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

Driftwood LNG Project
Final Environmental Impact Statement

Driftwood LNG, LLC and Driftwood Pipeline, LLC
Docket Nos. CP17-117-000 and CP17-118-000
FERC/FEIS-0284F

Cooperating Agencies:

U.S. Army Corps of Engineers

U.S. Coast Guard

U.S. Department of Energy

U.S. Department of Transportation

U.S. Environmental Protection Agency

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FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

<u>In Reply Refer To</u>:
OEP/DG2E/Gas Branch 3
Driftwood LNG, LLC
Driftwood Pipeline, LLC
Driftwood LNG Project
Docket Nos. CP17-117-000 and
CP17-118-000

TO THE INTERESTED PARTY:

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared a final environmental impact statement (EIS) for the Driftwood LNG and Pipeline Projects (Driftwood LNG Project), proposed by Driftwood LNG, LLC and Driftwood Pipeline LLC, collectively Driftwood, in the above-referenced dockets. Driftwood requests authorization to site, construct, and operate liquefied natural gas (LNG) export facilities and certain interstate, natural gas transmission pipeline facilities in Evangeline, Acadia, Jefferson Davis, and Calcasieu Parishes, Louisiana. The Project would provide gas and processing to produce up to 27.6 million tonnes per annum of LNG for export.

The final EIS assesses the potential environmental effects of the construction and operation of the Driftwood LNG Project in accordance with the requirements of the National Environmental Policy Act (NEPA). The FERC staff concludes that approval of the proposed project, with the mitigation measures recommended in the EIS, would result in adverse impacts on the environment; however, impacts on the environment would be reduced to less than significant levels with the implementation of Driftwood's proposed impact avoidance, minimization, and mitigation measures and the additional measures recommended by staff in the final EIS.

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

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

- five LNG plants (each plant consists of one gas pre-treatment unit, one condensation stabilization unit, and four heavy hydrocarbon removal and liquefaction units);
- three LNG storage tanks;
- three marine berths capable of accommodating LNG carriers of up to 216,000 cubic meters each;
- 74 miles of 48-inch-diameter pipeline, 10.6 miles of 42-inch-diameter pipeline, and 11.3 miles of 36-inch-diameter pipeline; one 3.4-mile-long, 30-inch-diameter lateral pipeline collocated with the mainline pipeline;
- three compressor stations providing a total of approximately 275,000 horsepower of compression; and
- six pig launchers and receiver facilities,[1] 15 meter stations, and 17 mainline valves.

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 libraries in the project area. The final EIS is only available in electronic format. It may be viewed and downloaded from the FERC's website (www.ferc.gov), on the Environmental Documents page (https://www.ferc.gov/industries/gas/enviro/eis.asp). In addition, the final EIS may be accessed by using the eLibrary link on the FERC's website. Click on the eLibrary link (https://www.ferc.gov/docs-filing/elibrary.asp), click on General Search, and enter the docket number in the "Docket Number" field, excluding the last three digits (i.e., CP17-117 or CP17-118). Be sure you have selected an appropriate date range. For assistance, please contact FERC Online Support at FercOnlineSupport@ferc.gov or toll free at (866) 208-3676, or for TTY, contact (202) 502-8659.

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

In addition, the Commission offers a free service called eSubscription which 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.

[1] A pig is an internal tool that can be used to clean and dry a pipeline and/or to inspect it for damage or corrosion.

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ACRONYMS AND ABBREVIATIONS

ACHP	Advisory Council on Historic Preservation
ANR	American Natural Resources
APE	area of potential effects
API	American Petroleum Institute
AQCR	Air Quality Control Region
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ATWS	Additional temporary workspace
BACT	Best Available Control Technology
Bcf/d	Billion cubic feet per day
B.E.G.	Below existing grade
BGEPA	Bald and Golden Eagle Protection Act
Bgs	feet below ground surface
BMPs	best management practices
BOG	boil off gas
BTU	British Thermal Units
BTU/ft^2-hr	British thermal units per square foot per hour
BUDM	beneficial use of dredged material
BWDS	ballast water discharge standards
BWMS	ballast water management system
CAA	Clean Air Act
CEQ	Council on Environmental Quality
Certificate	Certificate of Public Convenience and Necessity
CFR	Code of Federal Regulations
CGT	Columbia Gulf Transmission
CH_4	methane
CI	compression ignition
CO	carbon monoxide
CO_2	carbon dioxide
COE	U.S. Army Corps of Engineers
Commission	Federal Energy Regulatory Commission
COTP	Captain of the Port
CPT	Cone penetration tests
CS	Compressor Station
CTPL	Creole Trail natural gas pipeline
CUP	Coastal Use Permit
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
dB	decibel
dBA	A-weighted decibel scale
DFDE	dual fuel diesel engine

ACRONYMS AND ABBREVIATIONS (CONTINUED)

