impervious surfaces created as part of construction of the proposed Projects and other projects in the cumulative impacts area could also potentially affect groundwater resources by reducing infiltration and groundwater recharge. With the exception of the establishment of new impervious surfaces, which would represent a permanent impact, the project effects on groundwater would be limited to the duration of construction or shortly thereafter and, as such, this is the same timeframe for cumulative impacts on groundwater.

Considering the above locations where cumulative impacts would be the most concentrated, there are two known groundwater withdrawal wells or drinking water wells within 150 feet of the Louisiana Connector Project and Driftwood Pipeline Project where they are collocated; there are no known groundwater withdrawal wells or drinking water wells within 150 feet of the Texas Connector (including the FGT Lateral) and Louisiana Connector Projects, Golden Pass Pipeline Project, Lake Charles Expansion Project, and South Texas Expansion Project's Vidor Compressor Station where they intersect or are located nearby. Because these are all FERC-regulated projects, PAPL and the proponents of the other projects would mitigate for potential contamination of wells due to accidental spills or leaks of hazardous materials associated with vehicle refueling, vehicle maintenance, and storage of construction materials by adhering to the Commission's Plan and Procedures and their project-specific plans, which include spill prevention and containment measures to minimize potential impacts on groundwater resources.

As discussed in section 4.3.1, the Chicot aquifer underlies the Louisiana Connector Project between MPs 17 and 130. The Chicot aquifer system more broadly underlies any project occurring in Cameron, Calcasieu, Beauregard, Allen, Evangeline, and St. Landry Parishes, Louisiana (see table 4.13.1-1). The EPA has designated the Chicot aquifer as an SSA in southwestern Louisiana because it is the most heavily used aquifer in Louisiana, and water levels in the Chicot aquifer have declined in portions of Louisiana due to extensive pumping, which has led to concerns over the potential for saltwater intrusion (USGS, 2010). PAPL does not plan to use groundwater as a water supply during construction or operation of the pipelines. Water for hydrostatic testing would be obtained from the City of Port Arthur, the LNVA, and/or surface water sources. Since groundwater withdrawals are not anticipated for the Texas Connector and Louisiana Connector Projects, cumulative withdrawal impacts when combined with the other projects would not occur.

We conclude that there would be no significant cumulative impacts on groundwater because of the small aggregate size of actions within the watersheds and because each action would be required to obtain permits, such as storm and waste water discharge permits, that are designed to reduce impacts on groundwater and to ensure that the resource is managed in a sustainable manner. Further, PAPL, Driftwood, Golden Pass Pipeline LLC, KMLP, and TETCO would implement the measures in their respective construction and restoration plans, which includes the Commission's Plan and Procedures, to avoid or minimize cumulative impacts on groundwater.

4.13.2.4 Surface Water Resources

Projects from table 4.13.1-1 that are within the cumulative impacts area for surface water resources include all those within the same HUC-10 watershed(s) crossed by the proposed Projects. However, the majority of the listed projects are over 0.5 mile from the Projects and/or have undetermined timing (e.g., many of the commercial and residential developments). As such, cumulative impacts from these projects would be minor and would be dissipated the further they occur from the Projects. We have determined that potential cumulative impacts on surface water resources would be relatively greater at the same locations as those listed above, in section 4.13.2.3, due to proximity; and from the other LNG terminal projects (e.g., the Sabine Pass Liquefaction Expansion, Golden Pass Export Terminal, and Driftwood LNG Projects), and the SNWW Channel Improvement and Berth 5 Expansion Projects), due to the amount of proposed activity (e.g., dredging; ballast water exchange) in the marine/aquatic environment that would be required for these projects.

Most construction-related impacts from projects in the cumulative impacts area in or near waterbodies and aquatic resources would be within the immediate area of the waterbody crossing, temporary (returning to normal shortly after in-stream construction and restoration is completed), and diminishing with distance downstream of the crossing. As such, cumulative impacts on surface waters would be dissipated the further they occur from the Projects.

Construction and operation of the Projects and other actions in the cumulative impacts area could have direct and indirect impacts on onshore surface water quality and flow, as well as on fish and other organisms that inhabit affected waters. These impacts could include increased sedimentation, turbidity, decreased dissolved oxygen, impaired flow, releases of chemicals and nutrient pollutants, reduced riparian cover, thermal changes, modification of habitat, and fish injury or mortality. For example, construction and maintenance dredging during operation of the Liquefaction Project is anticipated to result in temporarily increased turbidity levels, decreased dissolved oxygen levels, and resuspension of nutrients or chemicals into the Port Arthur Canal water column. Ballast water and cooling water discharges associated with LNG vessels and discharged into the Port Arthur Canal could result in changes in temperature, pH, dissolved oxygen, and salinity levels.

Other actions within the cumulative impacts area that involve similar activities could also impact surface waters. Thus, cumulative impacts could occur where the location and timing of those other effects overlap with the Projects' effects, which includes the portions of the Driftwood Pipeline Project, Golden Pass Pipeline Project, Lake Charles Expansion Project, and South Texas Expansion Project as listed in section 4.13.2.3. In addition, the proposed dredging in the Port Arthur Canal in combination with the ongoing USACE maintenance dredging of the Port Arthur Canal and SNWW (CIP, Berth 5 Expansion Project) would cumulatively contribute to water quality impacts. While within the same HUC-10 watershed, most other projects (industrial and residential developments) are expected to avoid direct impacts on waterbodies because their facilities are at discrete locations (versus long linear features) and relatively flexible in placement (not dependent on connecting to another existing facility).

The Sabine Pass Liquefaction Expansion Project, Golden Pass Export Terminal Project, and Driftwood LNG Project are planned within the same HUC-10 watershed as PALNG's Liquefaction Project. Of these, the Golden Pass Export Terminal Project would also result in ballast water discharges in the broader extent of the SNWW of which the Port Arthur Canal is associated. However, these 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. As discussed in sections 4.3.2.2 and 4.6.2.2, PALNG anticipates that construction barge traffic would peak at about 175 barges per month in the early stages of construction and 180 additional vessels per year are expected to visit the liquefaction site during operations, which is less than a 1 percent increase in current traffic patterns. Given the fact that the Port Arthur Canal was created to accommodate vessel traffic and the amount of ballast water discharged into the Port Arthur Canal during each LNG vessel visit to the liquefaction facility would represent 0.03 percent of the water within a 500-meter stretch of the Port Arthur Canal, we do not anticipate the Liquefaction Project when combined with the other projects to contribute significantly to cumulative impacts associated with the intake or discharge of ballast water.

Construction of the Liquefaction Project's slip, berthing area, and turning basin would require dredging a total of about 7.2 million yd^3 of material. The Golden Pass Export Terminal Project would also require dredging along with ongoing USACE maintenance dredging of the Port Arthur Canal and SNWW. Golden Pass would remove a total of about 305,750 yd^3 of material from the SNWW to construct a supply dock, and dredging to improve vessel access to the tug berth would require removal of an estimated 530,000 yd^3 of sediment from the SNWW. This project is 1 mile from the Liquefaction Project 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. Ongoing USACE maintenance dredging is estimated at 97 million yd^3 over 20 years.

If the proposed dredging for PALNG's Liquefaction Project were to occur at the same time as the dredging for the other actions, the adverse impacts on water quality (e.g., increased turbidity, TSS, release of nutrient-bound contaminants) in the cumulative impacts 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 Liquefaction Project and other planned area projects, should these activities occur concurrently with each other, could also cumulatively affect water conditions; however, as with dredging, these impacts would be localized and temporary to short term.

Before any dredging or pile driving can occur, PALNG 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 the state of Texas or Louisiana. 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 could 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, adverse, or significant cumulative impacts on water quality as a result of foreseeable dredging and pile driving activities in the area.

Increased barge traffic could result in shoreline erosion. As stated above, barge traffic for the Liquefaction Project would result in a less-than-one percent increase in current traffic patterns. Also, PALNG developed a Shoreline Protection Report to address potential shoreline erosion, and would protect the shoreline within the project area through the installation of riprap or other erosion prevention measures, which has been successfully implemented for other facilities along the Port Arthur Canal. The Golden Pass Export Terminal Project is an existing facility already resulting in vessel traffic in the SNWW. Given that the increase in vessel traffic from the Liquefaction Project would represent a negligible increase in current traffic patterns, the Port Arthur Canal was specifically created to provide deepwater access for maritime commerce and is maintained by regular dredging (SNND, 2017a), and the other projects in the cumulative impacts area are expansions of existing projects where vessel traffic is already experienced, there would be no cumulatively significant impacts on shoreline erosion.

Cumulative impacts on waterbodies would be greatest where the Texas Connector Project and/or Louisiana Connector Project would be collocated or intersect with Driftwood Pipeline Project, Golden Pass Pipeline Project, Lake Charles Expansion Project, and South Texas Expansion Project as listed in section 4.13.2.3. Specific to the Texas Connector Project, one unnamed waterbody crossing would occur where multiple pipeline projects are proposed, and specific to the Louisiana Connector Project, two unnamed waterbody crossings would occur where multiple pipeline project are proposed.

Generally, impacts resulting from pipeline construction across waterbodies are localized and short term because surface water conditions would return to normal within days or weeks of completing construction, and cumulative impacts would only occur in the event that more than one project crosses the same waterbody within a similar period of time. Other activities such as clearing, grading, trenching, backfilling, drilling, dewatering, and refueling could result in minor impacts on surface water quality, quantity, and flow. Due to the temporary, short-term, and localized nature of impacts associated with the waterbody crossings during construction of the Texas Connector and Louisiana Connector Projects pipelines and the distance of these pipelines from most of the other projects listed in table 4.13.1-1, we believe these activities would result in only a minor contribution to cumulative impacts on surface waters in the Projects cumulative impacts area. Because these are FERC-regulated projects, PAPL and the other project proponents would adopt the construction and restoration measures described in the Commission's Procedures such as completing non-HDD crossings within 24 to 28 hours to limit the impacts on a waterbody. Additional protective measures outlined in the Commission's Procedures, such as fueling buffer restrictions, maintenance of flow rates, and stream and riparian area restoration, would further limit the potential for impacts on waterbodies associated with FERC-regulated projects. Given PAPL's and the other project proponents' commitment to restore waterbodies according to specifications based on the Commission's Procedures, direct and indirect impacts, such as increased sediment transport to waterbodies and turbidity levels, are expected to return to baseline levels following construction and restoration efforts at each crossing.

The impacts of each of the projects identified near the Projects on jurisdictional WOUS (e.g., wetlands and waterbodies) would be evaluated by the USACE and permitted accordingly. Although stormwater runoff from construction activities near waterbodies upstream or downstream of the proposed construction right-of-way could result in impacts, we are not aware of any other substantial construction projects that would affect surface water quality near PAPL's proposed waterbody crossings. As a result, the cumulative impact on surface water resources in these areas due to stormwater runoff would be minor. The Projects and other projects in the geographic scope area would be required to comply with the state regulations for discharge of pollutants in stormwater or point source discharges.

Based on compliance by PALNG, PAPL, and the proponents of the other projects with these regulations, implementation of the Commission's Plan and Procedures and other project erosion and sediment control plans, and project-specific best management practices, the cumulative impacts due to the withdrawal and discharge of hydrostatic test water would be temporary and minor.

4.13.2.5 Wetlands

Projects from table 4.13.1-1 that are within the cumulative impacts area for wetland resources include all those within the same HUC-10 watershed(s) crossed by the proposed Projects. However, the majority of the listed projects are over 0.5 mile from the Projects and/or have undetermined timing (e.g., many of the commercial and residential developments). As such, cumulative impacts from these projects would be minor and would be dissipated the further they occur from the Projects. We have determined that potential cumulative impacts on wetlands would be relatively greater at the same locations as those listed in section 4.13.2.3, due to proximity.

Most construction-related impacts from projects in the cumulative impacts area in or near wetlands would range from temporary to permanent, depending on the proposed action/facility and type of wetland impacted. For example, impacts on PEM wetlands from pipeline construction would be temporary because they would return to original emergent function and value shortly after construction; impacts on PSS wetlands from pipeline construction would be short to long term because they would take 3 to 5 years to return to original scrub-shrub function and value; and impacts on PFO wetlands from pipeline construction would be long term because trees would take from 3 to 50 years or longer to become reestablished and trees would not be allowed to become reestablished directly over the pipeline. The exception to these would be the permanent loss of wetlands at the Liquefaction Project site and other projects where aboveground facilities would be placed and operated in wetlands.

As mentioned above, cumulative impacts on wetlands would be relatively greater at the locations listed in section 4.13.2.3 where the projects overlap, which includes the portions of the Driftwood Pipeline Project, Golden Pass Pipeline Project, Lake Charles Expansion Project, and South Texas Expansion Project. In addition, the proposed dredging in the Port Arthur Canal in combination with the ongoing USACE maintenance dredging of the Port Arthur Canal and SNWW (CIP, Berth 5 Expansion Project) would cumulatively contribute to water quality impacts. While within the same HUC-10 watershed, most other projects (industrial and residential developments) are expected to avoid direct impacts on wetlands because their facilities are at discrete locations (versus long linear features) and relatively flexible in placement (not dependent on connecting to another existing facility).

Cumulative impacts on wetlands would be greatest where the Texas Connector Project and/or Louisiana Connector Project would be collocated or intersect with Driftwood Pipeline Project, Golden Pass Pipeline Project, Lake Charles Expansion Project, and South Texas Expansion Project as listed in section

4.13.2.3. Specific to the Texas Connector Project, about 11 acres and 5 acres of wetlands impacts would occur during construction and operation, respectively, where projects overlap or intersect in the cumulative impacts area. Specific to the Louisiana Connector Project, 89 acres and 37 acres of wetlands impacts would occur during construction and operation, respectively, where projects overlap or intersect in the cumulative impacts area. The impacts on wetlands at these areas would be both incremental and repeated. Incremental because they would expand the impacts already experienced at the given location and repeated because they would occur within the same relative timeframe (within a few months before or after) as the proposed pipeline projects. While each project proponent would be responsible for restoration of an area, the restoration timeframe could be extended because of ground disturbance associated with the next project in any given area.

Based on available information, operation of the Projects and other FERC-regulated actions in the cumulative impacts area would permanently affect at least 644 acres of wetlands (see table 4.13.1-2). The overall magnitude of this impact on wetlands relative to the total amount of wetlands within the affected counties and parishes equates to 0.03 percent, which is considered minor. Other specific impacts on wetlands from the other projects are unknown; however, given the extensive presence of wetlands in southeastern Texas and southwestern Louisiana, it is assumed that avoidance would be difficult, and wetlands would be affected to some extent during construction and operation of these actions.

Wetlands are broadly regulated under the CWA, and avoidance, minimization, compensation, and/or replacement would be required by the USACE for most impacts. PALNG and PAPL, as well as the proponents of the other projects in the cumulative impacts area, would need to obtain applicable permits from the USACE. Accordingly, as part of the permitting and approval process, PALNG, PAPL, and the other project proponents would prepare a wetlands mitigation plan and provide compensatory mitigation for the impacts on these wetlands. These plans promote no net loss of WOUS and, therefore, no significant cumulative effects would result. In addition, the Liquefaction Project would result in a beneficial impact on wetlands due to the fact that it would bring dredged material to the J.D. Murphree WMA for wetland mitigation and restoration from project impacts. As part of the ongoing USACE maintenance dredging of the Port Arthur Canal, dredged material is used for coastal wetlands and marshland creation and restoration, which could also help offset some of the long-term wetlands losses from other cumulative projects. Lastly, each of the FERC-regulated projects would minimize impacts on wetlands by implementing the measures in the Commission’s Plan and Procedures (or variations that provide equal or greater protection) and its own best management practices during construction and operation of the Projects.

Based on the expected wetland mitigation (including the adoption of the HDD method at over 50 locations), and the proposed Projects’ mitigation for wetland losses, the Projects when combined with other projects in the cumulative impacts area would not have substantial or long-term impacts on sensitive wetlands and the contribution to cumulative effects would be limited.

4.13.2.6 Vegetation and Wildlife

Projects from table 4.13.1-1 that are within the cumulative impacts area for vegetation and wildlife resources include all those within the same HUC-10 watershed(s) crossed by the proposed Projects. However, the majority of the listed projects are over 0.5 mile from the Projects and/or have undetermined timing (e.g., many of the commercial and residential developments). As such, cumulative impacts from these projects would be minor and would be dissipated the further they occur from the Projects. We have determined that potential cumulative impacts on vegetation and wildlife would be relatively greater at the same locations as those listed in section 4.13.2.3, due to proximity.

Most construction-related impacts from projects in the cumulative impacts area for vegetation and wildlife would depend on the type of project/activity, amount and type of habitat affected, and the rate at which the vegetation and wildlife habitat would regenerate after construction (either short term, long term, or permanent, as discussed in the vegetation and wildlife resources sections 4.5 and 4.6 of this EIS).

Cumulative impacts on vegetation and wildlife from the Projects and other actions in the cumulative impacts area could occur from overlapping or temporally sequential construction activities such as clearing, grading, and installation of impervious surfaces (e.g., building pads, access roads), or activities that cumulatively contribute to a long-term or permanent conversion of habitat. 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.

Based on available information, operation of the Projects and other FERC-regulated actions in the cumulative impacts area would permanently affect almost 1,600 acres of vegetation (see table 4.13.1-2). The overall magnitude of this impact on vegetation and wildlife habitat relative to the total amount of vegetated land within the affected counties and parishes equates to less than 0.5 percent, which is considered minor. Other specific impacts on vegetation from the other projects are unknown; however, it is assumed that avoidance would be difficult and vegetation and wildlife would be affected to some extent during construction and operation of these actions. It should be noted that previous activities have resulted in the degradation of wildlife habitat in the area surrounding the Port Arthur liquefaction facility, which has reduced the number and diversity of species inhabiting the area. Also, the Liquefaction Project would result in a beneficial impact on wildlife due to the fact that it would bring dredged material to the J.D. Murphree WMA for wetland vegetation mitigation and restoration from project impacts.

Operation of the liquefaction facilities would result in increased noise, lighting, and human activity that could disturb wildlife in the area. However, due to current industrial activities at the existing Golden Pass Export Terminal Project that is about 1 mile away from the Liquefaction Project and the other industrial facilities in the cumulative impacts area, most wildlife is acclimated to these conditions. Birds flying through the project area could also be affected by flaring at both the Port Arthur liquefaction facility and nearby Golden Pass Export Terminal Project and Sabine Pass Liquefaction Expansion Project facilities. Startup flaring would be required and during operation of the liquefaction facilities, use of the emergency flares would only occur occasionally. It is unlikely that the startup flares from the three facilities would be in use at the same time due to schedule variability. In addition, PALNG would restrict any permanent lighting needed for the liquefaction facility and pipeline to the boundaries and pointed downward towards these sites. This includes security lighting for the facility and pipeline meter stations, pump stations, or security features. Therefore, cumulative impacts on wildlife due to noise, light, and human activity during operation of the facilities would be minor.

As mentioned above, cumulative impacts on vegetation and wildlife would be relatively greater at the locations listed in section 4.13.2.3 where the pipeline projects overlap. During pipeline construction, vegetation would be cleared from the right-of-way during construction and then restored before operation, except for at aboveground facilities, new permanent access roads, and in forested areas along the permanent right-of-way. While the vegetation impacts of the Projects within the cumulative impacts area would not be inconsequential, we consider the overall impact of all projects minor in comparison to the abundance of comparable habitat in the area. For example, based on data from the National Land Cover Database from the USGS, there are about 408,408.4 acres of upland forest in the shared HUC-10 watershed within the geographic scope considered for our analysis (USGS, 2014).

Specific to the Texas Connector Project, its estimated (based on an average 100-foot-wide construction and 50-foot-wide operational right-of-way) that about 37 acres and 18 acres of vegetation and wildlife habitat impacts would occur during construction and operation, respectively, where projects overlap or intersect in the cumulative impacts area. Specific to the Louisiana Connector Project, its estimated (based on an average 100-foot-wide construction and 50-foot-wide operational right-of-way) that about 121 acres and 60 acres of vegetation and wildlife habitat impacts would occur during construction and operation, respectively, where projects overlap or intersect in the cumulative impacts area. The impacts on vegetation at these areas would be both incremental and repeated. Incremental because they would expand the impacts already experienced at the given location and repeated because they would occur within the same relative timeframe (within a few months before or after) as the proposed pipeline projects. While each project proponent would be responsible for restoration of an area, the restoration timeframe could be extended because of ground disturbance associated with the next project in any given area.

Vegetation and wildlife habitat near the Texas Connector and Louisiana Connector Projects have been affected by past and ongoing agricultural processes, oil and gas development, and construction and maintenance of existing roads, railroads, natural gas and oil pipelines, utility lines, and electrical transmission line rights-of-way. The oil and gas development, transportation projects, residential development projects, and nonjurisdictional project-related facilities listed in table 4.13.1-1 would also likely be required to implement mitigation measures designed to minimize the potential for long-term erosion and resource loss, increase the stability of site conditions, and revegetate disturbed soils, thereby minimizing the degree and duration of the impacts of these projects.

The development of the Texas Connector and Louisiana Connector Projects and other projects in the cumulative impacts area would result in habitat fragmentation due to vegetation removal. Existing roads, trails, agricultural practices, forest harvesting, and other infrastructure in the geographic scope area are also contributing to fragmentation. New or modified roads associated with new projects would also result in increased fragmentation. Fragmentation of forested habitat would make the right-of-way permanently unsuitable for interior forest species, and would create additional forest edge susceptible to edge effects, which may include change in microclimate factors, spread of invasive plant species, increased avian predation, and creation of wildlife movement barriers. Some species, such as white-tailed deer and some predator species, may benefit from the creation of an open corridor. PAPL would minimize impacts on vegetation and wildlife habitat by collocating the pipelines with other existing pipelines, using the HDD method at several locations, refraining from maintaining the pipeline right-of-way between HDD exit and entrance points during operation, and implementing the Commission's Plan and Procedures, which would be adopted for the other FERC-regulated projects proposed or under construction by Driftwood, Golden Pass Pipeline LLC, KMLP, and TETCO. Constructing and operating the projects adjacent to existing rights-of-way would minimize the areas of previously undisturbed vegetation that would be affected, be incremental to what is already experienced, and reduce additional cumulative impacts on vegetation communities and wildlife habitats.

With the implementation of the Commission's Plan and Procedures, the adoption of the HDD method at several locations (over 50 for the pipeline projects), the existing habitat changes that have already occurred as a result of previous projects, and the acquisition of federal and state permits, construction and operation of the proposed Projects, when considered with the other projects in the cumulative impacts area, would not contribute significantly to cumulative impacts on vegetation and wildlife.

4.13.2.7 Aquatic Resources and EFH

Projects from table 4.13.1-1 that are within the cumulative impacts area for aquatic resources and EFH include all those within the same HUC-10 watershed(s) crossed by the proposed Projects. However, the majority of the listed projects are over 0.5 mile from the Projects and/or have undetermined timing (e.g., many of the commercial and residential developments). As such, cumulative impacts from these projects would be minor and would be dissipated the further they occur from the Projects. Potential cumulative impacts on aquatic resources and EFH would be relatively greater at the same locations as those discussed for surface water resources (section 4.13.2.4).

Activities such as dredging, pile driving, increased barge/vessel traffic, the release of ballast water or hull fouling, alternative of light regimes, stormwater runoff, the accidental spill of petroleum, and HDD installation could affect offshore water quality, fish, marine mammals, and aquatic organisms, including EFH, by disturbing the seafloor, suspending sediment in the water, dispersing the sediment over a wider area, and possibly re-suspending and re-distributing contamination. Similar to waterbodies, most construction-related impacts from projects in the cumulative impacts area for aquatic resources and EFH would be within the immediate area of the waterbody crossing, temporary (returning to normal shortly after in-stream construction and restoration is completed), and diminishing with distance downstream of the crossing. As such, cumulative impacts on surface waters would be dissipated the further they occur from the Projects. As discussed above, there is a potential for relatively greater cumulative impacts at the locations listed in section 4.13.2.3 where the pipeline projects overlap, as well as where liquefaction facility construction occurs in shared waterbodies.

The proposed Liquefaction Project, Sabine Pass Liquefaction Expansion Project, Golden Pass Export Terminal Project, and Driftwood LNG Project would all result in permanent impacts on aquatic species, including EFH and EFH-managed species. Dredging and pile driving during construction of the liquefaction facilities would disturb the estuarine bed and potentially result in mortality of some benthic and aquatic organisms if present. If PALNG's dredging and pile driving activities occur concurrently with those required for the other liquefaction projects, this impact would be exacerbated as a direct result of each of the projects' dredge activities and as sediments resettle following construction. Other than the Driftwood LNG Project, which is along the Calcasieu River, these impacts would occur within the existing SNWW and Port Arthur Canal, which are maintained (including periodic dredging) to support shipping for industrial activity. 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, would be temporary, with habitat use reverting to normal conditions following completion of construction.

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. It is expected that other proposed LNG projects along the Port Arthur Canal and SNWW, and within the cumulative impacts area (Sabine Pass Liquefaction Expansion Project, Golden Pass Export Terminal Project), may also generate hydroacoustic impacts on aquatic resources during their construction phase. If PALNG's project is approved within the next year, these project schedules would overlap (see table 4.13.1-1) and noise and vibration impacts would occur within the same impact zones. To reduce the cumulative impact associated with noise on aquatic resources, PALNG would implement construction methods such as pre-drilling pile holes, the use of a vibratory hammer, bubble curtains/cofferdams, and ramping driving activities. PALNG would also ramp pile driving activities by gradually increasing power and frequency over a period of time, which would allow sensitive aquatic species to depart the area before harmful underwater sound pressures are reached by the vibratory hammers.

Cumulative impacts would include those associated with the transit and operation of vessels serving the various project facilities while in the Port Arthur Canal and SNWW. NOAA Fisheries is currently reviewing the permit applications for the Liquefaction Project. Because the Port Arthur Canal was created and is maintained to support industrial activities, it is assumed that NOAA Fisheries would issue similar opinions for work conducted by the other projects in the Port Arthur Canal and SNWW. Also, because of these ongoing industrial activities, the quality of aquatic resources and EFH is not high. As such, cumulative impacts on aquatic resources and EFH affected by construction and operation of the proposed liquefaction facility would not be significant.

Impacts associated with construction and operation of the Texas Connector and Louisiana Connector Projects, as well as the other pipeline, industrial, waterway improvement or expansions, utility, and residential projects in the cumulative impacts area would be limited to the duration of construction or shortly thereafter because water conditions would return to normal within days or weeks of completing construction. Benthic communities would take slightly longer to recover, but would be expected to recolonize within 3 years.

We expect that most of the projects in the cumulative impacts area would be designed to minimize impacts on waterbodies, and thus on fisheries and aquatic resources, to the extent practicable. For example, the FERC-regulated projects are required to adopt the waterbody and wetland crossing measures identified the Commission's Procedures, or variations that provide equal or greater protection. Any waterbodies that could not be avoided would be mitigated through implementation of BMPs and restoration practices in accordance with the respective federal, state, and local permitting agencies. Further, we expect that the Texas and Louisiana state permitting agencies would require any other applicable projects constructed in the geographic scope to adhere to state-mandated or recommended time of year restrictions for construction within waterbodies containing sensitive fish and mussel species.

PAPL would avoid most impacts by crossing EFH-designated wetlands and waterbodies using the HDD method. More specifically, PAPL would avoid 12.7 acres of EFH along the Texas Connector Project and 25.6 acres of EFH along the Louisiana Connector Project by crossing EFH-designated wetlands and waterbodies using HDD installation methods. Of the 10.4 acres along the Texas Connector Project and 1,534.7 acres along the Louisiana Connector Project to be impacted, PAPL would restore any EFH impacted areas within 6 months, thus avoiding permanent impacts on EFH. Any unavoidable impacts on EFH would be mitigated for through USACE wetland mitigation. Where projects overlap or intersect in the cumulative impacts area, there would be no impacts on EFH.

Based on adherence to the Commission's Plan and Procedures, which includes adopting agency-recommended time of year restrictions; the increase in the amount of estuarine water column habitat created during construction of the berthing area, MOF, and Pioneer Dock associated with the Liquefaction Project; the increased habitat for encrusting species; avoidance of designated-EFH areas by using the HDD method at over 50 locations; preliminary coordination with NOAA Fisheries; and the development of the wetland mitigation plans, construction and operation of the proposed Projects, when considered with the other projects in the cumulative impacts area, would not adversely or significantly contribute to cumulative impacts on aquatic resources, EFH, or EFH-managed species.

4.13.2.8 Special Status Species

Projects from table 4.13.1-1 that are within the cumulative impacts area for special status or protected species include all those within the same HUC-10 watershed(s) crossed by the proposed Projects. However, the majority of the listed projects are over 0.5 mile from the Projects and/or have undetermined timing (e.g., many of the commercial and residential developments). As such, cumulative impacts from these projects would be minor and would be dissipated the further they occur from the Projects. Potential cumulative impacts on special status species could be greater at the same locations as those discussed for wildlife resources (section 4.13.2.6), or, for marine species, where activities may be cumulative as discussed for aquatic resources (section 4.13.2.7).

The ESA prohibits the take of any threatened and endangered species except under federal permit or take statement. A federal permit or take statement is issued only if individual and cumulative impacts on a listed species are not significant. A such, the other federal projects in the cumulative impacts area are required to comply with section 7 of the ESE to ensure construction and operation of the facility would not jeopardize the continued existence of federally listed species. Non-federal projects are also required to adhere to section 10 of the ESA, although the FWS has a different mechanism for evaluation and minimizing impacts.

As discussed in section 4.7, we have determined that the Projects would have *no effect* on 8 federally listed species or their critical habitat, and *would not adversely affect* 19 federally listed species and/or their designated critical habitats. These determinations are based on consultations with the FWS and NMFS, and commitments from PALNG and PAPL, to complete outstanding biological surveys and, if the species is identified during preconstruction surveys or encountered during construction, to adopt species-specific avoidance or conservation measures recommended by the FWS and/or NMFS. As such, no additional mitigation is proposed and the Projects would not contribute to cumulative impacts on these species.

Additionally, marine mammals are federally protected under the MMPA. While many marine mammals are listed as threatened or endangered under the ESA, the MMPA provides additional protections for all marine mammals. The MMPA prohibits, with certain exceptions, the take of marine mammals. Where incidental take by harassment cannot be avoided, NOAA has the authority to issue harassment authorizations, so long as the effects are not significant on the species. Thus, given the regulatory requirements, the Projects would not have an individual or cumulatively significant impact on marine mammals.

Protection of threatened, endangered, and other special status species is part of the various state permitting processes or resource reviews. As such, cumulative impacts on such species would be specifically considered and reduced or eliminated through conservation and mitigation measures identified during those relevant processes and consultations.

4.13.2.9 Land Use, Recreation, and Visual Resources

Land Use

Projects from table 4.13.1-1 that are within the cumulative impacts area for land use generally include the same ones discussed above for geologic resources.

Similar to vegetation (see section 4.13.2.6), cumulative impacts on land uses from the Projects and other actions in the cumulative impacts area could occur from construction activities such as clearing and grading, and construction of buildings, structures and/or impervious surfaces (e.g., building pads, access roads). The duration of impacts on land use would depend on the type of land cover affected and the rate at which the land can be restored to its preconstruction use and condition after construction. Pipeline project impacts on agricultural land, transportation land, residential land, commercial/industrial land, and open water would be temporary because they would return to their preconstruction uses and conditions almost immediately after construction. Pipeline project impacts on open lands, emergent wetlands, and scrub-shrub wetlands would be short to long term because those areas likely would require 1 to 5 years to regain preconstruction use and composition. Pipeline project impacts on forested uplands and wetlands would be long term or permanent because trees would take up to 50 years or longer to become reestablished and would not be allowed to become reestablished in directly over the pipeline. Impacts where new buildings, structures, and/or impervious surfaces are installed also would be permanent because they would permanently change the underlying land use. In general, the cumulative impacts of the Texas Connector and Louisiana Connector Projects on land use, when combined with the other projects identified above, would be similar to that described for vegetation (section 4.13.2.6).

With the implementation of the Commission's Plan and Procedures, the adoption of the HDD method at several locations (over 50 for the pipeline projects), the existing land use changes that have already occurred as a result of previous projects, and the acquisition of federal and state permits, construction and operation of the proposed Projects, when considered with the other projects in the cumulative impacts area, would not contribute significantly to cumulative impacts on land use.

Recreation

Projects from table 4.13.1-1 that are within the cumulative impacts area for recreation include all those within 0.25 mile of the Projects. However, the majority of the listed projects are over 0.5 mile from the Projects and/or have undetermined timing (e.g., many of the commercial and residential developments). As such, cumulative impacts from these projects would be minor and would be dissipated the further they occur from the Projects.

The Texas Connector Project would cross the J.D. Murphree WMA at four locations and private property managed for hunting would be crossed between MPs 65.5 and 67.2 along the Louisiana Connector Project. As listed in section 4.13.2.3, the Driftwood Pipeline Project, Golden Pass Pipeline Project, Lake Charles Expansion Project, and South Texas Expansion Project would be collocated with and/or intersected by the Texas Connector or Louisiana Connector Projects. However, there are no designated recreational areas or facilities within the cumulative impacts area at these locations. As such, the pipeline projects would not have cumulative impacts on recreation when considered with other projects in the cumulative impacts area.

Visual Resources

Projects from table 4.13.1-1 that are within the cumulative impacts area for visual resources include all those within 5 miles of the Liquefaction Project and 0.5 mile of the pipeline projects.

The visual character of the proposed liquefaction facility would be similar to and consistent with the visual character of the adjacent existing industrial facilities surrounding the project area. The tops of the three LNG storage tanks would be 256 feet above grade, which would create a strong vertical visual contrast across a relatively flat existing landscape. The LNG vessel berths, offloading facilities, and utility buildings would also alter the existing viewshed. The storage tanks and liquefaction facilities would not be screened and would result in long-term and moderate visual impacts on views from the eastern edge of the J.D. Murphree WMA. Impacts on views for those traveling on SH 87 and SH 82 and visiting Pleasure Island and the Port Arthur Canal, when combined with other projects in the cumulative impacts area (Sabine Pass Liquefaction Expansion Project, Golden Pass Export Terminal Project), would be relatively minor due to existing industrial facilities surrounding the site.

The pipeline facilities proposed as part of the Texas Connector and Louisiana Connector Projects would be in rural areas and collocated with other existing pipeline rights-of-way for much of their routes. The visual impact of other projects in the cumulative impacts area would occur primarily from the conversion of forested land to scrub-shrub or herbaceous vegetation types. Permanent visual impacts would occur in developed areas where permanent structures (e.g., houses, buildings, guardrails) would remain. Whereas these permanent visual impacts may be locally noticed, generally they would not be inconsistent with the existing visual character of the area.

As discussed in section 4.13.2.6, cumulative impacts on vegetation would be greatest where tree clearing would occur and where the Texas Connector Project and/or Louisiana Connector Project would be collocated or intersect with Driftwood Pipeline Project, Golden Pass Pipeline Project, Lake Charles Expansion Project, and South Texas Expansion Project. Where projects overlap or intersect in the cumulative impacts area, its estimated (based on an average 50-foot-wide operational right-of-way) that about 45 acres of forest would be cleared for operation.

The visual character of the vegetation and land uses near the Texas Connector and Louisiana Connector Projects have been affected by past and ongoing agricultural processes, oil and gas development, and construction and maintenance of existing roads, railroads, natural gas and oil pipelines, utility lines, and electrical transmission line rights-of-way. The oil and gas development, transportation projects, residential development projects, and nonjurisdictional project-related facilities listed in table 4.13.1-1 would also likely be required to implement mitigation measures designed to minimize the potential for long-term erosion and resource loss, increase the stability of site conditions, and revegetate disturbed soils, thereby minimizing the degree and duration of the impacts of these projects.

Given the proposed Projects' mitigation measures described in earlier sections and the existing, surrounding developed areas, cumulative impacts on visual resources would mostly be limited to the construction phase (except as noted above), cumulative impacts on visual resources resulting from the construction and operation of the Projects when combined with the other projects in the cumulative impacts area would not contribute significantly.

4.13.2.10 Socioeconomics

Socioeconomic Conditions

Every project and action listed in table 4.13.1-1 would occur within a similar county or parish as the Projects, and cumulative impacts could occur where the timing of those other effects overlap the Projects effects. Although the timing of many of these projects is unknown (e.g., transportation and residential projects), impacts on population and employment; demand for housing and public services; transportation and tourism; and government revenue from sales and payroll taxes would be temporary because these impacts would be limited to the period of construction.

Construction and operation of the Projects could result in changes to population and employment; increased demand for housing and public services; transportation and tourism impacts; and an increase in government revenue associated with sales, payroll, and property taxes. Impacts on government revenue associated with property taxes would be long term to permanent because PALNG and PAPL, as well as the other FERC-regulation projects, would pay ad valorem property tax on its pipeline indefinitely.

The LNG export projects listed in table 4.13.1-1 would have the greatest impact on the social and economic conditions within the cumulative impacts area (i.e., counties and parishes) because they require a large numbers of workers. For example, if the two nearest LNG export projects, Golden Pass and Sabine Pass, had peak construction periods occurring at the same time as PALNG's Liquefaction Project, an influx of over 8,350 construction personnel would occur in Jefferson and Orange Counties, Texas and Cameron and Calcasieu Parishes, Louisiana. Because the proponents of these projects have committed to hiring up to 40 percent of its workforce from local populations, the cumulative effect of over 5,000 persons into a community would be a reduction in local and perhaps regional unemployment. The abundance of jobs resulting from the Liquefaction Project when combined with the other LNG export projects in the cumulative impacts area would in turn lead to an influx of non-local workers, which would impact transient housing Projects' geographic scope area, and could increase the need for some public services, such as police, fire, and medical services.

A large workforce for the simultaneously constructed projects would have a beneficial cumulative effect on revenues for the states, counties, and 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 states, counties, and parishes would also receive a substantial increase in property taxes from the combined projects.

While construction of the three nearest LNG projects (PALNG's Liquefaction Project, Golden Pass, Sabine Pass) could result in the influx of over 5,000 persons, this would only represent a 1 to 2 percent increase of the total populations of Jefferson and Orange Counties, Texas. Therefore, cumulative impacts on socioeconomic conditions from construction and operation of the Liquefaction Project, when combined with the other projects in the cumulative impacts area, would not be significant.

Marine Transportation

The cumulative impact area for marine transportation is limited to the Liquefaction Project and includes the Port Arthur Canal and SNWW. As described in section 4.9.6.1, during construction, PALNG estimates between 100 and 200 deliveries would be needed per month during the first 25 months of construction or about 3 to 6 barges per day. Of the other LNG export and marine projects in the cumulative impacts area and located in the Port Arthur Canal or SNWW, only the Liquefaction Project would be new as the other projects involve expansions or modifications of existing facilities. The Port Arthur Canal was specifically created to provide deepwater access for maritime commerce and is maintained by regular dredging (SNND, 2017a). Marine traffic in the area is already over 125 million tons of cargo shipments annually (SNND, 2017b). Therefore, deliveries during construction of PALNG's liquefaction facility when combined with other projects in the cumulative impacts area would not cause significant cumulative impact when compared to the total amount of traffic in the Port Arthur Canal and SNWW.

In addition to commercial barge traffic, there is also traffic associated with commercial offshore fishing vessels, although commercial fishing traffic in the SNWW is minor (USACE, 2011). Recreational fishing also occurs along the SNWW. The impacts of construction on marine traffic in the SNWW would be minor and temporary to short-term, concentrated during the first 25 months of project construction.

Concurrent construction of the other projects in the cumulative impacts area and specific to the Port Arthur Canal and SNWW would result in cumulatively increased 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.

During operation of the Liquefaction Project, PALNG estimates about 180 transits of LNG vessels per year from the liquefaction facility. The impacts of operation of the Liquefaction Project on marine traffic in the Port Arthur Canal and SNWW, as well as the other projects in the cumulative impacts area, would be governed by USCG requirements. Therefore, cumulative impacts on marine transportation from operation of the Liquefaction Project, when combined with the other projects in the cumulative impacts area, would not be significant. Impacts on marine transportation from construction and operation of the proposed pipelines are not anticipated.

Traffic

The greatest potential for cumulative impacts on vehicular traffic and roads during construction and operation of the Projects is associated with the proposed liquefaction facility. During construction of the liquefaction facility, along with the relocation of SH 87 and the other existing utilities currently on the eastern side of the proposed liquefaction site, 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. AECOM, on behalf of PALNG, commissioned a traffic impact study focused on the intersection of SH 87 and SH 82. The traffic study concluded that the intersection of SH 87 and SH 82 remained at a stable traffic flow with a high degree of freedom to select speed and operating conditions but with some influence from other users after taking into account the workforce and ground-based delivery traffic projected to occur at the Liquefaction Project site during construction and operation (see section 4.9.6.1). Due to the fact that the LOS on the roads in the project study area would remain at current acceptable levels of service, the impacts on the roadways would be minor, temporary, and not likely to result in significant cumulative impacts on local traffic.

Construction-related traffic associated with the proposed pipelines 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. Construction of the pipeline projects, as well as the commercial and residential projects in the cumulative impacts area, could contribute to cumulative traffic, parking, and transit impacts if other projects are scheduled to take place at the same time. PAPL would use major highways and the construction right-of-way, to the extent practicable, to reduce impacts on local roadways. It is likely the other projects listed in table 4.13.1-1 would also use existing public roads. In addition, increased use of local roadways from multiple projects could accelerate degradation of roadways and require early replacement of road surfaces. However, PAPL and the other project sponsors in the geographic scope area would be required to adhere to local road permit requirements (which may have provisions for road damage repairs or compensation) and road weight restrictions.

The measures described above, 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, cumulative impacts on land transportation would not be significant.

4.13.2.11 Cultural Resources

Projects from table 4.13.1-1 that are within the cumulative impacts area for cultural resources include those that overlap the project work area or, for indirect effects, are closely adjacent. This generally corresponds to the same projects considered for geologic and soils resources, and the SNWW Channel Improvement Project. Those that are defined as federal actions (e.g., all FERC-regulated projects) would have to adhere to section 106 of the NHPA and include mitigation measures designed to avoid or minimize additional direct impacts on cultural resources. Where direct impacts on significant cultural resources are unavoidable, mitigation (e.g., recovery of data and curation of materials) would take place before construction. Non-federal actions would need to comply with any mitigation measures required by the affected states.

The Texas SHPO concurred with PALNG that no historic properties would be affected by the Liquefaction Project, and we also concur. However, as noted above, cumulative impacts on cultural resources could occur where the Texas Connector or Louisiana Connector Projects would be collocated with or overlap portions of the Driftwood Pipeline Project, Golden Pass Pipeline Project, Lake Charles Expansion Project, and South Texas Expansion Project. PAPL has consulted with the Texas and Louisiana SHPOs in regard to the impact of the pipeline projects. Cultural resource surveys have been completed where access was allowed and survey reports prepared. Where survey access was denied, surveys would be completed once access is obtained. PALNG and PAPL have developed project-specific plans to address unanticipated discoveries of cultural resources and human remains during construction.

Because it is not known how other foreseeable actions would affect cultural resources, we cannot make any definitive quantitative statements about the nature of cumulative impacts on historic properties. However, we can conclude that given the state and federal laws and regulations that protect cultural resources mentioned previously, it is not likely that there would be significant cumulative impacts on historic properties resulting from the Texas Connector and Louisiana Connector Projects when considering the other projects in the cumulative impacts area.

4.13.2.12 Air Quality and Noise

Air Quality

Construction Cumulative Impacts

From table 4.13.1-1, present and/or reasonably foreseeable projects within the defined geographic scope for cumulative air impacts (0.25 mile) and with a similar schedule as the Projects include the Golden Pass Export Terminal Project, Sabine Pass Liquefaction Expansion Project, Driftwood LNG Project (pipeline aspects only), Lake Charles Expansion Project, South Texas Expansion Project, CIP, and electric distribution line to the proposed Louisiana Connector Project's compressor station.

Project construction would involve the use of heavy, earthmoving equipment, on-road and off-road vehicles, generators, air compressors, and other equipment that would generate air emissions largely through combustion of diesel fuel or gasoline. Construction would also generate particulate matter in the form of fugitive dust. Construction emissions would cease with the end of construction; thus, the period of influence for cumulative air quality impacts during construction of the Texas Connector and Louisiana Connector Projects would be temporary (weeks to months at each location) and of the Liquefaction Project would be short term (5 years). In addition, construction emissions would also disperse within the airshed and diminish in concentration with distance from active construction areas.

Construction of the Projects would temporarily increase air quality impacts surrounding the construction workspaces due to emissions from the combustion engines used to power construction equipment, vehicle emissions traveling to and from the construction sites, and fugitive emission dust resulting from equipment movement on dirt roads and earth-disturbing activities. The potential for cumulative construction emissions impacts would be greatest during site preparation when fugitive dust production would likely be at its peak. Emissions from equipment engines and vehicles operating concurrently for the different projects would also result in cumulative air quality impacts in the local area. PALNG and PAPL and the sponsors of the FERC-regulated projects would implement mitigation measures to minimize construction impacts on air quality such as applying water or dust control chemicals to minimize fugitive dust, and by complying with applicable EPA mobile source emission performance standards and using equipment manufactured to meet these standards. It is assumed that the sponsors of or permitting authorities associated with the other projects in the region of influence would also implement or require measures to minimize air quality impacts and keep them within their respective permitted levels.

Construction of the liquefaction trains would occur in multiple phases. If the project is approved, the first train would begin operations as early as the 1st Quarter of 2023 and the second train would begin operations as early as the 3rd Quarter of 2023. Emissions from commissioning and operating the first train would overlap with construction emissions of the second train.

Based on the short-term nature of construction and the implementation of appropriate mitigation measures, the cumulative impacts on air quality due to construction of these facilities would not be significant. Local residents near the liquefaction site and/or pipeline projects and within the impact area may experience localized minor to moderate elevated levels of fugitive dust and tailpipe emissions near the construction areas.

Due to the limited amount of combustion engines required to construct transmission lines and the short duration of construction activities associated with construction of the nonjurisdictional facilities (i.e., electric transmission lines to the compressor station), we determined that cumulative impacts on air quality due to construction of the supporting facilities would be negligible.

Operational Cumulative Impacts

Cumulative impacts associated with the operation of the aboveground facilities associated with the Projects were evaluated according to the significant impact area of the proposed facilities, determined through a significant impact modeling assessment. For the Liquefaction Project, we considered cumulative impacts on air quality from reasonably foreseeable, major sources of air emissions out to 50 kilometers (31 miles), as this is the maximum distance used in air quality modeling for PSD-applicable sources. Using these parameters, 15 projects would have operational emissions with the potential to contribute to cumulative air quality impacts with the proposed Projects (see table 4.13.1-1 and figure 4.13-1). Some of the larger of these projects, and most likely to contribute to cumulative impacts for operational air emissions, are the Golden Pass Export Terminal Project, the Driftwood LNG Project, and the Sabine Pass Terminal Expansion Project. The Golden Pass Export Terminal Project and Sabine Pass Terminal Expansion are both expansion projects of existing facilities currently contributing to air quality impacts. Other projects listed in the table, such as the residential developments and the CIP are within the cumulative impacts area; however, they would not include major sources of air emissions and thus would not contribute to cumulative impacts and are not discussed further.

Emissions from the indefinite operational of the Liquefaction Facility, the North Compressor Station (associated with the Texas Connector Project), and the Louisiana Connector Compressor Station would contribute to a cumulative impact on air quality. Several current or planned actions exist near each of these gas-fired aboveground facilities and would result in cumulative air quality impacts during operation.

Air quality impact modeling of the operational emissions of each of these facilities (the North Compressor Station, the Louisiana Connector Project compressor station, and the Liquefaction Terminal) are discussed in detail in section 4.11.1.3. In all three cases, modeled concentrations were first compared to SILs for criteria air pollutants to determine which, if any, could be of meaningful impact to air quality. When modeled emissions exceeded the SILs, a subsequent full cumulative model including potential operational emissions from major facilities within 50 kilometers were performed.

The Texas Connector Project's North Compressor Station models and assumptions indicated no meaningful impact on air quality, and table 4.11.1-10 presents the results of the modeling analyses, including the current ambient monitored data, the facility impact, the combined concentration, and a comparison with the NAAQS. We therefore conclude the Texas Connector Project would not have a significant cumulative impact on air quality.

The emissions from PAPL's Louisiana Connector Project compressor station exceeded the SILs for 1-hour NO_2, 24-hour $PM_{2.5}$, and 24-hour PM_{10} NAAQS. A full cumulative impact analysis for these pollutants is summarized in table 4.11.1-8 and results showed an exceedance of the NAAQS for 1-hour NO_2. This indicates there may be a significant cumulative impact on air quality based on the potential to emit of nearby industrial emission sources. As described in section 4.11.1.3, subsequent modeling showed that the Louisiana Connector Project's compressor station would not contribute to a violation of the 1-hour NO_2 NAAQS and would not significantly contribute to cumulative impacts.

The emissions from PALNG's Liquefaction Terminal exceeded the SILs for SO_2, NO_2, PM_{10}, or $PM_{2.5.}$ When all existing and planned projects are included, the concentrations of NO_2 1-hour and $PM_{2.5}$ 24-hour exceed the NAAQS, as shown in table 4.11.1-13. This indicates there may be a significant cumulative impact on air quality based on the potential to emit of nearby industrial emission sources. As described in section 4.11.1.3, subsequent modeling showed that the Liquefaction Project's facilities would not contribute to a violation of the 1-hour NO_2 or $PM_{2.5}$ 24-hour NAAQS and would not significantly contribute to cumulative impacts.

Projects that would potentially be constructed in the future and are considered to be major sources of air emissions would be required to conduct a similar PSD analysis. Should operation of a new project result in a significant impact on air quality, TCEQ and LDEQ would enforce operational limitations or require emissions controls that ensure the facility's compliance with each state's SIP and attainment with the NAAQS. In addition, PALNG and PAPL would be required to comply with permit conditions during operation of the facility and incorporate the required controls to limit the emission of certain criteria pollutants, HAPs, and/or GHGs.

The cumulative modeling analysis of the "potential to emit" (emission limits by permit) of nearby industrial emission sources showed past and present activities may have already resulted in exceedances of the NAAQS in the vicinity of the Liquefaction Terminal and Louisiana Connector Compressor Station and the Projects would be incrementally adding to the existing condition. However, the Project area is designated as in "attainment" with NAAQS based on ongoing monitoring of actual air quality. Based on the detailed modeling presented in section 4.11.1.3, we conclude that the Liquefaction Project facilities and the Louisiana Connector Project's compressor station would not significantly contribute to cumulative operational air impacts. In other areas of the Projects, we conclude there would not be significant cumulative operational air impacts.

Noise

The region of influence for cumulative effects of construction-related noise was conservatively estimated to be an area about 0.5 mile around the liquefaction facility, compressor stations, HDD sites, and pile driving. For operational noise impacts, the geographic scope was set at 1 mile. Present and/or reasonably foreseeable projects listed in table 4.13.1-1 that are within these areas and with a similar schedule as the Projects include the Driftwood LNG Project (pipeline aspects only), Lake Charles Expansion Project, South Texas Expansion Project, CIP, the SNWW Channel Improvement Project, and the electric distribution line to the proposed Louisiana Connector Project's compressor station.

<u>Construction Cumulative Impacts</u>

Construction of the Projects would require the use of heavy equipment, HDD drilling rigs, marine vessels, pile driving equipment, and other equipment and vehicles, all of which would generate noise. Other actions in the Projects area would also generate noise, and cumulative impacts could occur where the location and timing of those noise effects overlap the Projects noise effects. As discussed in section 4.11.2.3, the Projects' construction noise would attenuate quickly as the distance from the construction site increases.

The greatest potential for cumulative construction-related noise impacts would be from internal combustion engines and pile driving activities during construction. The estimated noise generated from construction associated with the Liquefaction Project and Texas Connector Project's South Compressor Station could reach 60 dBA at the nearest NSAs during pile driving activities. This value exceeds our criterion of 55 dBA L_{dn}. However, pile driving would only be conducted for 10 hours a day, 6 days a week. Estimated noise generated from construction associated with the Texas Connector and Louisiana Connector Projects would not exceed 90 dBA at 50 feet when equipment is operating at full load. Ambient sound levels near the Louisiana Connector Project's compressor station is 57 dBA, which is higher than our recommended 55 dBA. Similarly, ambient sound levels near several of the HDD entry and exit locations exceed our recommended 55 dBA L_{dn}. As discussed in section 4.11.2.3, an acoustical analysis was performed determine the noise level attributable to the construction of the Louisiana Connector Project's compressor station and HDD sites. During some construction activities, noise levels at the nearest NSA would exceed our 55 dBA L_{dn} criterion. However, the due to the high ambient noise levels at these NSAs, the project-related noise impacts would be less than 10 dBA above existing noise levels. Based on the analysis above, the temporary nature of construction, and compliance with our criterion of 55 dBA L_{dn} or less than a 10 dBA increase, we conclude that construction noise at the aboveground facility sites would not have a significant impact on nearby NSAs.

Operational Cumulative Impacts

The estimated operational noise level of the liquefaction facility at the nearest NSA (about 0.95 miles to the northeast) is 54 dBA L_{dn}. The ambient noise level at this NSA is currently 64 dBA $L_{dn.}$ Operation of the liquefaction facilities would increase this ambient noise level to 64.4 dBA L_{dn}, which exceeds our recommended level of 55 dBA L_{dn}. The threshold of perception of change in sound levels for human hearing is about 3 dB; therefore, the increase would be unnoticeable or barely noticeable at the nearest NSA.

Noise decreases logarithmically with increasing distance from a noise source; therefore, cumulative operational noise impacts would only occur where other facilities or activities would occur very close to the Projects' noise-emitting facilities, i.e., the liquefaction facility and compressor stations. Also, the cumulative noise during operation of some of the projects and facilities identified above would likely be less than during construction because they would generate little to no noise after they are built. We did not identify any projects that would contribute to operational noise impacts in the cumulative impact area for the North Compressor Station and the Louisiana Connector Project's compressor station. The project most likely to result in and contribute to cumulative noise impacts based on its proximity to the Liquefaction Project is the CIP. While the channel improvement project and any maintenance dredging of the SNWW could contribute to the cumulative noise impact of NSAs near the liquefaction site, the effect would be temporary and limited to when dredging is occurring very close by. As such, we conclude that operation of the Projects would not contribute significantly to existing noise in the area.

4.13.2.13 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. However, recent research has begun to attribute certain extreme weather events to climate change (U.S. Global Change Research Program, 2017).

Climate change has resulted in a wide range of impacts across every region of the country. Impacts extend beyond atmospheric climate change alone and include changes to water resources, transportation, agriculture, ecosystems, and human health. The United States and the world are warming; global sea level is rising and acidifying; and certain weather events are becoming more frequent and more severe. These changes are driven by accumulation of GHG in the atmosphere through combustion of fossil fuels (coal, petroleum, and natural gas), combined with agriculture and clearing of forests. These impacts have accelerated throughout the end 20th and into the 21st century. Although climate change is a global concern, for this analysis, we focus on the potential cumulative impacts in the Projects area.

The following observations of environmental impacts are attributed to climate change in the Gulf Coast and Southeast regions with a high or very high level of confidence: [73,74,75]

- The region's climate is generally warm and wet, with mild and humid winters. Since1970, average annual temperatures in the region have increased by about 2 °F. Higher average temperatures are occurring in the summer months. There have been increasing number of days above 95 °F and decreasing number of extremely cold days since the 1970s.

- Average annual temperatures in the region are projected to increase by 4 to 8 °F by 2100.

- Most areas, with the exception of southern Florida, are getting wetter. Autumn precipitation has increased by 40 percent since 1948. The number of heavy downpours has increased in many parts of the region.

- Despite increases in fall precipitation, the area affected by moderate and severe drought, especially in the spring and summer, has increased since the mid-1970s.

- The coasts will likely experience stronger hurricanes and sea level rise. Storm surge could present problems for coastal communities and ecosystems.

- Many coastal areas in Texas and Louisiana are subsiding; local land elevation is sinking relative to sea level. Combined with global sea level rise, local subsidence will lead to a higher "relative" change in sea level at the local scale. Observed subsidence rates in the southeast are significant. The highest rise in relative sea level in the United States is found in Louisiana (0.3 to 0.4 inch per year) and Texas (0.2 to 0.3 inch per year).

- Higher temperatures increase evaporation and water loss from plants. Projected increases in temperature will likely increase the frequency, duration, and intensity of droughts in the area.

- Projected changes in surface water runoff to the coast and groundwater recharge will likely allow saltwater to intrude and mix with shallow aquifers in some coastal areas of the Southeast, particularly in Florida and Louisiana.

- If the region increases groundwater pumping to offset water shortfalls, then aquifers will be further depleted. In the long term, the depletion of groundwater supplies would place additional strain on surface-water resources.

- Higher temperatures will likely increase heat stress, respiratory illnesses, and heat-related deaths in the Southeast. High temperatures also correlate with poor air quality and pose a risk to people with respiratory problems. While the number of cold-related deaths is projected to decrease, net climate-related mortality will likely increase.

- Increased flooding and hurricanes could present extreme public-health and emergency-management challenges.

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73 Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe. Eds. 2013. 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2.

74 Global and Regional Sea Level Rise Scenarios for the United States, NOAA January 2017

75 U.S. Global Change Research Program, 2017: *Climate Science Special Report: Fourth National Climate Assessment, Volume I*

- The spread of some types of bacteria has been linked to warmer temperatures. For example, food poisoning from eating shellfish infected with *Vibrio* spp. bacteria is reported both a month earlier and a month later than historically observed, increasing the infection report period by two months. As temperatures increase, the frequency of these types of shellfish-borne disease outbreaks in coastal waters is likely to increase.

The rate and magnitude of expected changes would exceed those experienced in the last century.

The GHG emissions from construction and operation of the Projects are presented in section 4.11.1 and equate to 224,844 tons of CO_2e during construction and 335,674 tpy of CO_2e during operation (primarily at the liquefaction site, the South Compressor Station, and the Louisiana Connector Project's compressor station). A GHG BACT analysis was performed for the liquefaction facilities. Proposed GHG BACT for the liquefaction facilities includes use of low carbon fuels, combustion equipment (turbines, thermal oxidizers, emergency back-up and firewater pump engines) designed as operational energy efficient in accordance with EPA GHG BACT standards, and a leak detection and repair program for monitoring piping and storage tank components to limit the impact of CH_4 emissions. The North Compression Station (associated with the Texas Connector Project) and the Louisiana Connector Project's compressor station are not PSD major sources and therefore, GHG BACT analyses are not required for this facility. However, the installation of new turbines and internal combustion engines would also be designed for energy efficient operations.

Construction and operation emissions from the Projects 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. However, there is no widely accepted standard, per international, federal, or state policy, or as a matter of physical science, to determine the significance of the Projects' GHG emissions for purposes of meaningfully informing the Commission decision in this proceeding.

4.13.2.14 Safety

In general, impacts on reliability and public safety would be mitigated using the DOT Minimum Federal Safety Standards in 49 CFR 192, which are intended to protect the public and to prevent natural gas facility accidents and failures. In addition, PALNG's and PAPL's construction contractors would be required to comply with the OSHA and Health Regulations for Construction in 29 CFR 1926. Those rules and regulations ensure that the applicable design and engineering standards are 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 are provided by police departments, fire departments, and hospitals in area surrounding the liquefaction facility, and those services would expand to include the associated proposed liquefaction facility. In accordance with our regulations, PALNG and PAPL 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.

The other liquefaction projects listed in table 4.13.1-1, if authorized, constructed, and operated, would each 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 Projects area would include emergency services within their facilities, and have ERPs developed with the appropriate agencies. Emergency responses 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 of the facilities at the same time, there could be a short term but significant cumulative impact on emergency services within Jefferson and Orange Counties, Texas and Cameron, Calcasieu, Jefferson Davis, Beauregard, Allen, Evangeline, and St. Landry Parishes, Louisiana. That impact could be mitigated by assistance from emergency service providers from surrounding counties and parishes.

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, DOT PHMSA as cooperating agencies. A cooperating agency may adopt the EIS per 40 CFR 1506.3 if, after an independent review of the document, it concludes that its permitting requirements and/or regulatory responsibilities have been satisfied. However, each cooperating agency would present its own conclusions and recommendations in its respective and applicable record of decision. Otherwise, it may elect to conduct its own supplemental environmental analysis, if necessary.

We determined that construction and operation of the Projects would result in some 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, EFH, vegetation, land use, visual resources, and air quality and noise would also result from the Projects. However, if the Projects are constructed and operated in accordance with applicable laws and regulations, the mitigating measures discussed in this EIS, and our recommendations, these impacts would be reduced to less than significant levels. This determination is based on a review of the information provided by PALNG and PAPL 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 Projects. We are therefore recommending that our mitigation measures be attached as conditions to any authorization issued by the Commission. A summary of the anticipated impacts and our conclusions is provided in the following subsections, by resource area.

5.1.1 Geology

The overall effect of the Projects on topography and geology would be minor. Geologic impacts would be limited to construction activities and would include disturbance of slopes within the work areas. All areas disturbed during construction would be returned as closely as possible to preconstruction contours during cleanup and restoration.

In general, the potential is low for geologic hazards such as earthquakes, surface faults, soil liquefaction, subsidence, karst, landslides, or a seismically generated tsunami or seiche to significantly affect construction or operation of the proposed Projects. However, some hazards such as severe flooding, storm surges, high winds, erosion along the shoreline and docking facilities, and potential site access interruptions could affect the Liquefaction Project during operation. In addition to structural and mechanical elements that have been designed into the liquefaction facilities, PALNG would construct an earthen levee around the entire Liquefaction Project site to further minimize these hazards and monitor foundations and other critical facilities to ensure they are maintained within acceptable limits. Along the pipelines, PAPL would implement buoyancy control measures such as concrete-coated piping, anchors, or aggregate-filled saddle bags to weigh the pipe in wet areas, and would periodically monitor the pipeline right-of-way during operation to aid in identification of subsidence-related conditions that may require maintenance.

Construction of the Projects would not affect any known mineral resources or active wells, pits, or mines. However, the Projects would affect at least four abandoned wells and other abandoned wells may be discovered during surveying and construction of the Projects. Because PALNG and PAPL have not indicated what steps it would take if construction would impact an abandoned well, we are recommending that PALNG and PAPL file with the Secretary a plan for construction of the Projects near known abandoned wells and that discusses how PALNG and PAPL would maintain the integrity of any plugged wells.

Use of the HDD method would reduce impacts on existing geologic conditions between the HDD entry and exit points at the locations where this method is used. PAPL has not yet conducted geotechnical surveys for the proposed HDD crossings to evaluate the suitability of the geologic material, but proposes to conduct these investigations during final engineering design of the proposed pipelines. Additionally, PAPL has not yet completed geotechnical boring/investigations at the compressor stations, but proposes to conduct these investigations during the final engineering design. Therefore, we are recommending that, prior to construction of the compressor stations associated with the Texas Connector and Louisiana Connector Projects, PAPL file with the Secretary the geotechnical investigations for the compressor stations.

Paleontological resources are generally rare in the region, and no specific sites containing significant paleontological resources were identified in the Projects area. To minimize potential impacts on paleontological resources that may be uncovered during construction, PALNG and PAPL would follow procedures provided in their *Unanticipated Discovery of Paleontological Resources Plan*.

PALNG and PAPL do not anticipate that any blasting would be required during construction of the Projects. Based on this discussion, in consideration of PALNG's and PAPL's proposed mitigation and design criteria, and our recommended mitigation measures, we conclude that the Projects would not significantly impact or be impacted by geological conditions in the area.

5.1.2 Soils

Construction of the Projects could affect soil resources by increasing the potential for erosion, compaction, mixing of topsoil, and rutting. Based on the soil properties reviewed, none of the soils affected by the Projects are considered highly susceptible to erosion by wind or water; however, the area found along the SH 87, pipelines, and utilities relocation area has experienced long-term erosion issues associated with tidal action. These issues would be alleviated by PALNG's proposal to relocate SH 87, the pipelines, and utilities farther inland and outside of the proposed liquefaction site. The erosion potential of soils within the construction workspace is reduced by the generally level topography of the area and through the use of erosion control and revegetation measures described in PALNG's and PAPL's *Environmental Plan*.[76]

The upland portions of the liquefaction facilities site, dredge disposal areas, and nonjurisdictional facilities are comprised entirely of soils categorized as hydric soils that are comprised entirely of clay and peat soils prone to compaction. Operation of the compressor stations and other aboveground facilities along the pipelines for the Texas Connector and Louisiana Connector Projects would permanently affect 105.7 acres of prime farmland but would not result in a significant reduction of usable prime farmland soils in the area.

Based on comments from the EPA, PALNG committed to resampling sediments at the landward component of the MOF prior to dredging and disposal. Because the soil and sediment analyses have not yet been conducted, we are recommending that, prior to construction, PALNG provide the soil and sediment analysis to the EPA, USACE, TCEQ, and Texas RRC, and, if the analysis determines that the dredge material is not suitable, PALNG file evidence that authorizations and permits for the modified activity have been obtained. Additionally, the need for sediment testing could be required as part of the section 401

76 *Environmental Plans* for the Liquefaction Project, Texas Connector Project, and Louisiana Connector Project were filed on November 29, 2016; December 12, 2017; and October 16, 2017, respectively. These plans can be found on the FERC eLibrary website using Accession Numbers 20161129-5254 (Liquefaction Project), 20171212-5147 (Texas Connector Project), and 20171016-5210 (Louisiana Connector Project).

Water Quality Certification process, which is overseen by the Texas RRC. Prior to disposal at the J.D. Murphree WMA, PALNG is required to develop a dredge disposal plan per the TPWD.

Contamination from spills or leaks of fuels, lubricants, and coolant from construction equipment could also adversely affect soils. PALNG and PAPL would implement mitigation measures included in its *Environmental Plan*, which would specify cleanup procedures to minimize the potential for soil contamination from such spills or leaks. PALNG and PAPL would also follow its *Unanticipated Hazardous Waste Discovery Plan* in the event contaminated soil or water is encountered. 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.

Construction activities such as clearing, grading, excavation, backfilling, and the movement of construction equipment may affect soil resources at the liquefaction facilities. In order to increase the load bearing capacity of soils along the heavy haul road, an engineered grout would be added to the subsoil that would permanently alter the physical characteristics of 7.5 acres of soils at the liquefaction facilities.

To protect the liquefaction facility post-construction during its operation, PALNG would construct a storm surge barrier of improved soil and structural clay to a top elevation of 20 feet. About 4.4 million yd^3 of fill would be used on the remainder of the liquefaction facilities site. In addition, PALNG would further armor the Port Arthur Canal adjacent to the site by means of riprap or other erosion prevention measures, and would develop a Shoreline Protection Report to address potential shoreline erosion that may occur during operations in the shoreline zone.

With implementation of the proposed mitigation measures and plans, and with our additional recommendations, we conclude that impacts on soil resources would be adequately minimized.

5.1.3 Water Resources

5.1.3.1 Groundwater

The Projects are underlain by the Gulf Coast aquifer, which consists of the Chicot, Evangeline, and Jasper aquifers. Specifically, the Projects would be above the Chicot and Evangeline aquifers. In southwestern Louisiana, the Chicot aquifer is an EPA-designated SSA; however, this designation does not apply to the Chicot aquifer in Texas. We do not anticipate any long-term or significant impacts on the aquifer due to construction or operation of the Projects.

In some areas of southwest Louisiana, increased groundwater withdrawals have resulted in decreasing water levels (drawdown) and saltwater encroachment. Although no portion of the Chicot aquifer in Louisiana has been designated as an Area of Ground Water Concern, high water use in southwest Louisiana has been identified as one of the current major issues having an impact on groundwater sustainability management. In 2012, the LDNR and USGS entered into a joint partnership to increase groundwater monitoring. PALNG and PAPL do not plan to use groundwater as a water supply during construction or operation of the Projects. Water for the facilities would be obtained from the local municipal water system. Water for hydrostatic testing would be obtained from City of Port Arthur, the LNVA, and/or surface water sources.

Most construction activities associated with the liquefaction and pipeline facilities would involve shallow, temporary, and localized excavation, with the exception of concrete and steel piles for LNG vessel loading facilities and LNG tanks. Piles required for the LNG storage tanks and LNG ship loading and berthing areas would be driven to a depth no lower than 160 feet and are not expected to have direct impacts on the underlying aquifer, which is overlain by at least 155 feet of surficial sediments. During construction of the Texas Connector and Louisiana Connector Projects, shallow groundwater could be encountered within the first 3 feet below grade within Jefferson and Orange Counties, Texas and in Cameron, Calcasieu, and Beauregard Parishes, Louisiana. If it became necessary to remove water from the pipeline trench during construction, the water would be pumped through filter bags prior to being discharged. The typical pipeline trench excavation depth would be at least 6.5 feet, which is far shallower than the depth of the Chicot aquifer in the Texas Connector and Louisiana Connector Projects area. New impervious surfaces caused by construction of the Liquefaction Project and aboveground facilities and compressor stations for the Texas Connector and Louisiana Connector Projects could also potentially affect groundwater resources by reducing infiltration and groundwater recharge.

No drinking water wells or identified springs are within 150 feet of the Liquefaction Project. There are no known groundwater withdrawal wells, drinking water wells, designated WHPAs, or springs within 150 feet of the Texas Connector Project in Texas and Louisiana. There are 16 known groundwater withdrawal wells or drinking water wells within 150 feet of the Louisiana Connector Project in Louisiana and none in Texas. Eight of these wells are identified as plugged and abandoned, and eight are identified as active. Active wells include six private water wells for domestic or agricultural use, one commercial well, and one monitor well. There are no designated WHPAs or springs identified within 150 feet of the Louisiana Connector Project.

With implementation of the measures discussed above, the activities associated with the construction and operation of the Projects would result in negligible to minor and temporary impacts on local groundwater resources.

5.1.3.2 Surface Waters

Construction of the Liquefaction Project would involve crossing two waterbodies: the Port Arthur Canal and the Round Lake/Oilfield Road Canal. Round Lake is surrounded by both the jurisdictional and nonjurisdictional portions of the project on the northern end of the facility, but would not be directly impacted by project activities. The Port Arthur Canal has been designated as EFH and a Navigable Waterway under section 10 of the RHA.

The primary impacts on water quality within the Port Arthur Canal during construction of the Liquefaction Project would be associated with dredging the marine berths, MOF, and Pioneer Dock. Dredging for construction and maintenance dredging during operation are anticipated to result in temporarily increased turbidity levels, decreased dissolved oxygen levels, and resuspension of nutrients or chemicals into the Port Arthur Canal water column. Increased turbidity levels have the potential to negatively impact aquatic plants and phytoplankton in the immediate area of dredging activities, while decreased dissolved oxygen concentrations may negatively impact benthic organisms. To minimize impacts on aquatic resources due to increased turbidity and suspended solid levels, PALNG would use dry excavation methods to the extent practicable and utilize hydraulic cutter heads to capture siltation. During operation, maintenance dredging of the recessed berthing area would be required every 4 to 5 years to maintain adequate water depths for LNG vessel maneuvering.

During construction of the Liquefaction Project, dredge material would be transported to the J.D. Murphree WMA and SNND Dredge Disposal Areas 8, 9A, and 9B via a temporary 30-inch-diameter pipeline laid on the ground surface or, where necessary, floated in water. PALNG would complete final design of this temporary pipeline where it would cross the ICWW and Port Arthur Canal prior to construction to ensure navigational activities in the waterway are not interrupted.

Construction of the Liquefaction Project would reduce the amount of existing pervious surfaces, thereby increasing the potential frequency and volume of stormwater runoff into the Port Arthur Canal.

Stormwater runoff may pick up debris, chemicals, dirt, and other pollutants before entering a waterbody. Dredging activities associated with construction of the marine berths, MOF, and Pioneer Dock may cause temporary increases in erosion and sedimentation in the immediate vicinity of construction activities. Following construction, the Port Arthur shoreline would be stabilized with an armored shoreline protection system to prevent post-construction erosion.

The primary impact on water quality from construction of the Texas Connector and Louisiana Connector Projects would be sediment suspension caused by in-stream trenching and backfilling. To minimize potential erosion and sedimentation impacts on surface waters, PALNG and PAPL would implement its project-specific *Environmental Plan* (which includes the Commission's Plan and Procedures) and all stormwater regulations and permitting requirements. With the implementation of these measures and the design of the Projects, erosion and stormwater runoff from construction and operation would be minimized and not significant.

During operation of the Liquefaction Project, up to 180 LNG vessels would call on the liquefaction facility per year, each of which could discharge between 12 to 18 million gallons of ballast water (depending on LNG vessel size) into the Port Arthur Canal during loading. Potential impacts on water quality may include changes in temperature, pH, dissolved oxygen, and salinity levels. The amount of ballast water discharged into the Port Arthur Canal during each LNG vessel visit to the liquefaction facility would represent 0.03 percent of the water within a 500-meter stretch of the Port Arthur Canal, which would present a minor influence on the overall system. To ensure compliance with U.S. laws and regulations governing ballast water discharges, PALNG's marine staff would review any applicable documentation that the visiting ship is or has been operating the LNG vessel in accordance with federal standards and practices. With the implementation of international and national requirements, impacts on surface waters would be temporary and minor from ballast water discharge or temporary increases in turbidity.

LNG vessels and barges require water for cooling of the main engine/condenser, diesel generators, and fire main auxiliary and hotel services. The volume of water required for engine cooling would vary greatly based on the type of vessel calling on the liquefaction facility. Steam-powered LNG vessels (maximum LNG capacity of 138,000 m^3) would have the highest cooling water requirements while LNG vessels with dual fuel/diesel electric engines (maximum LNG capacity of 218,000 m^3) would require a smaller volume of cooling water. LNG vessels would require the least cooling water and may range from 530,000 to 660,000 gallons per hour depending upon type and size of the LNG vessel. At the high end of this range, a complete discharge of cooling water would represent less than 0.01 percent of the water in the Port Arthur Canal in the project area. Impacts on surface waters from cooling water intake and discharge would be primarily limited to an increase in water temperature near the LNG vessel. Based on a review of available information, we anticipate that cooling water discharged at the liquefaction facility could range between 2.7 °F and 7.2 °F warmer than ambient water temperatures. Due to the limited temperature differences and relatively small volume of discharge compared to the total water within the Port Arthur Canal, we anticipate that the increased water temperature levels would diminish shortly after discharge and, therefore, would have temporary and minor impacts on water quality.

About 151.1 million gallons of test water would be required for hydrostatic testing of the LNG tanks and pipelines, which would be obtained from using both municipal sources and surface waters, including waters on 303(d) impaired waters lists. Although the Port Arthur Canal is not listed on the Texas 2014 303(d) impaired waters list, the potential for chemical contamination exists because of the current and historical industrial use of the canal. In addition, the Texas Connector and Louisiana Connect Projects would cross 16 waterbodies that are on the 303(d) list of impaired waters. After completion of hydrostatic testing, PALNG would discharge the hydrostatic test water to the Port Arthur Canal, and PAPL would discharge hydrostatic test water to Sabine Pass (a 303[d] impaired water) and upland areas. To minimize potential impacts on surface water, PALNG and PAPL would discharge the hydrostatic test water in accordance with its Texas RRC discharge permit and its project-specific *Environmental Plan.* In addition, PALNG and PAPL would not add any chemicals to the hydrostatic test water and the discharged water would be tested in accordance with the requirements of their permits. With the implementation of these measures, impacts on water quality due to hydrostatic testing would be temporary to short term and minor.

During construction and operation, hazardous materials resulting from spills or leaks flushed into waterbodies with stormwater runoff or entering the Port Arthur Canal, Round Lake Canal, Round Lake, and Oil Field Road Canal could have an adverse impact on water quality. To minimize the potential for a release of hazardous materials and to avoid or minimize the impacts of a release if one were to occur, PALNG and PAPL would adhere to the measures outlined in its *Environmental Plan*.

The Texas Connector and Louisiana Connect Projects would cross 12 watersheds and construction would affect a total of 222 waterbodies, including 97 perennial, 42 intermittent, and 69 ephemeral, and 14 open waterbodies. Of these, 51 are major waterbody crossings (greater than 100 feet wide). None of the waterbodies crossed by the pipeline projects are listed as National Wild and Scenic Rivers, listed as important riparian areas, or designated as an Ecologically Significant Stream segment. None of the waterbodies crossed by the Texas Connector Project contain federally listed species. Four waterbodies crossed by the Louisiana Connector Project are designated as System Rivers: Beckwith Creek, Hickory Branch, Barnes Creek, and Whiskey Chitto Creek. PALNG and PAPL would minimize potential impacts on surface waters by implementing its *Environmental Plan* (which includes the Commission's Procedures).

PAPL proposes to conduct 24 HDD operations as part of the Texas Connector Project. As some of the HDDs would encompass more than one waterbody, a total of 53 waterbodies would be crossed using the HDD or bore method. For the Louisiana Connector Project, PAPL would use the open-cut method at 91 waterbody crossings, the HDD method at 26 crossings, the bore method at 7 crossings, the barge lay method at 3 crossings, and the push method at 23 crossings. Successful implementation of HDD or bore methods would avoid impacts on waterbodies. To minimize surface water impacts during open-trench construction, PAPL would limit the use of equipment operating in waterbodies, install and maintain sediment barriers around spoil piles, and complete the in-stream pipe section prior to commencing in-stream activity. In accordance with the Commission's Procedures, PAPL would provide detailed plans for each HDD crossing prior to construction, and prepare a preliminary HDD Contingency Plan that describes measures PAPL would implement in the event of the HDD is unsuccessful. PAPL stated that it would finalize the HDD Contingency Plan with the selected contractor and incorporate into construction compliance documents.

Sabine Lake would be crossed using the HDD and open-cut methods. Temporary siltation and sedimentation could occur at the HDD entry and exit points in Sabine Lake, primarily from the drilling mud associated with the initial drilling of the pilot hole, the subsequent reaming, and the pulling of the pipeline through the hole. Drilling mud is typically non-toxic and would not be expected to chemically affect organisms in the lake; however, sessile organisms near the release could be smothered and killed. The primary impacts on water quality associated with open-cut construction in the lake would be the resuspension of sediment into the water column. Dredging and excavation operations necessary to install the pipeline through Sabine Lake would suspend sediment and affect water quality and aquatic resources. Sediments may be resuspended during trench excavation and from spoil pile erosion due to wind and wave forces. These lake processes could result in additional impacts on water quality and aquatic resources. The suspended solids and turbidity levels would decline to ambient levels following completion of construction. Turbidity resulting from trenching could reduce light penetration and the corresponding primary production of aquatic plants, algae, and phytoplankton. Additionally, the resuspension of organic materials and sediments could cause an increase in biological and chemical oxygen demand along the construction right-of-way. Lower dissolved oxygen concentrations could cause a temporary displacement of motile organisms and may stress or kill sessile benthic organisms within the construction right-of-way. Detailed information, including site-specific HDD plans, for the Sabine Lake crossing along the Louisiana Connector Project are pending. PAPL would adhere to the Commission's Procedures, which requires that a site-specific crossing plan be provided for each major waterbody crossing (which includes Sabine Lake) prior to construction.

With implementation of PALNG's and PAPL's project-specific plans, the proposed mitigation measures discussed in this EIS, and our recommendations, we conclude that impacts on surface waters would be adequately minimized.

5.1.3.3 Wetlands

Construction of the Liquefaction Project facilities would permanently convert 725.7 acres of wetlands, including 303.7 acres of PEM wetlands, 21.2 acres of EEM wetlands, and 400.8 acres of PSS wetlands. Permanently impacted wetlands would be converted to upland industrial or open land within the liquefaction site, or open water within the marine berth, Pioneer Dock, and MOF. Operation and maintenance of the proposed facilities is not expected to result in additional wetland impacts. The USACE noted that the wetland data provided by PALNG and PAPL to the USACE differs from that filed with FERC. Therefore, we are recommending that PALNG and PAPL file updated wetland impact data for the Projects to ensure accuracy and consistency with the wetland data provided to the USACE as part of PALNG's and PAPL's permit applications prior to construction.

Construction of the marine facilities would require dredging 7.8 million yd^3 of material from the Port Arthur Canal. PALNG proposes to place about 4.9 million yd^3 of dredged material in the established SNND Dredge Disposal Areas, which are authorized by the USACE for use as disposal areas for the maintenance dredging of Port Arthur Canal. PALNG also proposes to utilize approximately 2.9 million yd^3 of material dredged from the ship berthing area and Pioneer Dock to restore wetlands within the 1,900-acre area of the J.D. Murphree WMA, which is southwest of the Liquefaction Project area. Placement of the dredge material would result in the creation of 1,268.8 acres of coastal marsh wetlands. Revegetation would be monitored over a minimum of 5 years to ensure achievement of 80 percent native vegetative cover. Placement of dredge material within the J.D. Murphree WMA and incorporation of design features described previously is intended to provide, maintain, or enhance shoreline protection, sediment deposition, nutrient and organic carbon exchange, wildlife habitat, native plant community, and plant biomass production. Achievement of these functions would provide adequate restoration of natural marsh function. As a result, the beneficial use of dredge material to recreate historic emergent wetlands is expected to offset adverse impacts on wetlands at the liquefaction site, resulting in a net benefit to wetlands within the Sabine Lake Watershed.

During operation, vessel traffic along the Port Arthur Canal and maneuvering within the berthing area could result in increased shoreline erosion, potentially impacting the wetland fringe along the canal due to increased wave activity. To avoid impacts along the canal and prevent erosion of the adjacent unprotected shoreline, PALNG would install rock armoring along the shore, which when considered along with the anticipated vessel speed and the fact that the Port Arthur Canal is an existing ship channel regularly subject to commercial marine traffic, we have determined the increase in vessel traffic within the Port Arthur Canal and berthing area would cause a negligible increase in erosion of the adjacent wetland fringe.

Construction of the Texas Connector and the Louisiana Connector Projects would affect a total of 1,007.8 acres of wetland, and operations would permanently affect a total of 260.0 acres. Permanent impacts along the Texas Connector Project would result in the conversion of 7.0 acres (4.5 acres along the Northern Pipeline, 0.9 acre along the FGT Lateral, and 1.6 acres along the GTS Lateral) of PFO wetland to PEM or PSS wetland, as well a permanent loss of 4.1 acres at permanently maintained access roads. Permanent impacts along the Louisiana Connector Project would result in the conversion of 68.6 acres of PFO wetland to PEM or PSS wetland along the pipeline right-of-way.

PAPL and PALNG are required to avoid wetland impacts and minimize all unavoidable impacts to the extent practicable. The guidelines also restrict the discharge of dredge or fill material where a less environmentally damaging alternative is feasible. Additionally, the USACE requires compensatory mitigation for all permanent wetland loss. PALNG and PAPL have developed draft compensatory mitigation plans that would include credit purchases from USACE-approved mitigation banks, permittee-responsible compensatory mitigation, and agency in-lieu fee programs with the amount of compensatory mitigation determined based on the USACE's preliminary jurisdictional determinations. The USACE may recommend additional conditions to address components of the compensatory mitigation plan or project authorization.

Our Procedures state that aboveground facilities should be located outside of wetlands, except where such siting would prohibit compliance with DOT regulations. PALNG has proposed locating the new liquefaction facility within a site that contains 725.7 acres of wetlands. We have determined that these proposed deviations from the Commission's Procedures are reasonable and adequately justified provided that PALNG complies with the conditions of its USACE permit, including any required mitigation. To construct aboveground facilities for the Texas Connector and Louisiana Connector Projects, PAPL has proposed permanently converting 6.0 acres and 0.2 acre of wetlands, respectively. We have determined that PAPL's proposed deviations from the Commission's Procedures are reasonable and adequately justified.

Our Procedures state that the width of the construction right-of-way should be limited to 75 feet or less in wetlands. PAPL has proposed a right-of-way width of 100 to 125 feet in wetlands. We determined that based on the site-specific conditions and soils in areas where conventional construction methods would be used, we have no objection to a 100- to 125-foot-wide construction right-of-way.

Our Procedures state that all extra workspace areas should be at least 50 feet away from wetland boundaries (expect where the adjacent upland consists of cultivated or rotated cropland or other disturbed land and, if not possible, to with the Secretary for review and written approval by the Director, site-specific justification for each extra work area with a less than 50-foot setback from wetland boundaries. In accordance with the Procedures, PAPL has proposed areas where extra workspaces are within 50 feet from a wetland and provided the required site-specific justification for each deviation (see appendix M). We conclude that the workspaces are adequately justified.

With the implementation of PALNG's and PAPL's project-specific plans, PALNG's proposed beneficial use of dredge material to restore emergent wetlands, the proposed mitigation measures discussed in this EIS, and our recommendations, impacts on wetlands due to construction and operation of the Projects would be short term to permanent but minor.

5.1.4 Vegetation

Construction and operation of the Projects would affect a total of 1,206.5 acres and 5,767.0 acres of forested and open land vegetation types, respectively. A total of 845.3 acres of vegetation would be cleared during construction of the liquefaction site for the Liquefaction Project and 808.0 acres would be permanently converted to industrial use associated with operation of the liquefaction facilities. Additionally, 151.0 acres of open water would be created for project operations. Following construction, temporarily impacted areas would be restored to their original contours and revegetated per landowner or NRCS recommendations in accordance with the Commission's Plan and Procedures, which are part of PALNG's *Environmental Plan*. To mitigate for permanent wetland impacts, PALNG developed a draft mitigation plan in coordination with the USACE.

Dredge materials removed by construction of the Liquefaction Facility would be deposited in four areas: the J.D. Murphree WMA, and the existing SNND Dredge Disposal Areas 8, 9A, and 9B. Project-related dredge material placement at the J.D. Murphree WMA would be used to improve existing degraded wetlands by creating coastal marshlands, temporarily affecting 903.0 acres of wetland vegetation. PALNG would revegetate the affected areas of the WMA and, as such, no permanent impacts in the form of lost vegetation are anticipated. SNND Dredge Disposal Areas 8, 9A, and 9B are existing dredge disposal locations operated by the SNND and permitted by the USACE where vegetation is routinely disturbed by placement of dredge material. Dredge disposal in these three sites would affect 3,431.8 acres of vegetation and, per agreements with the USACE, no restoration activities are proposed. The temporary aboveground 30-inch-diameter pipelines used to transport dredge materials to their respective sites would not require vegetation clearing; therefore, associated impacts on vegetation are not anticipated.

As a result of PALNG's development of a draft wetland mitigation plan, the beneficial reuse of dredge materials at the J.D. Murphree WMA, and impacts to regularly disturbed vegetation at the existing SNND Dredge Disposal Areas, we have determined that impacts on vegetation from construction and operation of the liquefaction facility would be permanent but minor.

Construction of the Texas Connector and Louisiana Connector Projects would disturb a total of 482.8 acres and 2,044.1 acres of vegetated land, respectively, including open and forested upland and wetland areas. Impacts on vegetation associated with installation of the pipelines would primarily be caused by vegetation clearing within the construction right-of-way and associated ATWS. About 184.4 acres of upland forest would be permanently affected along the pipeline route. Except for the 410.0 areas that would be crossed by HDD, vegetation would be cleared from the entire working right-of-way. PAPL would minimize impacts on vegetative communities affected by pipeline construction by collocating the Texas Connector Project with existing pipelines and utilities for 43 percent of the routes and the Louisiana Connector Project for 73 percent of its route.

No vegetative communities of special concern have been identified in the Liquefaction Project area. Construction of the Texas Connector Project would not affect vegetation communities of special concern. The Louisiana Connector Project would cross a Coastal Prairie community between MPs 34.5 and 38.5 and a stand of Western Acidic Longleaf Pine Savannah/Flatwoods between MPs 65.5 and 67.2. Permanent impacts are not anticipated due to active livestock grazing on the Coastal Prairie community, and existing silviculture management and a logging road on the Western Acidic Longleaf Pine Savannah/Flatwoods community. In addition, PAPL would implement its *Environmental Plan* to restore Coastal Prairie community.

Field surveys indicated that Chinese tallow, Japanese honeysuckle, and Chinaberry tree fern were present at the liquefaction site. Because the site would be cleared of vegetation and maintained in such state, no invasive species controls are anticipated. Invasive species present at the nonjurisdictional facilities would be periodically mowed by the TDOT.

Chinese tallow and alligator weed were identified in the Texas Connector Project area. PAPL proposes to control Chinese tallow and alligator weed through routine mowing of the right-of-way. The presence of invasive species along the Louisiana Connector Project was observed during wetland delineations. Chinese tallow was identified in upland areas, and alligator weed and water hyacinth were observed in canals and drainage ditches. PAPL proposes to control Chinese tallow through a management approach of leaf spraying per consultation with the NRCS. PAPL's *Environmental Plan* details measures that would be implemented to minimize the spread of aquatic invasive species, including equipment inspection and invasive species removal before equipment arrives on site, during in-stream work, and before equipment leaves the worksite. PAPL also would implement the measures in the Commission's Plan and

Procedures, which require post-construction monitoring for the first and second growing seasons in uplands, and for 3 years in wetlands, to evaluate the success of revegetation.

With the implementation of PAPL's *Environmental Plan*, which includes the Commission's Plan and Procedures, the previous activities at the liquefaction site, collocation of the pipeline projects, and adopting of the HDD method at multiple locations, construction and operation of the Texas Connector and Louisiana Connector Projects would not have a significant impact on vegetation.

5.1.5 Wildlife

Wildlife species in the Projects area are characteristic of the communities that inhabit the vegetative habitats that occur in these areas. About 7,828.1 acres of wildlife habitat would be affected by construction of the Projects and 6,003.1 acres would be affected during operations, although the majority of these impacts would occur at the dredge disposal areas. Overall, the greatest impacts would be on open wetland habitat, followed by open upland and forested upland habitats. Operation of the liquefaction facilities would result in increased noise, lighting, and human activity that could disturb wildlife in the area. However, due to current industrial activities at other facilities in the area (e.g., Golden Pass, Sabine Pass), wildlife species in the area are expected to be acclimated to the noise and artificial lighting associated with these activities. To minimize project-related impacts on wildlife, PALNG would implement its project-specific *Environmental Plan*, which includes the Commission's Plan and Procedures, as well as its *Spill Prevention Plan* during construction. During operation of the liquefaction facilities, PALNG committed to using ground flares as opposed to elevated flares to minimize impacts on migratory birds. Therefore, the temporary flaring during construction and the occasional flaring during operation would not adversely or significantly impact migratory birds.

Based on the previous use of the Liquefaction Project site for dredge material placement, adequate similar habitat for wildlife near the site, presence of exotic and/or invasive species (e.g., Chinese tallow), limited amount of forest habitat impacts, proposed beneficial use of dredge material, and implementation of PALNG's proposed mitigation measures, we have determined that construction and operation of the proposed Liquefaction Project would have permanent but minor impacts on wildlife. While we acknowledge that placement of dredge material at the J.D. Murphree WMA would create about 1,268.8 acres of coastal marsh wetland, resulting in a beneficial impact on wildlife species associated with this habitat, the activity could also result in the mortality of immobile/slow moving organisms and nesting birds and their eggs at the WMA.

Construction of the Texas Connector and Louisiana Connector Projects would affect 2,526.5 acres of vegetated wildlife habitat, with the greatest impact on open upland habitat, and operation would permanently convert 816.3 acres of wildlife habitat. The remaining acres of agricultural lands, open wetlands, and upland areas would be revegetated to a cover state similar to preconstruction conditions. Individuals of some wildlife species would be affected by construction and operation of the proposed aboveground facilities; however, most impacts on wildlife would be short term and limited predominantly to the construction period. PAPL would not conduct routine vegetation mowing or clearing over the entire width of the permanent right-of-way more frequently than every 3 years, except for a corridor not exceeding 10 feet in width centered on the pipeline that would be cleared at a frequency necessary to maintain an herbaceous state, and routine vegetation mowing or clearing would not occur during the migratory bird nesting season between April 15 and August 1.

PAPL would conduct surveys for rookeries and bald eagle nests prior to the start of construction. If active nests are identified, PAPL would adjust the construction timeline and implement the appropriate buffers in accordance with the agency recommendations.

The vegetation communities within the areas affected by the Projects provide potential habitat for migratory bird species, including songbirds, waterbirds, and raptors. However, much of the vegetated land associated with the Liquefaction Project and nonjurisdictional facilities is previously disturbed, and/or within or adjacent to existing facilities. Removal or conversion of these habitat types would reduce bird nesting and foraging habitat value. Impacts on migratory birds and BCC species and their habitat due to construction and operation of the Projects would typically be similar to impacts on general wildlife resources. Potential impacts specific to migratory birds could result from loss of habitat and injury or disorientation due to flaring and other artificial illumination.

During construction, PALNG would direct all shrouding lights downward to minimize impacts on migratory birds while providing the illumination needed to ensure safe operation of the facility. Additionally, PALNG would use nesting inhibitors (e.g., pennant flagging) in parking areas to discourage migratory birds from nesting in unsuitable areas. With the implementation of these mitigation measures, temporary flaring during construction and occasional flaring during operation would not adversely or significantly impact migratory birds. Similarly, outdoor lighting at the Texas Connector and Louisiana Connector Projects aboveground facilities would be limited, shielded, and downward-facing to facilitate safe operations at night or during inclement weather.

Based on the previous use of the site for dredge material placement, adequate similar habitat for wildlife near the site, presence of exotic and/or invasive species (e.g., Chinese tallow), limited amount of forest habitat impacts, proposed beneficial use of dredge material, and implementation of PALNG's proposed mitigation measures, we have determined that construction and operation of the proposed Liquefaction Project would have permanent but minor impacts on wildlife.

With the implementation of PAPL's *Environmental Plan*, which includes the Commission's Plan and Procedures, and since abundant similar habitat is available for wildlife adjacent to the affected areas, construction and operation of the Texas Connector and Louisiana Connector Projects would not have a significant impact on local wildlife populations or habitat.

5.1.6 Aquatic Resources

Aquatic habitat associated with waterbodies that would be affected by the Projects include the marine and estuarine habitats of the Port Arthur Canal adjacent to the Liquefaction Project, and the marine, estuarine, and freshwater habitats affected by the Texas Connector and Louisiana Connector Projects. Fifty-five (55) waterbodies that support warm water fisheries would be crossed by the Texas Connector Project and 167 waterbodies of the same type would be crossed by the Louisiana Connector Project.

Activities associated with construction and operation of the Liquefaction Project with the potential to impact aquatic species include increased turbidity due to dredging, increased in-water noise from pile driving, increased vessel traffic, the release of ballast water or hull fouling, alteration of light regimes, creation of habitat for encrusting species, alterations to stormwater drainage and increased stormwater runoff, alteration of wave energy, and inadvertent spills of hazardous materials.

Construction of the MOF, Pioneer Dock, and marine berth would require the dredging of 7.8 million yd^3 within the Port Arthur Canal. Potential impacts on aquatic resources resulting from dredging activities would temporarily cause sediment suspension and turbidity temporarily, lowering the water quality within a localized area surrounding the dredged area. Increases in turbidity can adversely affect fish physiology and behavior, resulting in less healthy individuals, reduced fecundity, reduced foraging habitat, and temporary emigration of fish out of the project area. Direct effects on the physical environment would result in less sunlight absorbed throughout the water column, affecting the amount of photosynthesis by aquatic plants, dissolved oxygen in the water column, algae, and phytoplankton, ultimately affecting the food chain. Within the first few days after completion of dredging operations, the benthic community would be reduced in species richness, species abundance, and biomass through direct mortality. This would reduce the amount of prey available for aquatic species within the berthing area. Based on historic dredging of the Port Arthur Canal, polychaetes, oligochaetes, and other similar species would quickly re-colonize in the soft mud bottom of the disturbed areas following dredging through natural rapid population growth as these species take advantage of unoccupied space in newly exposed sediments. PALNG would minimize turbidity and sediment suspension by commencing construction from the landward side, working its way into the Port Arthur Canal, and would use wet dredging techniques to retain much of the entrained sediment.

Maintenance dredging of the recessed berthing area would be conducted by PALNG every 4 to 5 years during operation of the liquefaction facilities. Potential impacts on aquatic resources from maintenance dredging include direct take and habitat modification as well as temporary increases in noise, turbidity, and suspended solid levels; however, impacts would be shorter in duration due to the reduced amount of material being removed from the recessed berthing area. As a result of similar projects in the area and the existing conditions and activities associated with the Port Arthur Canal, along with PALNG's impact minimization measures and agency accepted turbidity analyses, the impacts on aquatic resources associated with dredging during construction and operation of the project would be negligible to minor and temporary.

Construction of the Liquefaction Project would require the installation of approximately 779 piles over a 24-month period to support the proposed structures, including both in-water and onshore hydraulic piling rigs. It is anticipated that aquatic resources would largely avoid the pile driving area when the piles are being installed, although some aquatic resources could experience stress or injury due to the underwater sound pressure levels. PALNG would implement construction techniques that minimize noise effects on aquatic species, including pre-drilling pile holes, the use of a vibratory hammer, bubble curtains/ cofferdams, and ramping up driving activities. PALNG would also gradually increase the power and frequency of pile driving over a period of time, which would allow sensitive aquatic species to depart the area before harmful underwater sound pressures are reached by the vibratory hammers. With the implementation of PALNG's noise mitigation measures and our recommendations, impacts associated with pile driving during construction on aquatic species would be minor and temporary.

During construction and operation of the Liquefaction Project, barges and support vessels would call on the liquefaction facility, increasing ship traffic within the Port Arthur Canal. Potential impacts on aquatic resources resulting from increased vessel traffic include increased shoreline erosion and resuspension of sediments, ballast water discharges, cooling water discharges, and increased noise levels. PALNG would minimize potential erosion of the shoreline by installing rip-rap along the shoreline. Given the existing conditions and activities within the Port Arthur Canal, along with implementation of the mandatory practices required by federal regulations and USCG, the effects of ballast water discharges on aquatic resources and four ambient water quality parameters (i.e., temperature, pH, dissolved oxygen, and salinity) resulting from construction and operation of the Liquefaction Project would be minor and temporary. Impacts associated with increased barge traffic and noise on aquatic species would be consistent with current vessel traffic noise occurring in proximity to the liquefaction facilities. As a result, the impacts on aquatic species associated with increased vessel traffic during construction and operation of the project would be minor and temporary.

During construction of the work dock, and particularly during operation, additional lighting within and near the Port Arthur Canal would be present at the liquefaction facility. Aquatic species in the area are generally acclimated to the current ambient light. Increased light could affect small organisms by causing minor disruptions to the food chain, including changes in the vegetation community structure and increased predation. Impacts on aquatic resources resulting from shading could include reduced plant growth and changed vegetation assemblages, which would affect the food chain and modify animal behavior.

Additionally, reduced natural light levels in areas due to new structures providing shading would occur where previously not experienced. Changes in light regimes resulting from construction and operation of the Liquefaction Project would have minor to moderate and temporary to permanent impacts on aquatic species.

An additional 50,000 square feet of habitat for encrusting species would be created by construction of the new dock structures and installation of rip-rap along the shoreline for erosion control. The new encrusting species expected to inhabit the new area would be consistent with the existing biota and would permanently contribute to the biodiversity of Port Arthur Canal. While the habitat for encrusting species would have a minor, temporary impact on aquatic resources during construction, the additional hard surface would create a permanent and beneficial impact on these aquatic species.

Conversion of land to impervious surface areas at the liquefaction facility site and pipeline facilities would result in an increased volume of stormwater runoff, which could create changes in salinity, temperature, and/or dissolved oxygen for aquatic species in the areas affected by discharges, as well as increase the potential for contamination. To minimize direct stormwater runoff, catch basins and water diversion structures would be used in accordance with PALNG's and PAPL's project-specific *Environmental Plans*. To reduce contamination to waterways, direct fueling spills would be minimized by including a hazardous material containment area in the fueling facility design and implementing the spill control procedures included as part of PALNG's and PAPL's project-specific *Environmental Plans*. The effects of stormwater runoff resulting from construction and operation of the Projects would not have significant or adverse impacts on aquatic species.

Changes to wave energy within the Liquefaction Project area would result from the installation of piers, pilings, and docks during construction, and increased vessel traffic during operation. Potential impacts from increased wave energy include erosion, increased turbidity, and sedimentation, which could alter the plant and animal composition as substrate regimes change. The Port Arthur Canal has been previously altered with shoreline stabilization devices to minimize erosion, turbidity, and sedimentation to allow for heavy vessel traffic. To further minimize the potential for erosion and sedimentation resulting from project-related vessel traffic and construction activities, PALNG would install rip-rap along the shoreline of the Port Arthur Canal. The impacts on aquatic species associated with changes to wave energy during construction and operation of the Liquefaction Project would be negligible to minor and temporary (i.e., lasting as long as the vessels are in the area).

Construction of the Texas Connector and Louisiana Connector Projects would temporarily impact aquatic resources from activities such as waterbody crossings, removal of streamside vegetation, hydrostatic testing, and inadvertent spills. Potential operational impacts on aquatic resources would be primarily limited to increases in impervious surfaces and associated stormwater runoff and streamside vegetation clearing for operation, and would not otherwise affect aquatic resources.

Potential impacts on aquatic resources related to construction and operation of the Texas Connector and Louisiana Connector Projects would be associated with increased erosion and sedimentation due to open-cut waterbody crossings, inadvertent release of drilling mud during HDD crossings, physical or chemical water alterations from hydrostatic testing, entrainment from water appropriation for hydrostatic testing, and inadvertent spills. Due to the relatively small number of crossings, limited construction workspace and duration, and implementation of the mitigation measures, the Projects would have minor and localized impacts on aquatic resources.

5.1.7 Essential Fish Habitat

Estuarine emergent marsh EFH occurs within the J.D. Murphree WMA and Dredge Disposal Area 8 as well as within the shoreline of the Port Arthur Canal and Sabine Lake, along the Texas Connector

Project at MP 5.1 on the Northern Pipeline and at MP 2.6 and 7.2 on the Southern Pipeline, and at various locations along the Louisiana Connector Project.

Construction and operation of the Liquefaction Project would affect 3.2 acres of estuarine water column and estuarine mud/soft bottom EFH, which would result in temporary and permanent impacts. The Liquefaction Project would create 68.3 acres of additional open water habitat for aquatic species and EFH-managed species by dredging the berthing area and MOF, resulting in a net increase of estuarine mud/soft bottom and estuarine water column EFH. The restoration of marsh habitat within the J.D. Murphree WMA would also create an additional 1,268.8 acres of estuarine emergent marsh EFH offsite and the installation of riprap along the shoreline would provide habitat for encrusting species

For the Texas Connector Project, construction of the Northern and Southern Pipelines and access roads would temporarily affect 1.2 acres, 8.4 acres, and 0.8 acre of estuarine emergent marsh EFH, respectively. Estuarine scrub-shrub EFH is crossed at MP 7.1 along the Southern Pipeline but would be avoided using the HDD method.

Pipeline construction on the Louisiana Connector Project would affect 1,534.7 acres of EFH, including 131.7 acres of estuarine emergent marsh EFH and 1,403.0 acres of estuarine water column and mud/soft bottom EFH. Permanent access roads required for the operation would permanently affect 1.7 acres of EFH, 1.2 acres of estuarine emergent marsh, and 0.5 acre of estuarine water column and estuarine mud/soft bottom (see table 4.6.3-2). The MLV at MP 19.2 would also impact 0.1 acre of estuarine emergent EFH. Several EFH areas would be avoided by implementing the HDD method along the route, including parts of Sabine Lake and the ICWW.

As a non-federal party assisting the FERC in meeting its obligations under the MSA, PALNG and PAPL coordinated with NMFS regarding potential project impacts on EFH. NMFS indicated that the Projects would not have significant impacts on EFH, provided the PALNG and PAPL implements EFH conservation measures, including the use of HDD crossing methods, an inadvertent release plan, wetland and waterbody restoration, and wetland and waterbody mitigation, as applicable. The beneficial use of dredge material to recreate historic emergent wetlands within the J.D. Murphree WMA is expected to offset adverse impacts on estuarine mud/soft bottom and water column EFH at the Liquefaction Project, resulting in long-term benefits to wetlands.

Due to the relatively small area of EFH impacted by the Projects (i.e., the recessed berthing area, MOF, and Pioneer Dock), which cumulatively represents 5 percent of the total acreage within the canal; the increase in the amount of estuarine water column habitat created during construction of the Liquefaction Project; the increased habitat for encrusting species; avoidance of designated-EFH crossings by HDD installations; coordination with NMFS; wetland and waterbody restoration methods per the *Environmental Plan*; and the development of the Wetland Mitigation Plan, the Projects would not have a significant adverse impact on EFH. To meet our obligations under MSA, we have provided this draft EIS as our EFH assessment to the NMFS and await their response.

5.1.8 Threatened, Endangered, and Other Special Status Species

Based on input from the FWS and NMFS, 27 federally listed threatened and endangered species may occur within the parishes and/or counties affected by the Projects. The FWS confirmed the proposed Texas Connector Project would have no effect on federal trust resources in Louisiana. We determined the Projects would have *no effect* on 8 of the 27 federally listed threatened and endangered species and/or their designated critical habitat and would be *not likely to adversely affect* the other 19 species and/or their designated critical habitats. LNG vessel traffic associated with the Liquefaction Project would cross critical habitat for the loggerhead sea turtle. Consultation with the Texas Coastal Ecological Services Field Office is ongoing for the West Indian manatee.

Surveys for the American chaffseed have not been completed due to lack of access and, therefore, consultation with the Louisiana FWS is ongoing for the American chaffseed. We are recommending that PAPL conduct surveys for the American chaffseed on the no-access parcels with potential habitat prior to construction and file the results of the survey with the Secretary and the FWS. In addition, if the American chaffseed is found, PAPL should incorporate methods to avoid impacts on the American chaffseed and file with the Secretary and Louisiana FWS any proposed avoidance methods.

ESA section 7 consultation for the Projects is complete for all species under NMFS' jurisdiction. As required by section 7 of the ESA, we are requesting that the FWS review and concur with the information provided in section 4.7 of the draft EIS, which also serves as the BA for the Projects.

Consultations with FWS and NMFS regarding listed species are ongoing; therefore, before construction of the Projects can begin, we are recommending that PALNG and PAPL finish all necessary biological surveys, complete ESA section 7 consultations with FWS, and receive written notification from the Director of OEP that construction and/or use of mitigation (including implementation of conservation measures) may begin.

Based on information obtained from the TPWD and LDWF, 18 state-listed threatened and endangered species, and 16 state rare species may occur within the areas of the Liquefaction Project and Texas Connector Project in Texas. According to the LDWF, no impacts on rare, threatened, or endangered species or critical habitats are anticipated for the Louisiana portion of the Texas Connector Project. To mitigate for potential impacts on listed species in Texas, PALNG and PAPL would educate workers on all sensitive habitats and wildlife species prior to construction and adopt the species-specific mitigation measures described in section 4.7.4.1.

The LDWF identified nine rare species that may occur within the Louisiana Connector Project area and recommended typical BMPs to minimize impacts on the crested caracara and avoiding disturbances in waterbodies (such as pollution, siltation, and dams) to protect old prairie crawfish habitat. PAPL has not developed any project-specific BMPs for this purpose but would implement its *Environmental Plan* to minimize impacts on habitats crossed by the Louisiana Connector Project. No specific recommendations were provided for the six rare plant species identified as potentially occurring in the area, but PAPL has committed to further consultation with the LDWF prior to construction to determine if additional rare plant species surveys would be necessary.

With the implementation of PAPL's *Environmental Plan*, which includes the Commission's Plan and Procedures, and the conservation and mitigation measures proposed by the FWS and NMFS and adopted by PALNG and PAPL, construction and operation of the Projects would not have a significant impact on federally and state protected species or their habitat.

5.1.9 Land Use, Recreation, and Visual Resources

Construction of the Projects, including nonjurisdictional facilities, would temporarily affect a total of 10,612.0 acres of land. Of this, 7,952.5 acres would be permanently affected by operation of the Projects, and 2,659.5 acres would be allowed to revert to the existing land use type after the completion of construction. Impacts on permanently affected wetlands would be partially offset through restoration of about 1,268.8 acres of tidally influenced coastal marsh habitat within the J.D. Murphree WMA.

The land retained as new permanent right-of-way would generally be allowed to revert to its former use, except for forest/woodland and silviculture. Certain activities, such as the construction of permanent structures or the planting of trees, would be prohibited within the permanent right-of-way. To facilitate pipeline inspection, operation, and maintenance, the entire permanent right-of-way in upland areas would be maintained in an herbaceous vegetated state. This maintained right-of-way would be mowed no more than once every 3 years, but a 10-foot-wide strip centered over the pipeline might be mowed more frequently to facilitate corrosion and other operational surveys.

The Liquefaction Project's proposed construction workspace is not within 50 feet of any residence. The Texas Connector and Louisiana Connector Projects' proposed construction workspaces are within 50 feet of 11 and 24 residential structures, respectively, which includes homes, sheds, and associated structures. PAPL has developed site-specific RCPs for the residential structures within 25 feet of the construction work area. We reviewed these plans and find them acceptable. To further minimize effects on residences, FERC staff recommends that the owners of the six residences located within 25 feet of the construction work area provide us comments on the plan specific to their property. PALNG and PAPL would develop a grievance and resolution plan as part of its *Implementation Plan* that identifies how stakeholders can contact pipeline company representatives with questions, concerns, and complaints prior to, during, and after construction. We conclude that implementation of PALNG's and PAPL's mitigation measures, including the construction methods in residential areas and commercial facilities, its site-specific RCPs, and grievance and resolution process, impacts on residential and commercial areas would be minimized or mitigated.

No planned or ongoing residential or commercial/industrial development projects were identified within 0.25 mile of the proposed Liquefaction Project facilities. Three planned commercial/industrial development projects (i.e., an electric substation, the Golden Pass LNG Project, and the Sabine Pass LNG Project) have been identified within 0.3 mile of the proposed Texas Connector Project facilities. One planned commercial/industrial development project (i.e., Driftwood) has been identified parallel to the Louisiana Connector Project between MPs 45.4 and 54.5 in Calcasieu Parish and at MP 116 in Evangeline Parish.

Construction of the Projects would affect a total of 520.5 acres of agricultural land, and 175.7 acres would be retained during operation of the Projects. Agricultural land in the construction rights-of-way would generally be taken out of production for one growing season and would be restored to previous use following construction. PAPL would coordinate with landowners during construction and maintain landowner access to fields, storage areas, field access roads, structures, and other agricultural areas as well as maintain irrigation and drainage systems crossed by the right-of-way. If drain tiles are damaged during construction, PAPL would immediately mark the locations of damaged tiles, assess all drainage tile systems within the area of disturbance, and replace or repair all tiles to preconstruction conditions or better. If irrigation lines are damaged during construction, PAPL would complete repairs within one week of identifying the damaged irrigation system.

The Projects would cross 213 roads and 6 railroads. Of these, 58 roads and 2 railroads would be crossed using the bore method, 74 roads and 2 railroads would be crossed using the HDD method, 79 roads would be crossed using the open-cut and upland methods, and 2 roads would be crossed using the push-pull method. Project-related impacts on roads and railroads would be temporary to short-term and minor. Most paved roads and railroads would be crossed by the HDD or bore method, and unimproved or gravel roads would be crossed using the open-cut method. Potential effects associated with roadway crossings include temporary disruption of traffic flow, disturbance of existing underground utilities (i.e., water and sewer lines), and hindrance of emergency vehicle access. In areas where traffic volumes are high or other circumstances (e.g., congested areas) exist, PAPL would obtain the assistance of law enforcement to ensure traffic flow and the safety of pedestrians and vehicles.

The Projects would affect or be within 0.25 mile of a WMA, state-designated wild and scenic rivers, and other general recreational activities, including public and private hunting lands. PALNG and PAPL would construct the Liquefaction Project and the Texas Connector Project near several recreation areas, including the J.D. Murphree WMA and Round Lake, Keith Lake, and Port Arthur Canal. The Louisiana Connector Project would cross four designated scenic rivers and two state scenic byways in Louisiana. In general, effects of the Projects on recreational and special interest areas would be temporary and limited to the period of active construction, which typically lasts several days to several weeks in any one area. These effects would be minimized by implementing the measures in PALNG's and PAPL's *Environmental Plan* and site-specific crossing plans.

All of the Liquefaction Project facilities, the entire Northern Pipeline and associated aboveground facilities, portions of the Southern Pipeline, and portions of the Louisiana Connector Project pipeline and associated ATWS are subject to a federal coastal zone consistency review in Texas and Louisiana. We are recommending that PALNG and PAPL file documentation of concurrence from the USACE, Texas General Land Office, and the Louisiana Office of Coastal Management that the Projects are consistent with the Texas and Louisiana CZMA.

The Liquefaction Project and Texas Connector Project would be within 0.25 mile of three sites listed as potential or known sources of contamination and hazardous wastes. There are no properties within 0.25 mile of the Louisiana Connect Project facilities that are listed as potential or known sources of contamination. The Projects would also cross waterbodies that are listed under section 303(d) of the CWA for various contaminants. Should contaminated media (i.e., soil or groundwater) be encountered during construction, PALNG and PAPL would implement their respective project-specific *Unanticipated Hazardous Waste Discovery Plan*. We reviewed PALNG's and PAPL's *Unanticipated Hazardous Waste Discovery Plans* and find it acceptable.

Impacts on visual resources would be greatest where the pipeline routes parallel or cross roads and the pipeline rights-of-way, and the LNG storage tanks and marine facilities that can be seen by passing motorists and boaters; from residences where vegetation used for visual screening or for ornamental value is removed; and where the pipelines are routed through forested (including silvicultural land) areas. The majority of pipelines (about 69 percent or 113.8 miles) would be installed within or parallel to existing rights-of-way. As a result, the visual resources along these portions of the Projects have been previously affected by other similar activities. In other areas, the visual effects of construction in forests, including silvicultural land, would be permanent on the maintained right-of-way where the regrowth of trees would not be allowed, and would be long term in the temporary workspaces. After construction, all disturbed areas, including forested areas, would be restored in accordance with PALNG's and PAPL's project-specific *Environmental Plan* and any agency and landowner requirements. Generally, this would include seeding the restored areas with grasses and other herbaceous vegetation, after which trees would be allowed to regenerate within the temporary workspaces.

Visual effects also would occur at rivers, roads, and historic properties that are valued for their scenic quality, including Beckwith Creek, Hickory Branch, Barnes Creek, Whiskey Chitto Creek, Myths and Legends Byway, and Zydeco Cajun Prairie Byway. Historic properties are described in section 5.1.11. Visual impacts on these areas would be minimized by collocation with an existing corridor or use of HDD or bore construction method.

The Texas Connector Project's North and South Compressor Stations, and Louisiana Connector Project's Compressor Station would be visible to motorists passing through the immediate area and to the few nearby residences during construction and operation. The greatest visual impacts would be for those residences south of the North Compressor Station and for motorists traveling on Mansfield Ferry Road. The greatest permanent visual impacts from the South Compressor Station would be to those visiting the lakes and traversing relocated SH 87. The greatest visual impacts from the Louisiana Compressor Station would be for motorists traveling on Green Oak Cemetery Road. To minimize visual impacts of the Compressor Stations on nearby residences and motorists, lighting would be directed toward the facilities to minimize glare on surrounding areas. Some visual screening would be provided by the remaining forested areas between the compressor stations and residences.

Construction activities at the existing meter stations, mainline valves, and pig launchers/receivers would have permanent visual impacts. Most visual impacts would be minor because of surrounding land use and visual screening provided by trees and forested areas. The CGT Meter Station would be 0.1 mile from a residence and requires noise mitigation. PAPL has committed to implementing noise mitigation measures to reach a 55-decible day-night equivalent level at all NSAs located within 0.5 mile of the CGT Meter Station. Land use surrounding the CGT Meter Station is agricultural, and because PAPL would not enclose or paint the structure to blend in with the surroundings, the meter station would be visible to motorists traveling on nearby roads and the residence.

Visual impacts from access roads would be temporary and insignificant. New access roads in forested areas associated with operation of the Projects would represent a permanent visual impact. The greatest visual impacts would occur on visitors of the J.D. Murphree WMA and nearby lakes, including users of the Keith Lake boat ramp, during construction of the new access roads at MP 2.9 and MP 3.7 along the South Pipeline of the Texas Connector Project, which are adjacent to these features.

With the implementation of PAPL's *Environmental Plan*, which includes the Commission's Plan and Procedures, the previous activities at the liquefaction site, collocation of the pipeline projects, and adopting of the HDD method at multiple locations, construction and operation of the Texas Connector and Louisiana Connector Projects would have temporary to permanent, but minor, impacts on land use, recreation, and visual resources.

5.1.10 Socioeconomics

Construction and operation activities could affect socioeconomic conditions in the Projects area including impacts on local populations, employment, provision of community services, tourism and transportation, and state tax revenues from sales taxes, payroll taxes, and property taxes.

Construction of the liquefaction facilities would take place over an approximate 5-year period and would increase the population within Jefferson and Orange counties in Texas for about 3 years. PALNG estimates the peak construction workforce for the Liquefaction Project would be about 3,000 workers at month 32. After construction, 200 permanent jobs would be created at the liquefaction facility. This would be a small increase for the population of Jefferson County, and PALNG anticipates that 140 of the permanent employees (70 percent) would be hired locally.

Construction of the Texas Connector and Louisiana Connector Projects would take place over an approximate 1.5-year period and would increase the population within the counties and parishes crossed by the projects in Texas and Louisiana. Construction of the Texas Connector and Louisiana Connector Projects would average 623 and 600 workers per month, respectively. PAPL estimates the peak construction workforce would be about 750 workers for each project. The influx of construction workers would be limited to the time of construction. The demand for temporary housing by non-local workers is not expected to exceed the available number of hotels, motels, and campground units in the study area, but accommodations could experience some minor limited availability, particularly during planned construction periods that overlap with the peak tourism season in the projects area, which is typically during spring.

After construction, 20 permanent employees would be employed during operation of the Texas Connector Project pipeline and associated facilities and 10 permanent employees would be employed during operation of the Louisiana Connector Project pipeline and associated facilities. This would be a minor increase for the population of the study area. PAPL anticipates that about two to four persons (20 to 40 percent) of the permanent employees would be hired locally for each project.

PALNG estimates 150 construction workers would be needed for the duration of the relocation of SH 87, pipelines, and utilities. Population impacts resulting from the SH 87, pipeline, and utility relocation are expected to be temporary and are scheduled to conclude prior to or following the influx of the peak workforce of the Projects.

The Projects are expected to have their peak workforce requirements at roughly the same time, from the fourth quarter of 2019 through the first quarter of 2022. At the peak, anticipated for the third quarter of 2020, a combined workforce of over 3,230 workers would be needed. This could represent a population increase of less than 1 percent to the entire study area. Where the Projects would overlap the greatest geographically, in Cameron Parish and Orange and Jefferson Counties, this would be an increase of 1 percent to the population. Based on the populations of the counties/parishes and cities in the study area, in the event some construction workers and families do temporarily relocate to the area, the increase in population would not be significant. Additionally, there appears to be adequate public service infrastructure near the Projects to accommodate the temporary needs of the non-local construction workforce and long-term needs of non-local operations, while not compromising services to residents. In addition, any temporary increase in population would be distributed throughout the study area and would not have a permanent impact on public services in any one location.

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 areas. PALNG estimates that during peak construction just over 3,000 workers would be traveling to the project site via personal vehicle or bus. In addition to the 500 parking spaces available, an estimated 48 busses would transport the remaining workers to and from the construction site to offsite parking lots. Ground-based deliveries would occur throughout the 5-year construction period. At the peak of material and equipment delivery, PALNG estimates 6,900 deliveries per month to the liquefaction project site. On average, 2,562 material deliveries per month would be made to the site throughout the construction period. When possible, ground-based deliveries would be made during off-peak hours to minimize congestion and impacts on roadways in the Liquefaction Project study area. To minimize and mitigate potential impacts on transportation, we are recommending that PALNG file a traffic management plan outlining the measures it would adopt to manage vehicle traffic during construction of the Liquefaction Project.

Construction activities in the Texas Connector and Louisiana Connector Projects study areas would result in temporary effects on local transportation infrastructure and vehicle traffic, including disruptions from increased transportation of construction materials, equipment, and workforce; disruptions from construction of pipeline facilities at or across existing roads; and damage to local roads caused by heavy machinery. PAPL estimates a total of 3,120 vehicles trips per week for the Texas Connector Project along the length of the pipeline route during the 12-month construction period. Of this number, 600 heavy truck trips and 2,520 commuter trips are anticipated.

PAPL estimates a total of 626 vehicles trips per week for the Louisiana Connector Project along the length of the pipeline route during the 21-month construction period. Of this number, 91 heavy truck trips and 535 commuter trips are anticipated.

PALNG would construct a MOF to support the transfer of construction materials delivered by barge. During construction, PALNG estimates between 100 and 200 deliveries would be needed per month during the first 25 months of construction, or three to six barges per day. These trips would not cause significant impact when compared to the total amount of traffic in the SNWW. During operation of the project, PALNG estimates 180 transits of LNG vessels per year from the liquefaction facility. The impacts of operation of the Liquefaction Project on marine traffic in the SNWW would be minor and permanent.

Specific to the Louisiana Connector Project, water routes would also be used to access portions of the upland right-of-way and Sabine Lake construction. Vessels used to access Sabine Lake would consist of digging and backfill barges, pipelaying barges, pipe transportation barges, HDD barges, and tug boats. Sabine Lake is regularly accessed by similar types of activities and the project would impact a relatively small percentage (less than 1 percent) of the entire lake area. Project-related impacts would primarily affect barges and smaller recreational vessels. To mitigate for potential impacts on other vessels in Sabine Lake, PAPL stated that the pipeline would be installed using barges mobilized with tug boats. This procedure would minimize impacts resulting from construction operations.

Construction activities in the Projects study area would result in temporary effects on local transportation infrastructure and vehicle traffic, including disruptions from increased transportation of construction equipment, materials, and workforce; disruptions from construction of pipeline facilities at or across existing roads; and damage to local roads caused by heavy machinery and materials.

Construction of the nonjurisdictional facilities may temporarily impact transportation and traffic across and within roadways due to increased vehicle traffic to the project area associated with the construction workforce, construction vehicles and equipment, and delivery of materials. Traffic control measures would be employed as necessary to ensure safety of local traffic, including flagmen and signs. Additionally, the existing SH 87 would remain open until the relocated SH 87 is completed.

Construction and operation of the Liquefaction Project would not have a disproportionately high adverse effect on minority or low-income populations. The Texas Connector and Louisiana Connector Projects would result in negligible to minor negative impacts and minor positive impacts on socioeconomic characteristics and economies in the project area. Potentially adverse environmental effects associated with the projects would be minimized or mitigated, as applicable. Additionally, we did not find evidence that the Texas Connector or Louisiana Connector Projects would cause a disproportionate share of adverse environmental or socioeconomic impacts on any racial, ethnic, or socioeconomic group.

As a result of PALNG's and PAPL's measures and methods, construction and operation activities associated with the Projects would result in minor and temporary to short-term impacts on transportation infrastructure and traffic.

5.1.11 Cultural Resources

Due to the environmental setting, no cultural resource surveys were required within the areas affected by construction of the Liquefaction Project, the turning basin within the SNWW, Dredge Disposal Areas 9A and 9B, and the dredge disposal area within the J.D. Murphree WMA. In letters dated June 2, 2015 and August 24, 2017, the Texas SHPO concurred that no historic properties would be affected by construction of the proposed Liquefaction Project. We concur. PALNG has not filed information to or comments from the Texas SHPO concerning proposed Dredge Disposal Area 8. In addition, no direct or indirect impacts on cultural resources are anticipated for in-kind use of the four existing offsite parking lots.

Cultural resources surveys have been completed for 83.3 percent of the Northern Pipeline, and 50.6 percent of the Southern Pipeline in Texas and 92.5 percent in Louisiana. Surveys were completed for the

North Compressor Station, the three yards, and the HPL, FGT, and GTS/CIPCO Meter Stations. The historic aboveground survey resulted in the identification of one cemetery and five historic standing structures that have been assessed as not eligible for the listing on the NRHP. In a letter dated September 16, 2016, the Texas SHPO concurred that the five historic structures would not be NRHP-eligible, and requested PAPL maintain a 25-foot-wide buffer zone between the cemetery and the construction workspace. PAPL would avoid the cemetery and maintain a 25-foot-wide buffer on the eastern and western property boundaries. In a letter dated July 28, 2017, the Texas SHPO requested mechanical scraping of the proposed buffer area to confirm the cemetery boundaries. PAPL has not yet provided results of the additional investigation to FERC or Texas SHPO. No archaeological resources have been identified to date; however, three previously recorded sites have not been assessed for NRHP-eligibility. On September 1, 2016, the Texas SHPO received PAPL's Phase I report summarizing the survey results for portions of the Southern Pipeline that only cross the J.D. Murphree WMA. No archaeological sites or architectural resources were identified during survey of the J.D. Murphree WMA. On September 13, 2016, the Texas SHPO, and on September 12, 2016 the Louisiana SHPO, concurred with the Phase I report's recommendations that no historic properties within the areas surveyed would be affected by the Texas Connector Project. We concur also.

Cultural resources surveys have been completed for 58.0 percent of the Louisiana Connector Project corridor, compressor station, access roads, contractor yard, valve sites, and ATWS. The survey resulted in the identification of two archaeological sites, nine historic architectural properties, and four cemeteries. The two archaeological sites have been assessed as not eligible for the NRHP. The historic architectural properties represent three farmstead complexes, four residential buildings, and two collapsed structures. PAPL recommended that eight of these historic architectural properties were not eligible for the NRHP, and one would be avoided by the project. PAPL would maintain a 50-foot buffer around two of the cemeteries, would not encroach on the third cemetery, and would not affect the fourth cemetery based on distance. In a letter dated December 14, 2017, the Louisiana SHPO concurred.

PAPL has not assessed three sites for NRHP eligibility as they extend into parcels in which the landowners have denied survey permission, and would complete surveys at these sites once access becomes available.

PAPL also completed a geophysical survey for a 17.6-mile-long, 600-foot-wide corridor along the offshore portion of the Louisiana Connector Project across Sabine Lake. A total of 157 magnetic anomalies and 32 side scan sonar contacts were identified. Analysis resulted in the recommendation that no submerged cultural resources nor relic geomorphic features with the potential of archaeological deposits are present. In a letter dated December 15, 2017, the Louisiana SHPO concurred that no historic properties would be impacted by this portion of the Louisiana Connector Project. We concur also.

PALNG and PAPL provided FERC and each SHPO an unanticipated discoveries plan for Texas and Louisiana, which would be implemented if cultural resources or human remains are encountered during construction of the Projects. The plan also provides for the notification of Native American tribes in the event of any discovery. In a letter dated December 15, 2017, the Louisiana SHPO concurred with the plan. The Texas SHPO has not commented on the plan.

PALNG, PAPL, and FERC staff contacted several Native American tribes to identify properties of traditional, religious, or cultural importance that may be affected by the proposed Projects. The Choctaw Nation of Oklahoma requested shapefiles from PAPL on the Louisiana portion of the Texas Connector Project, which were provided on May 21, 2015. On June 22, 2015, the tribe requested a copy of the technical report from PAPL to enable an evaluation of the project and its potential impacts on archaeological and human remains; the Phase I report was submitted by PAPL to the tribe on March 17, 2017. No other responses have been received by FERC to date regarding the Texas Connector Project.

Regarding the Louisiana Connector Project, the Choctaw Nation of Oklahoma, in an email dated June 26, 2017, requested shapefiles and a copy of the technical report from PAPL to enable an evaluation of the project and its potential impacts on archaeological and human remains, which was provided on September 12, 2017. In a June 21, 2018 letter, the Coushatta Tribe of Louisiana requested government-to-government consultation and a meeting. No other responses have been received by FERC to date regarding the Louisiana Connector Project. In addition, we communicated with the Coushatta Tribe of Louisiana in June and August 2018, and have arranged to meet with the tribe in October 2018.

Because the process of complying with section 106 of the NHPA has not been completed for the Projects, we are recommending that prior to construction, PALNG and PAPL file all outstanding information, survey reports, evaluation reports, special studies, and plans, and the SHPOs' comments on these.

5.1.12 Air Quality and Noise

Most Projects-related air emissions would be produced by operation of the liquefaction facilities and the compressor stations. PALNG and PAPL would comply with all applicable air permit requirements for those facilities. Construction of the Projects would also create emissions from fossil-fueled construction equipment and fugitive dust. Such air quality impacts would generally be short term and localized. PALNG and PAPL have each prepared separate project-specific *Fugitive Dust Control Plans* with specific mitigation measures to control dust during construction.

The Projects are generally located in attainment areas; however, the delivery of equipment and facilities by marine vessels would pass through the Houston-Galveston-Brazoria area which is classified a marginal nonattainment area for the 2008 8-hour ozone standard. We conducted a General Conformity applicability determination for the estimated emissions from the marine operations through the Houston-Galveston-Brazoria area. The marine operations emissions would not exceed the general conformity determination thresholds for nitrogen oxides or VOCs (both precursors for ozone) and General Conformity would not apply to the Projects. We would not expect construction equipment emissions to cause or significantly contribute to a violation of an applicable air quality standard.

Long-term impacts on air quality would result from operation of the Liquefaction Project facilities and the compressor stations. PALNG and PAPL would minimize potential impacts on air quality caused by operation of the liquefaction facilities and compressor stations by adhering to applicable federal and state regulations and installing best available control technology to minimize emissions. The Air Quality Permit 131769 and the PSD Air Quality Permits PSDTX1456, and GHGPSDTX134 were issued by the TCEQ on February 17, 2016, authorizing construction and operation of the liquefaction facilities. The LDEQ issued minor New Source Review permit and Title V operating permit 0060-00107-V0 was issued on March 29, 2018 for the Louisiana Connector Project's compressor station. PAPL proposes to submit an air permit application for the Texas Connector's North Compressor Station 6 months prior to start of construction, as required by Texas air permitting regulations. It is expected that compliance with the applicable federal and state air quality standards and regulations would be addressed accordingly in the corresponding permit applications and issued permits.

During construction of the Texas Connector and Louisiana Connector Projects, use of the HDD method would result in minor impacts on NSA in the vicinity. We are recommending that PAPL develop an HDD noise mitigation plan for any HDD that could exceed the sound level criterion at the closest NSA to reduce the projected noise level attributable to the proposed drilling operations at nearby NSAs. We conclude that, with the recommended mitigation, construction noise from the Texas Connector and Louisiana Connector Projects would result in minor and temporary impacts on the nearest NSAs.

Operation of the liquefaction facilities and associated South Compressor Station would generate sound levels throughout the life of the project, but the increase in noise levels would be below the "barely detectable" noise level increase of 3 dBA and would result in minor impacts on the nearest NSA. The proposed noise level would be below the FERC limit of a L_{dn} of 55 dBA. In addition, we are recommending that PALNG file a full-load noise survey no later than 60 days after each liquefaction train is put in service for the first and second liquefaction trains. If noise levels attributable to operation of the Liquefaction Project exceed the FERC limit of 55 dBA L_{dn}, PALNG would reduce the liquefaction facility's noise contribution to result in a noise level that is no higher than the FERC guideline. We are also recommending that PALNG file a full-load noise survey no later than 60 days after placing all the Liquefaction Project facilities in service. Therefore, we conclude that operational noise from the Liquefaction Project would result in minor impacts on the nearest NSAs.

Sound levels would increase during operation of the North Compressor Station, the Louisiana Connector Project's compressor station, and the meter stations associated with the project. Those sound level increases would occur for the life of the projects. PAPL would implement mitigation measures to reduce noise impacts, such as the use of acoustically treated compressor enclosures, silencers on the exhaust outlet and air intake, and acoustically treated wall and roof fan openings. Based on our noise analysis, the predicted noise levels attributable to operation of the North Compressor Station associated the Texas Connector Project, the Louisiana Connector Project's compressor station, and the meter stations would be less than 55 dBA L_{dn} at all nearby NSAs. To ensure that noise levels would be below 55 dBA L_{dn}, we are recommending that PAPL file noise surveys during full-load operations and, if the noise levels exceed the FERC guideline, that PAPL install additional noise controls to meet the guideline within 1 year of the in-service date. As a result, the impact on noise levels during operation of the projects would be minor.

5.1.13 Safety and Reliability

As part of the NEPA review and NGA determinations, Commission staff assesses the potential impact to the human environment in terms of safety and whether the proposed facilities would be in the public interest based on whether it would operate safely, reliably, and securely.

As a cooperating agency, the DOT assists the FERC by determining whether PALNG's proposed design would meet the DOT's 49 CFR 193 Subpart B siting requirements. The DOT reviewed information submitted by PALNG and on March 20, 2018 provided a letter to FERC staff stating that the DOT had no objection to PALNG's methodology to comply with the Part 193 siting requirements for the proposed LNG liquefaction facilities, but would need to resolve legal control of exclusion zones. The DOT would provide a LOD on the project's compliance with 49 CFR Part 193 Subpart B, which includes legal control of exclusion zones. This would be provided to the Commission as further consideration to the Commission on its decision and final action on the project application. If the facility is authorized and constructed, the facility would be subject to the DOT's inspection and enforcement program and final determination of whether a facility is in compliance with the requirements of 49 CFR Part 193 would be made by the DOT staff.

As a cooperating agency, the USCG also assisted the FERC staff by reviewing the proposed LNG terminal and the associated LNG carrier traffic. The USCG reviewed a WSA submitted by PALNG that focused on the navigation safety and maritime security aspects of LNG carrier transits along the affected waterway. On September 11, 2015, the USCG issued a LOR to FERC staff indicating the Sabine Neches Ship Channel would be considered suitable for accommodating the type and frequency of LNG marine traffic associated with this Project, based on the WSA and in accordance with the guidance in the USCG's NVIC 01-11. If the Project is authorized and constructed, the facilities would be subject to the USCG's inspection and enforcement program to ensure compliance with the requirements of 33 CFR Parts 105 and 127.

FERC staff reviewed potential external impacts based on the site location and is conducting a technical review of the engineering design in conjunction with NEPA that would continue throughout final design, and throughout the life of the facility. Based on our external impact analysis and preliminary evaluation of the engineering design, we believe that the PALNG liquefaction facilities 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. Furthermore, the following recommendations would be provided to the Commission for consideration to incorporate as possible conditions to an order. These recommendations would be implemented prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout the life of the facility to enhance the reliability and safety of the facility and to mitigate the risk of impact on the public. We may also add additional recommendations for possible consideration to be incorporated in the order based on our ongoing review.

PAPL must design, construct, operate, and maintain its proposed pipelines and aboveground facilities in accordance with 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 pipelines from corrosion.

We conclude that the proposed Texas Connector and Louisiana Connector Projects would incrementally increase the risk of a pipeline accident; however, PAPL's compliance with the DOT's safety standards will ensure that PAPL's construction and operation of the facilities would not have a significant impact on public safety.

5.1.14 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.

We assessed those projects that occurred within the same time and space as the either or both the Liquefaction Project and pipeline projects, when considered with these other projects, to cumulatively contribute to impacts on those resources. As discussed in detail in section 4.13 and as summarized in sections 5.1.1 through 5.1.13, measures to minimize effects on environmental resources, mitigation measures, laws and regulations protecting environmental resources, and permitting requirements on the Projects and other projects, the potential for the Projects to significantly contribute to cumulative impacts from the is not anticipated for all environmental resources.

5.1.15 Alternatives

As alternatives to the proposed action, we evaluated the No-Action Alternative, system alternatives for the Projects, alternative liquefaction site locations, alternative pipeline routes, and alternative aboveground facility sites. While the No-Action Alternative would eliminate the short- and long-term environmental impacts identified in the EIS, the stated objectives of the proposed action would not be met.

We evaluated system alternatives for the liquefaction facility, including operating LNG import terminals with approved, proposed, or planned expansions to provide liquefaction capabilities, and approved and proposed liquefaction projects along the Gulf of Mexico in the southern United States. All of these were eliminated from further consideration and we concluded that the potential system alternatives were not reasonable alternatives or did not offer a significant environmental advantage over the Liquefaction Project.

We evaluated four sites for the liquefaction facility, including the proposed site and three alternatives. The sites were selected based on location along the SNWW and property considerations (e.g., size and contiguity, current ownership, potential availability). Various environmental criteria were applied for site prioritization and selection when compared to the proposed site, including potential impacts on aquatic species; deepwater channel access, access to safety and security infrastructure, sufficient size and practicability of the site, available utilities, and road access. The alternatives analysis concluded that the currently proposed site represents the preferred site for the proposed liquefaction facility because it provides sufficient upland areas for construction of the facilities, includes existing dock structures for material off-loading, requires fewer newly constructed access roads, and does not require the construction or improvement of bridges. While the proposed site does contain wetlands and forested cover, the loss of habitat diversity and function resulting from facility development would be generally comparable with that anticipated at the other sites, with the advantage that no designated wildlife refuges, important bird areas, or higher quality wetlands would be affected.

We also evaluated two additional sites that are located farther away and reevaluated the analysis of the proposed Liquefaction Project site in 2006 (FERC Docket No. CP05-83-000). The Lake Charles LNG Project is currently being constructed about 6 miles west of the proposed Liquefaction Project but would not be a viable alternative due to the significant disadvantages presented by the physical, safety, infrastructure, and pipeline routing restrictions at the site. The G2 LNG Project is currently being constructed about 36 miles east of the proposed but would also not be a viable alternative because it cannot provide the necessary capacity to support the Liquefaction Project.

The 2006 analysis concluded that the impacts associated with the proposed site were acceptable because the project would be mostly located on land that has been historically used for dredge material placement, best fulfilled the technical and economic criteria required to meet the project objectives, and had received support of the community and elected officials. Conditions at the Liquefaction Project site have not changed significantly since 2006.

We analyzed the regional setting of PAPL's pipeline routes and determined that different routes (which would likely be longer) between other points of interconnection would not offer any environmental advantage, irrespective of engineering feasibility or cost. We identified minimal environmental impacts associated with the construction and operation of these facilities. With the exception of the alternatives along the Louisiana Connector Project and the proposed Driftwood Pipeline Project, which would be collocated and/or overlap with the Louisiana Connector Project for about 10 miles, we did not find any environmental concerns that indicate a need to identify and evaluate any additional alternative routes for the Texas Connector and Louisiana Connector Projects.

The proposed Texas Connector and Louisiana Connector Projects' pipeline routes would be collocated with existing pipelines and other utility rights-of-way for about 43 percent and 73 percent, respectively. In addition, where collocated with other pipelines owned and operated by one of its affiliates, the Louisiana Connector Project would be offset from the existing pipeline by 25 to 35 feet, where feasible. This would limit environmental impacts. As a result, many types of environmental impacts have been reduced compared to establishing new rights-of-way. In addition, PAPL incorporated minor route variations into the Texas Connector and Louisiana Connector Projects routes as a result of environmental and engineering investigations and stakeholder outreach efforts. Beyond a general analysis of viable pipeline system alternatives, we did not receive any comments requesting us to look at a specific pipeline system alternative. Therefore, we did not further consider pipeline system alternatives.

No significant environmental concerns were identified, and no comments were received asking us to examine any additional sites for either the Texas Connector Project's North Compressor station site or the Louisiana Connector Project's compressor station site. Therefore, no alternative sites were considered for these facilities. The Texas Connector Project's South Compressor Station would be located within the same area affected by the Liquefaction Project and therefore the impacts associated with the South Compressor Station are accounted for in with the Liquefaction Project. None of the alternative liquefaction terminal sites and layouts that we evaluated offer a significant environmental advantage over the proposed site and, by association, no alternative site was considered for the South Compressor Station.

5.2 FERC STAFF'S RECOMMENDED MITIGATION

If the Commission authorizes the Projects, we are recommending that the following measures be included as specific conditions in the Commission's Order. We have determined that these measures would further mitigate the environmental impacts associated with the construction and operation of the Projects.

1. PALNG and PAPL shall follow the construction procedures and mitigation measures described in its application and supplements (including responses to staff data requests) and as identified in the EIS, unless modified by the Order. PALNG and PAPL 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 Liquefaction Project, 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 Projects. This authority shall allow:

   a. the modification of conditions of the Order;

   b. stop-work authority and authority to cease operation; and

   c. the imposition of any additional measures deemed necessary to ensure continued compliance with the intent of the conditions of the Order as well as the avoidance or mitigation of unforeseen adverse environmental impact resulting from project construction and operation.

3. For the pipeline facilities, the Director of OEP, or the Director's designee, has delegated authority to address any requests for approvals or authorizations necessary to carry out the conditions of the Order, and take whatever steps are necessary to ensure the protection of environmental resources during construction and operation of the project. This authority shall allow:

   a. the modification of conditions of the Order;

   b. stop-work authority and 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.

4. **Prior to any construction**, PALNG and PAPL shall file affirmative statements with the Secretary, certified by a senior company official, that all company personnel, EIs, and contractor personnel will be informed of the EIs' 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**, PALNG and PAPL 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.

   PAPL's exercise of eminent domain authority granted under NGA section 7(h) in any condemnation proceedings related to the Order must be consistent with these authorized facilities and locations. PAPL's right of eminent domain granted under NGA section 7(h) does not authorize it to increase the size of its natural gas pipelines or facilities to accommodate future needs or to acquire a right-of-way for a pipeline to transport a commodity other than natural gas.

6. PALNG and PAPL 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; staging areas; pipe storage yards; new access roads; and other areas that will 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 will be affected, and whether any other environmentally sensitive areas are within or abutting the area. All areas shall be clearly identified on the maps/sheets/aerial photographs. Each area must be approved in writing by the Director of OEP **before construction in or near that area**.

   This requirement does not apply to extra workspace allowed by the Commission's Plan and/or minor field realignments per landowner needs and requirements that do not affect other landowners or sensitive environmental areas such as wetlands.

   Examples of alterations requiring approval include all route realignments and facility location changes resulting from:

   a. implementation of cultural resources mitigation measures;

   b. implementation of endangered, threatened, or special concern species mitigation measures;

   c. recommendations by state regulatory authorities; and

   d. agreements with individual landowners that affect other landowners or could affect sensitive environmental areas.

7. **Within 60 days of the acceptance of the authorization and before construction begins**, PALNG and PAPL shall file Implementation Plans with the Secretary for review and written approval by

the Director of OEP. PALNG and PAPL must file revisions to their plans as schedules change. The plans shall identify:

a. how PALNG and PAPL 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 PALNG and PAPL will incorporate these requirements into the contract bid documents, construction contracts (especially penalty clauses and specifications), and construction drawings so that the mitigation required at each site is clear to on-site construction and inspection personnel;

c. the number of EIs assigned per spread and how PALNG and PAPL will ensure that sufficient personnel are available to implement the environmental mitigation;

d. the number of 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 PALNG and PAPL will give to all personnel involved with construction and restoration (initial and refresher training as the Projects progress and personnel change), with the opportunity for OEP staff to participate in the training session(s);

f. the company personnel (if known) and specific portion of the PALNG's and PAPL's organization having responsibility for compliance;

g. the procedures (including use of contract penalties) PALNG and PAPL 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 on-site personnel;

    iii. the start of construction; and

    iv. the start and completion of restoration.

8. PALNG and PAPL shall employ a team of EIs, including at least one EI for the Liquefaction Project, and at least one EI per construction spread for the pipeline facilities. The EI(s) 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) 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 the Implementation Plans, PALNG and PAPL shall each file updated status reports with the Secretary on a **monthly** basis for the Liquefaction Project and **weekly** basis for the Texas Connector and Louisiana Connector Projects 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 PALNG's and PAPL's efforts to obtain the necessary federal authorizations;

   b. the construction status of Liquefaction Facilities and each spread of the Texas Connector and Louisiana Connector Projects, 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 that 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 PALNG and PAPL from other federal, state, local, or tribal permitting agencies concerning instances of noncompliance, and the PALNG's and PAPL's responses.

10. PALNG and PAPL must receive written authorization from the Director of OEP **before commencing construction of any project facilities**. To obtain such authorization, PALNG and PAPL shall file with the Secretary documentation that it has received all applicable authorizations required under federal law (or evidence of waiver thereof).

11. PALNG must receive written authorization from the Director of OEP **prior to introducing hazardous fluids into the liquefaction 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. PALNG must receive written authorization from the Director of OEP **before placing the Liquefaction Project facilities into service**. Such authorization will only be granted following a

determination that the facilities have been constructed in accordance with FERC approval and applicable standards, can be expected to operate safely as designed, and the rehabilitation and restoration of the area affected by the Liquefaction Project facilities are proceeding satisfactorily.

13. PAPL must receive written authorization from the Director of OEP **before placing the Texas Connector and/or the Louisiana Connector Projects into service**. Such authorization will only be granted following a determination that the rehabilitation and restoration of the right-of-way and other areas affected by the Texas Connector and Louisiana Connector Projects are proceeding satisfactorily.

14. **Within 30 days of placing the authorized facilities in service**, PALNG and PAPL shall file an affirmative statement with the Secretary, certified by a senior company official:

    a. that the facilities have been constructed in compliance with all applicable conditions, and that continuing activities will be consistent with all applicable conditions; or

    b. identifying which of the Certificate conditions PALNG and PAPL have complied with or will comply with. This statement shall also identify any areas affected by the Projects where compliance measures were not properly implemented, if not previously identified in filed status reports, and the reason for noncompliance.

15. **Prior to construction of the Projects**, PALNG and PAPL shall file with the Secretary for review and written approval by the Director of OEP a project-specific plan for construction near known abandoned wells. This plan shall identify actions to be taken if any unidentified wells are discovered during construction and discuss how PALNG or PAPL will maintain the integrity of any plugged wells. (*section 4.1.2*)

16. **Prior to construction of the compressor stations associated with the Texas Connector and Louisiana Connector Projects**, PAPL shall file with the Secretary the results of geotechnical studies for the compressor stations, including any recommended mitigation measures PAPL will adopt as part of the final engineering design. (*section 4.1.3.1*)

17. **Prior to construction of the Liquefaction Project**, PALNG shall provide the EPA, USACE, TCEQ, and Texas RRC the soil and sediment analysis conducted at the area within the ship canal at the marine berth, construction dock, MOF, and landward component of the MOF for review. PALNG shall file the conclusions of the reviews with the Secretary along with documentation of its consultations with these agencies including any measures PALNG will need to adopt if the analysis discovers previously unknown contamination. (*section 4.2.1.6*)

18. **Prior to construction of the Texas Connector and Louisiana Connector Projects**, PAPL shall file with the Secretary for review and approval by the Director of OEP the anticipated volume and source of water to be used for dust control. (*section 4.3.2.2*)

19. **Prior to the close of the draft EIS comment period**, PALNG and PAPL shall file with the Secretary updated wetland impact data for the Projects to ensure accuracy, as well as consistency with the wetland data provided to the USACE as part of PALNG's and PAPL's permit applications. The updated data shall be filed with the FERC using the same format and wetland classification system/definitions as submitted to the USACE. (*section 4.4*)

20. **PALNG and PAPL shall not begin construction of the Projects until**:

   a. all outstanding biological surveys are completed;

   b. the FERC staff complete any necessary ESA section 7 consultation with the FWS;

   c. PALNG and PAPL have received written notification from the Director of OEP that construction and/or use of mitigation (including implementation of conservation measures) may begin. (*section 4.7.3*)

21. **Prior to construction of the Louisiana Connector Project**, PAPL shall conduct surveys for the American chaffseed on the no-access parcels with potential habitat and file the results of the survey with the Secretary and the FWS. If the American chaffseed is found, PAPL shall incorporate methods to avoid impacts on the American chaffseed. Any proposed avoidance methods shall be filed with the Secretary and the Louisiana FWS. (*section 4.7.3.5*)

22. **Prior to construction of the Liquefaction Project**, PALNG shall file with the Secretary documentation of concurrence from the USACE and TGLO that the Liquefaction Project is consistent with the CZMA. (*section 4.8.9.1*)

23. **Prior to construction of the Texas Connector and Louisiana Connector Projects**, PAPL shall file with the Secretary documentation of concurrence from the USACE, TGLO, and Louisiana Office of Coastal Management that the Texas Connector Project and Louisiana Connector Project are consistent with the CZMA. (*section 4.8.9.2*)

24. **Prior to construction of the Liquefaction Project,** PALNG shall file with the Secretary its Transportation Plan for the Liquefaction Project, for review and written approval by the Director of OEP. The plan shall include personnel training; permitting requirements; consultations conducted with local and state agencies; and how access to/from the work site by personnel, equipment, and materials will be managed on a daily basis throughout construction. (*section 4.9.6.1*)

25. PALNG shall **not begin** construction of facilities and/or use of staging, storage, or temporary work areas and new or to-be-improved access roads **associated with the Liquefaction Project until**:

   a. PALNG files with the Secretary, the outstanding information for Dredge Disposal Area 8, and the Texas SHPO's comments on the information;

   b. PALNG files any required survey report and the Texas SHPO's comments on the report;

   c. the ACHP is afforded an opportunity to comment on the undertaking if historic properties will be adversely affected; and

   d. the FERC staff reviews and the Director of OEP approves any cultural resources report and notifies PALNG in writing that construction may proceed.

   All material filed with the Commission that contains location, character, and ownership information about cultural resources must have the cover and any relevant pages therein clearly labeled in bold lettering "**CUI//PRIV- DO NOT RELEASE**." (*section 4.10.4.1*)

26. PAPL shall **not begin** construction of facilities and/or use of staging, storage, or temporary work areas and new or to-be-improved access roads **associated with the Texas Connector and Louisiana Connector Projects until**:

   a. PAPL files with the Secretary all outstanding survey reports, evaluation reports, special studies, and any required avoidance/treatment plans, and the Texas and Louisiana SHPOs' comments (as applicable) on these;

   b. the ACHP is afforded an opportunity to comment if historic properties will be adversely affected; and

   c. the FERC staff reviews and the Director of OEP approves the cultural resources reports, studies, and plans, and notifies PAPL in writing that treatment plans/mitigation measures (including archaeological data recovery) may be implemented and/or construction may proceed.

   All materials filed with the Commission containing location, character, and ownership information about cultural resources must have the cover and any relevant pages therein clearly labeled in bold lettering "**CUI//PRIV – DO NOT RELEASE**."(*section 4.10.4.2*)

27. **Prior to construction of HDDs at MPs 19.6 and 20.3 along the Texas Connector Project's Northern Pipeline; MP 0.5 along the GTS Lateral; MP 0.8 along the FGT Lateral; and MPs 38.7, 40.5, 42.5, 47.9, 48.5, 56.8, 60.2, 79.4, 91.1, 96.9, 110.1, and 110.3 along the Louisiana Connector Project where HDD-related noise could exceed the sound level criterion at the closest NSA**, PAPL shall file with the Secretary, for the review and written approval by the Director of OEP, an HDD noise mitigation plan to reduce the projected noise level attributable to the proposed drilling operations at nearby NSAs. During drilling operations, PAPL shall implement the approved plan, monitor noise levels, and make all reasonable efforts to restrict the noise attributable to the drilling operations to no more than an L_{dn} of 55 dBA at the NSAs or 10 dBA above background where nighttime ambient noise is above 55 dBA L_{dn}. (*section 4.11.2.3*)

28. PALNG shall file a noise survey with the Secretary **no later than 60 days after placing each Liquefaction Project train in service**. If a full load condition noise survey is not possible, PALNG shall instead file an interim survey at the maximum possible horsepower load and file the full load survey **within 6 months**. If the noise attributable to the operation of all of the equipment at the site under interim or full horsepower load exceeds 55 dBA L_{dn} at any nearby NSA, PALNG 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**. PALNG shall confirm compliance with the 55 dBA L_{dn} 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*)

29. PAPL shall file a noise survey with the Secretary n**o later than 60** days after placing the Texas Connector Project North Compressor Station and Louisiana Connector Project's compressor station in service. If a full load condition noise survey is not possible, PAPL shall instead file an interim survey at the maximum possible horsepower load and file the full load survey **within 6 months**. If the noise attributable to the operation of all of the equipment at any station under interim or full horsepower load exceeds 55 dBA L_{dn} at any nearby NSA, PAPL 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**. PALP shall confirm compliance with the 55 dBA L_{dn} 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*)

30. **Prior to the end of the draft EIS comment period,** PALNG shall file with the Secretary documentation demonstrating it has filed for an Aeronautical Study under 14 CFR 77 for all permanent structures, temporary construction equipment, and mobile objects that exceed the height requirements in 14 CFR 77.9. *(section 4.12.6)*

31. **Prior to initial site preparation,** PALNG shall file with the Secretary documentation demonstrating it has received a determination of no hazard (with or without conditions) by DOT FAA for all permanent structures, temporary construction equipment, and mobile objects that exceed the height requirements in 14 CFR 77.9. *(section 4.12.6)*

32. **Prior to construction of final design,** PALNG shall file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in Texas:

    a. Site preparation drawings and specifications.

    b. LNG terminal structures and foundation design drawings and calculations (including prefabricated and field constructed structures).

    c. Seismic specifications for procured equipment.

    d. Quality control procedures to be used for civil/structural design and construction.

    In addition, PALNG shall file, in its Implementation Plan, the schedule for producing this information. *(section 4.12.6)*

33. **Prior to commencement of service,** PALNG shall file with the Secretary a monitoring and maintenance plan, stamped and sealed by the professional engineer-of-record registered in Texas, for the perimeter levee which ensures the crest elevation relative to mean sea level will be maintained for the life of the facility considering berm settlement, subsidence, and sea level rise. *(section 4.12.6)*

Information pertaining to recommendations 34 through 128 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 recommendation. 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 submitted 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 will be subject to public disclosure. All information shall be filed **a minimum of 30 days** before approval to proceed is requested.

34. **Prior to initial site preparation,** PALNG shall file an overall project schedule, which includes the proposed stages of the commissioning plan. *(section 4.12.6)*

35. **Prior to initial site preparation,** PALNG shall file quality assurance and quality control procedures for construction activities. *(section 4.12.6)*

36. **Prior to initial site preparation,** PALNG shall file procedures for controlling access during construction. *(section 4.12.6)*

37. **Prior to initial site preparation,** PALNG shall develop an ERP (including evacuation) and coordinate procedures with the USCG; state, county, and local emergency planning groups; fire departments; state and local law enforcement; and appropriate federal agencies. This plan shall include at a minimum:

    a. designated contacts with state and local emergency response agencies;

    b. scalable procedures for the prompt notification of appropriate local officials and emergency response agencies based on the level and severity of potential incidents;

    c. procedures for notifying residents and recreational users within areas of potential hazard;

    d. evacuation routes/methods for residents and public use areas that are within any transient hazard areas along the route of the LNG marine transit;

    e. locations of permanent sirens and other warning devices; and

    f. an "emergency coordinator" on each LNG carrier to activate sirens and other warning devices.

    PALNG shall notify the FERC staff of all planning meetings in advance and shall report progress on the development of its ERP at **3-month intervals**. *(section 4.12.6)*

38. **Prior to initial site preparation,** PALNG shall file a Cost-Sharing Plan identifying the mechanisms for funding all Project-specific security/emergency management costs that will 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. PALNG 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**. *(section 4.12.6)*

39. **Prior to construction of final design,** PALNG shall file change logs that list and explain any changes made from the FEED provided in PALNG's application and filings. A list of all changes with an explanation for the design alteration shall be provided and all changes shall be clearly indicated on all diagrams and drawings. *(section 4.12.6)*

40. **Prior to construction of final design,** PALNG shall file information/revisions pertaining to PALNG' response numbers 9, 11, 18, 19, 24, 28, 29, 30-33, 34, 36-41, 43-46, 54-55 of its January 29, 2018 filing and 52 and 57 of its February 7, 2018 filing, which indicated features to be included or considered in the final design. *(section 4.12.6)*

41. **Prior to construction of final design,** PALNG shall file a plot plan of the final design showing all major equipment, structures, buildings, and impoundment systems. *(section 4.12.6)*

42. **Prior to construction of final design,** PALNG shall file three-dimensional plant drawings to confirm plant layout for maintenance, access, egress, and congestion. *(section 4.12.6)*

43. **Prior to construction of final design,** PALNG shall file drawings of the storage tank piping support structure and support of horizontal piping at grade including pump columns, relief valves, pipe penetrations, instrumentation, and appurtenances. *(section 4.12.6)*

44. **Prior to construction of final design,** PALNG shall file a complete specification and drawings of the proposed LNG tank design and installation. *(section 4.12.6)*

45. **Prior to construction of final design,** PALNG shall file an up-to-date equipment list, process and mechanical data sheets, and specifications. The specifications shall include:

    a. building Specifications (control buildings, electrical buildings, compressor buildings, storage buildings, pressurized buildings, ventilated buildings, blast resistant buildings);

    b. mechanical Specifications (piping, valve, insulation, rotating equipment, heat exchanger, storage tank and vessel, other specialized equipment);

    c. electrical and Instrumentation Specifications (power system specifications, control system specifications, SIS specifications, cable specifications, other electrical and instrumentation specifications);

    d. security and Fire Safety Specifications (security, passive protection, hazard detection, hazard control, firewater) *(section 4.12.6)*

46. **Prior to construction of final design,** PALNG shall file up-to-date PFDs and P&IDs, including vendor P&IDs. The PFDs shall include heat and material balances. The P&IDs shall include the following information:

    a. Equipment tag number, name, size, duty, capacity, and design conditions.

    b. Equipment insulation type and thickness.

    c. Storage tank pipe penetration size and nozzle schedule.

    d. Valve high pressure side and internal and external vent locations.

    e. Piping with line number, piping class specification, size, and insulation type and thickness.

    f. Piping specification breaks and insulation limits.

    g. All control and manual valves numbered.

    h. Relief valves with size and set points.

    i. Drawing revision number and date. *(section 4.12.6)*

47. **Prior to construction of final design,** PALNG shall file P&IDs, specifications, and procedures that clearly show and specify the tie-in details required to safely connect subsequently constructed facilities with the operational facilities. *(section 4.12.6)*

48. **Prior to construction of final design,** PALNG shall file a car seal philosophy and a list of all car-sealed and locked valves consistent with the P&IDs. *(section 4.12.6)*

49. **Prior to construction of final design,** the engineering, procurement, and construction contractor shall verify that the recommendations from the FEED Hazard Identification are complete and consistent with the requirements of the final design as determined by the engineering, procurement, and construction contractor. *(section 4.12.6)*

50. **Prior to construction of final design,** PALNG shall file a HAZOP review prior to issuing the P&IDs for construction. A copy of the review, a list of the recommendations, and actions taken on the recommendations shall be filed. *(section 4.12.6)*

51. **Prior to construction of final design,** PALNG shall file the safe operating limits (upper and lower), alarm and shutdown set points for all instrumentation (i.e., temperature, pressures, flows, and compositions). *(section 4.12.6)*

52. **Prior to construction of final design,** PALNG shall file cause-and-effect matrices for the process instrumentation, fire and gas detection system, and ESD system for review and approval. The cause-and-effect matrices shall include alarms and shutdown functions, details of the voting and shutdown logic, and set points. *(section 4.12.6)*

53. **Prior to construction of final design,** PALNG shall file an evaluation of ESD valve closure times. The evaluation shall account for the time to detect an upset or hazardous condition, notify plant personnel, and close the ESD valve. *(section 4.12.6)*

54. **Prior to construction of final design,** PALNG shall file an evaluation of dynamic pressure surge effects from valve opening and closure times and pump operations. *(section 4.12.6)*

55. **Prior to construction of final design,** PALNG shall demonstrate that hazardous fluid 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. *(section 4.12.6)*

56. **Prior to construction of final design,** PALNG shall specify that all drains from high pressure hazardous fluid systems are equipped with double isolation and bleed valves. *(section 4.12.6)*

57. **Prior to construction of final design,** PALNG shall provide electrical area classification drawings. *(section 4.12.6)*

58. **Prior to construction of final design,** PALNG 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). *(section 4.12.6)*

59. **Prior to construction of final design,** PALNG 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. *(section 4.12.6)*

60. **Prior to construction of final design,** PALNG shall include layout and design specifications of the pig trap, inlet separation and liquid disposal, inlet/send-out meter station, and pressure control. *(section 4.12.6)*

61. **Prior to construction of final design,** PALNG shall specify that piping and equipment that may be cooled with liquid nitrogen is to be designed for liquid nitrogen temperatures, with regard to allowable movement and stresses. *(section 4.12.6)*

62. **Prior to construction of final design,** PALNG shall include LNG tank fill flow measurement with high flow alarm. *(section 4.12.6)*

63. **Prior to construction of final design,** PALNG shall include BOG flow, tank density profile, and temperature profile measurement for each tank. *(section 4.12.6)*

64. **Prior to construction of final design,** PALNG shall file the structural analysis of the LNG storage tank and outer concrete impoundment wall to demonstrate they are designed to withstand all loads and combinations. *(section 4.12.6)*

65. **Prior to construction of final design,** PALNG shall file an analysis of the structural integrity of the outer containment of the full containment storage tanks when exposed to a roof tank top fire or adjacent tank top fire. *(section 4.12.6)*

66. **Prior to construction of final design,** PALNG shall evaluate and utilize the minimum distance required for valve maintenance, between the LNG loading header and the first valve in the discharge piping to the loading arm. *(section 4.12.6)*

67. **Prior to construction of final design,** PALNG 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. *(section 4.12.6)*

68. **Prior to construction of final design,** PALNG shall file detailed cooldown plans showing the piping flow, valve alignment, and instruments used to monitor the initial cooldown and filling of the LNG storage tanks. *(section 4.12.6)*

69. **Prior to construction of final design,** PALNG shall include detailed procedures for import of LNG during the initial cooldown of the LNG storage tanks including detailed P&IDs with flow paths and valve alignment showing the position of valves and lockout/tagout devices. *(section 4.12.6)*

70. **Prior to construction of final design,** PALNG shall file an evaluation on the need to install fixed toxic gas detection to detect H_2S releases from loss of containment from the acid gas piping system and potential release points (i.e., vents, relief valves, vent stacks, and thermal oxidizer stack). *(section 4.12.6)*

71. **Prior to construction of final design,** PALNG shall file process simulation results for the deethanizer, depropanizer depressurized conditions to ensure the associated deethanizer, depropanizer, reboiler, piping, and other associated equipment are adequately designed for settle out and upset conditions to prevent brittle facture of piping and associated equipment. *(section 4.12.6)*

72. **Prior to construction of final design,** PALNG shall evaluate the minimum design metal temperature needed for the deethanizer, depropanizer, reboiler and piping during upset/settleout conditions. *(section 4.12.6)*

73. **Prior to construction of final design**, PALNG shall include a back pressure control valve at the outlet of the regenerator to control the regenerator at constant pressure. *(section 4.12.6)*

74. **Prior to construction of final design,** PALNG shall include a thermal relief valve between the propane shutoff valves (XV-30687 and XV0-30686) to protect piping. *(section 4.12.6)*

75. **Prior to construction of final design,** PALNG shall include a thermal relief valve between the ethane shutoff valves (XV0-30729 and XV0-30731) to protect piping. *(section 4.12.6)*

76. **Prior to construction of final design,** PALNG shall include an automatic shutoff valve, actuated by low temperature in the dry flare knockout drum located on the drain line from the dry flare knockout drum to the blow case. *(section 4.12.6)*

77. **Prior to construction of final design**, PALNG shall include details of the flare knockout drum heater and detailed procedures for draining flare knockout drums to a safe location. *(section 4.12.6)*

78. **Prior to construction of final design,** PALNG shall file detailed calculations for the flow rate of the jockey pumps accounting for flow rate losses due to leaks or when drain valves are opened to ensure that system losses do not exceed the specified design flow rate of the jockey firewater pumps. *(section 4.12.6)*

79. **Prior to construction of final design,** PALNG shall the need to install pressure relieving protection for flammable liquid piping segments (i.e., refrigerants, liquid hydrocarbons, condensate products) that can be isolated by valves. *(section 4.12.6)*

80. **Prior to construction of final design,** PALNG shall specify that all ESD valves are to be equipped with open and closed position switches connected to the DCS/SIS. *(section 4.12.6)*

81. **Prior to construction of final design,** PALNG shall file a drawing showing the location of the ESD buttons. Emergency shutdown buttons shall be easily accessible, conspicuously labeled, and located in an area which will be accessible during an emergency. *(section 4.12.6)*

82. **Prior to construction of final design,** PALNG shall file drawings and specifications for vehicle barriers at each facility entrance for access control. *(section 4.12.6)*

83. **Prior to construction of final design,** PALNG shall file an evaluation on the need to install turning lanes to minimize the risk of hazardous material truck and other vehicle incidents entering and exiting the facility from SH 87. *(section 4.12.6)*

84. **Prior to construction of final design,** PALNG shall file an evaluation on the need for installing internal road vehicle protections (e.g., guard rails, barriers, and bollards) to protect transfer piping, pumps, and compressors, etc. and to ensure that they are located away from roadway or protected from inadvertent damage from vehicles. *(section 4.12.6)*

85. **Prior to construction of final design,** PALNG shall file a projectile analysis for review and approval to demonstrate that the outer concrete impoundment wall of a full-containment LNG tank could withstand windborne projectiles. The analysis shall detail the projectile speeds and characteristics and method used to determine penetration or perforation depths. *(section 4.12.6)*

86. **Prior to construction of final design,** PALNG shall file security camera, intrusion detection, and lighting drawings. The security camera drawings shall show the location, areas covered, and features of the camera (fixed, tilt/pan/zoom, motion detection alerts, low light, mounting height, etc.) to verify camera coverage of the entire perimeter with redundancies for cameras interior to the facility to enable rapid monitoring of the LNG plant. The intrusion detection drawings shall show or note the location of the intrusion detection to verify it covers the entire perimeter of the LNG plant. The lighting drawings shall show the location, elevation, type of light fixture, and lux levels of the lighting system. *(section 4.12.6)*

87. **Prior to construction of final design,** PALNG shall file the details of the ESD system, including whether a plant-wide ESD button with proper sequencing and reliability will be installed or whether another system will be installed that is demonstrated through a human reliability analysis to provide a means to quickly and reliably shutdown the entire plant. *(section 4.12.6)*

88. **Prior to construction of final design,** PALNG shall file an updated fire protection evaluation of the proposed facilities. A copy of the evaluation, a list of recommendations and supporting justifications, and actions taken on the recommendations shall be filed. *(section 4.12.6)*

89. **Prior to construction of final design,** PALNG shall file spill containment system drawings with dimensions and slopes of curbing, trenches, impoundments, and capacity calculations considering any foundations and equipment within impoundments, as well as the sizing and design of the down-comer that will transfer spills from the tank top to the ground-level impoundment system. The spill containment drawings shall show containment for all hazardous fluids from the largest flow from a single line for 10 minutes or from the largest vessel or otherwise demonstrate spill containment will not significantly reduce the flammable vapor dispersion or radiant heat consequences of a spill. *(section 4.12.6)*

90. **Prior to construction of final design**, PALNG shall specify the material of construction for the curbed areas, trenches, and impoundments as insulated concrete or otherwise demonstrate insulated concrete will not significantly reduce the flammable vapor dispersion or radiant heat consequences of a spill. *(section 4.12.6)*

91. **Prior to construction of final design,** PALNG shall file an analysis of the localized hazards to operators from a potential liquid nitrogen release and shall also provide spill containment and low oxygen detectors to mitigate liquid nitrogen releases. *(section 4.12.6)*

92. **Prior to construction of final design,** PALNG 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 and demonstrate potential releases resulting in an offsite impact could be detected by at least two detectors to allow for shutdown in less than 10 minutes. The list shall include the instrument tag number, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment. *(section 4.12.6)*

93. **Prior to construction of final design,** PALNG shall file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas of the hazard detectors when determining the lower flammable limit set points for CH_4, propane, butane, ethane, and condensate. *(section 4.12.6)*

94. **Prior to construction of final design,** PALNG shall file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas of hazard detectors when determining the set points for toxic components such as aqueous ammonia, natural gas liquids and H_2S. *(section 4.12.6)*

95. **Prior to construction of final design,** PALNG shall file a technical review of facility design that:

    a. identifies all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and

    b. demonstrates that these areas are adequately covered by hazard detection devices and indicates how these devices will isolate or shutdown any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency. *(section 4.12.6)*

96. **Prior to construction of the final design,** PALNG shall file a building siting assessment to ensure plant buildings that are occupied or critical to the safety of the LNG plant are adequately protected from potential hazards involving fires and vapor cloud explosions. *(section 4.12.6)*

97. **Prior to construction of final design,** PALNG shall file a drawing that includes smoke detection in occupied buildings. *(section 4.12.6)*

98. **Prior to construction of final design,** PALNG shall file a drawing that includes hazard detection suitable to detect high temperatures and smoldering combustion products in electrical buildings and control room buildings. *(section 4.12.6)*

99. **Prior to construction of final design,** PALNG shall file a drawing that includes clean agent systems in the electrical switchgear and instrumentation buildings. *(section 4.12.6)*

100. **Prior to construction of final design,** PALNG shall file facility plan drawings and a list of the fixed and wheeled dry-chemical, hand-held fire extinguishers, and other hazard control equipment. Plan drawings shall clearly show the location by tag number and elevation of all fixed, wheeled, and hand-held extinguishers and demonstrate travel distances are along normal paths of access and egress and in compliance with NFPA 10, 15, and 17. 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. *(section 4.12.6)*

101. **Prior to construction of final design,** PALNG shall file facility plan drawings showing the proposed location of the firewater and any foam systems. Plan drawings shall clearly show the location of firewater and foam piping, post indicator valves, and the location and area covered by, each monitor, hydrant, hose, water curtain, deluge system, foam system, water-mist system, and sprinkler. The drawings shall demonstrate that each process area, fire zone, or other sections of piping with several users can be isolated with post indicator valves and that firewater coverage is provided by at least two monitors or hydrants with sufficient firewater flow to cool exposed surfaces subjected to a fire. Drawings shall also include piping and instrumentation diagrams of the firewater and foam systems. *(section 4.12.6)*

102. **Prior to construction of final design,** PALNG shall file detailed calculations to confirm that the final fire water volumes will be accounted for when evaluating the capacity of the impoundment system during a spill and fire scenario. *(section 4.12.6)*

103. **Prior to construction of final design,** PALNG 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. *(section 4.12.6)*

104. **Prior to construction of final design,** PALNG shall specify that the firewater pump shelter is designed with a removable roof for maintenance access to the firewater pumps. *(section 4.12.6)*

105. **Prior to construction of final design,** PALNG shall file calculations for the firewater spray systems sized to provide cooling for mitigation of boiling-liquid-expanding-vapor explosions. *(section 4.12.6)*

106. **Prior to construction of final design,** PALNG shall file a design that accounts for the fire water required for foam generation in calculating the total fire water required for 2 hours of supply. *(section 4.12.6)*

107. **Prior to construction of final design,** PALNG shall file drawings and specifications for the structural passive protection systems to protect equipment and supports from cryogenic releases. *(section 4.12.6)*

108. **Prior to construction of final design,** PALNG shall file a detailed quantitative analysis to demonstrate that adequate thermal mitigation will be provided for each significant component within the 4,000 BTU/ft^2-hr zone from an impoundment, or provide an analysis that evaluates the consequences of pressure vessel bursts and boiling liquid expanding vapor explosions. Trucks at the truck transfer station shall be included in the analysis. 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 to mitigate the heat absorbed by the vessel. *(section 4.12.6)*

109. **Prior to construction of final design,** PALNG shall file an evaluation of the voting logic and voting degradation for hazard detectors. *(section 4.12.6)*

110. **Prior to commissioning,** PALNG 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. PALNG 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. *(section 4.12.6)*

111. **Prior to commissioning,** PALNG shall file detailed plans and procedures for: testing the integrity of onsite mechanical installation; functional tests; introduction of hazardous fluids; operational tests; and placing the equipment into service. *(section 4.12.6)*

112. **Prior to commissioning,** PALNG shall file a plan for clean-out, dry-out, purging, and tightness testing. This plan shall address the requirements of the American Gas Association's Purging Principles and Practice, and shall provide justification if not using an inert or non-flammable gas for clean-out, dry-out, purging, and tightness testing. *(section 4.12.6)*

113. **Prior to commissioning,** PALNG shall file the procedures for pressure/leak tests which address the requirements of ASME BPVC section VIII and ASME B31.3. The procedures shall include a line list of pneumatic and hydrostatic test pressures. *(section 4.12.6)*

114. **Prior to commissioning,** PALNG shall file the operation and maintenance procedures and manuals, as well as safety procedures, hot work procedures and permits, abnormal operating conditions reporting procedures, simultaneous operations procedures, and management of change procedures and forms. *(section 4.12.6)*

115. **Prior to commissioning,** PALNG shall tag all equipment, instrumentation, and valves in the field, including drain valves, vent valves, main valves, and car-sealed or locked valves. *(section 4.12.6)*

116. **Prior to commissioning,** PALNG shall maintain a detailed training log to demonstrate that operating staff has completed the required training. *(section 4.12.6)*

117. **Prior to commissioning,** PALNG shall equip the LNG storage tank and adjacent piping and supports with permanent settlement monitors to allow personnel to observe and record the relative settlement between the LNG storage tank and adjacent piping. The settlement record shall be reported in the semi-annual operational reports. *(section 4.12.6)*

118. **Prior to introduction of hazardous fluids,** PALNG shall develop and implement an alarm management program to reduce alarm complacency and maximize the effectiveness of operator response to alarms. *(section 4.12.6)*

119. **Prior to introduction of hazardous fluids**, PALNG shall file results of the LNG storage tank hydrostatic test and foundation settlement results. At a minimum, foundation settlement results shall be provided thereafter annually**.** *(section 4.12.6)*

120. **Prior to introduction of hazardous fluids,** PALNG shall complete and document all pertinent tests (Factory Acceptance Tests, Site Acceptance Tests, Site Integration Tests) associated with the DCS and SIS that demonstrates full functionality and operability of the system. *(section 4.12.6)*

121. **Prior to introduction of hazardous fluids,** PALNG shall complete and document 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). *(section 4.12.6)*

122. **Prior to introduction of hazardous fluids,** PALNG shall complete and document a pre-startup safety review to ensure that installed equipment meets the design and operating intent of the facility. The pre-startup safety review shall include any changes since the last hazard review, operating procedures, and operator training. A copy of the review with a list of recommendations, and actions taken on each recommendation, shall be filed. *(section 4.12.6)*

123. **Prior to unloading or loading the first LNG commissioning cargo,** PALNG shall request and receive written authorization from the Director of OEP. After production of first LNG, PALNG shall file **weekly** reports on the commissioning of the proposed systems that detail the progress toward demonstrating the facilities can safely and reliably operate at or near the design production rate. The reports shall include a summary of activities, problems encountered, and remedial actions taken. The weekly reports shall also include the latest commissioning schedule, including projected and actual LNG production by each liquefaction train, LNG storage inventories in each storage tank, and the number of anticipated and actual LNG commissioning cargoes, along with the associated volumes loaded or unloaded. Further, the weekly reports shall include a status and list of all planned and completed safety and reliability tests, work authorizations, and punch list items. Problems of significant magnitude shall be reported to the FERC **within 24 hours**. *(section 4.12.6)*

124. **Prior to commencement of service,** PALNG shall label piping with fluid service and direction of flow in the field, in addition to the pipe labeling requirements of NFPA 59A (2001). *(section 4.12.6)*

125. **Prior to commencement of service,** PALNG shall provide plans for any preventative and predictive maintenance program that performs periodic or continuous equipment condition monitoring. *(section 4.12.6)*

126. **Prior to commencement of service,** PALNG shall develop procedures for offsite contractors' responsibilities, restrictions, and limitations and for supervision of these contractors by PALNG staff. *(section 4.12.6)*

127. **Prior to commencement of service,** PALNG shall notify the FERC staff of any proposed revisions to the security plan and physical security of the plant. *(section 4.12.6)*

128. **Prior to commencement of service,** PALNG shall request and receive written authorization from the Director of OEP. Such authorization will only be granted following a determination by the USCG, under its authorities under the Ports and Waterways Safety Act, the Magnuson Act, the MTSA of 2002, and the Safety and Accountability For Every Port Act, that appropriate measures to ensure the safety and security of the facility and the waterway have been put into place by PALNG or other appropriate parties. *(section 4.12.6)*

In addition, recommendations 129 through 132 shall apply **throughout the life of the facility**.

129. 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, PALNG shall respond to a specific data request including information relating to possible design and operating conditions that may have been imposed by other agencies or organizations. Up-to-date detailed P&IDs reflecting facility modifications and provision of other pertinent information not included in the semi-annual reports described below, including facility events that have taken place since the previously submitted semi-annual report, shall be submitted. *(section 4.12.6)*

130. 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); and plant modifications, including future plans and progress thereof. Abnormalities shall include, but not be limited to, unloading/loading/shipping problems, potential hazardous conditions from offsite vessels, storage tank stratification or rollover, geysering, storage tank pressure excursions, cold spots on the storage tanks, storage tank vibrations and/or vibrations in associated cryogenic piping, storage tank settlement, significant equipment or instrumentation malfunctions or failures, non-scheduled maintenance or repair (and reasons therefore), relative movement of storage tank inner vessels, hazardous fluids releases, fires involving hazardous fluids and/or from other sources, negative pressure (vacuum) within a storage tank, and higher than predicted boil off rates. Adverse weather conditions and the effect on the facility also shall be reported. Reports shall be submitted within 45 days after each period ending June 30 and December 31. In addition to the above items, a section entitled "Significant Plant Modifications Proposed for the Next 12 Months (dates)" shall be included in the semi-annual operational reports. Such information will provide the FERC staff with early notice of anticipated future construction/maintenance at the LNG facilities. *(section 4.12.6)*

131. 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. *(section 4.12.6)*

132. Significant non-scheduled events, including safety-related incidents (e.g., LNG, condensate, refrigerant, or natural gas releases; fires; explosions; mechanical failures; unusual over pressurization; and major injuries) and security-related incidents (e.g., attempts to enter site, suspicious activities) shall be reported to the FERC staff. In the event that an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification shall be made immediately, without unduly interfering with any necessary or appropriate emergency repair, alarm, or other emergency procedure. In all instances,

notification shall be made to the FERC staff **within 24 hours**. This notification practice shall be incorporated into the liquefaction facility's emergency plan. Examples of reportable hazardous fluids-related incidents include:

a. fire;

b. explosion;

c. estimated property damage of $50,000 or more;

d. death or personal injury necessitating in-patient hospitalization;

e. release of hazardous fluids for 5 minutes or more;

f. unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of 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 from hazardous fluids transportation occurring at or en route to and from the LNG facility; or

m. an event that is significant in the judgment of the operator and/or management even though it did not meet the above criteria or the guidelines set forth in an LNG facility's incident management plan. *(section 4.12.6)*

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 liquefaction facility to cease operations. Following the initial company notification, the FERC staff would determine the need for a separate follow-up report or follow up in the upcoming semi-annual operational report. All company follow-up reports shall include investigation results and recommendations to minimize a reoccurrence of the incident.

FEDERAL ENERGY REGULATORY COMMISSION
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