DHS	Department of Homeland Security
DMPA	dredge material placement area
DOD	U.S. Department of Defense
DOE	Department of Energy, Office of Fossil Energy
DOT	U.S. Department of Transportation
Driftwood	DWLNG and DWPL, collectively
Driftwood Plan	Driftwood *Upland Erosion Control, Revegetation & Maintenance Plan*
Driftwood Procedures	Driftwood *Wetland & Waterbody Construction & Mitigation Procedures*
DWLNG	Driftwood LNG LLC
DWPL	Driftwood Pipeline LLC
E2	Estuarine intertidal emergent (wetlands)
EFH	essential fish habitat
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
ESCP	Erosion and Sedimentation Control Plan
ESD	Emergency Shutdown
FAA	Federal Aviation Administration
Facility	Proposed Driftwood LNG production and export terminal
FEED	Front End Engineering Design
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FERC Plan	FERC *Upland Erosion Control, Revegetation, and Maintenance Plan*
FERC Procedures	FERC *Wetland and Waterbody Construction and Mitigation Procedures*
FOC	Fiber Optic Cable
FSP	facility security plan
GHG	greenhouse gas
GIS	geographic information systems
GMD	Geomagnetic disturbance
GMFMC	Gulf of Mexico Fishery Management Council
Gpm	gallons per minute
GPS	Global Positioning System
GTL	Gas-to-liquids
GWP	Global Warming Potential
GWRC	Ground Water Resources Commission
H_2S	hydrogen sulfide
H8H	high-eighth-high
HAP	hazardous air pollutants
HAZOP	Hazard and operability review
HCA	high consequence areas
HDD	Horizontal Directional Drilling

ACRONYMS AND ABBREVIATIONS (CONTINUED)

hp	horsepower
HUC	Hydrologic Unit Code
IBC	International Building Code
ICE	internal combustion engine
ICW	Intracoastal Waterway
IMO	International Maritime Organization
ISA	International Society for Automation
ITM	Inland Testing Manual
km	kilometer
kV	kilovolt
L2UB	Lacustrine, Littoral Unconsolidated Bottom
LAC	Louisiana Administrative Code
LADOTD	Louisiana Department of Transportation and Development
LCCP	Lake Charles Cracker Project
LDAR	leak detection and reporting
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
L_{dn}	day-night noise level
L_{eq}	equivalent sound level
$L_{eq,n}$	night time equivalent sound level
LNG	Liquefied Natural Gas
LOD	Letter of Determination
LOI	Letter of Intent
LOR	Letter of Recommendation
LOS	Level of Service
LPDES	Louisiana Pollutant Discharge Elimination System
LRAM	Louisiana Wetland Rapid Assessment Method
MAOP	maximum allowable operating pressure
MBTA	Migratory Bird Treaty Act
MCL	Maximum Contaminant Level
MEOW	maximum envelope of water
MER	minimum emission rate
MLV	Mainline Valve
MMPA	Marine Mammal Protection Act
MOF	materials offloading facility
MOU	Memorandum of Understanding
MP	milepost
MR	mixed refrigerant
MS	Meter Station
MSA	Metropolitan Statistical Area
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MTPA	metric tonnes per annum
MTSA	Maritime Transportation Security Act

ACRONYMS AND ABBREVIATIONS (CONTINUED)

NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NGA	Natural Gas Act
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_x	nitrogen oxides
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	noise sensitive area
NSPS	New Source Performance Standards
NSR	New Source Review
NVIC	Navigation and Vessel Inspection Circular
NWI	National Wetland Inventory
NWR	National Wildlife Refuge
O_3	ozone
OBE	Operating Basis Earthquake
OCM	Office of Coastal Management
OEP	Office of Energy Projects
OHX	Overhead Crossing
OPS	Office of Pipeline Safety
OSHA	Occupational Safety and Health Administration
P&ID	piping and instrument diagrams
PDS	Pipeline Delivery Station
PEM	palustrine emergent (wetlands)
PFO	palustrine forested (wetlands)
PHMSA	Pipeline and Hazardous Materials Safety Administration
Pipeline	Proposed Driftwood natural gas pipeline
$PM_{2.5}$	particulate matter with an aerodynamic diameter ≤2.5 microns
PM_{10}	particulate matter with an aerodynamic diameter ≤10 microns
ppb	Parts per billion
ppt	Parts per thousand
Project	Driftwood LNG Project
PSD	Prevention of Significant Deterioration
PSM	Process Safety Management of Highly Hazardous Chemicals; Explosives and Blasting Agents
PSS	palustrine scrub-shrub (wetlands)

ACRONYMS AND ABBREVIATIONS (CONTINUED)

QA/QC	Quality assurance and quality control
RECAP	Risk Evaluation / Corrective Action Program
RMP	Risk Management Plan
ROW	right-of-way
RP	Recommended Practice
SAFE	Security and Accountability For Every Port Act
SAV	Submerged aquatic vegetation
SCR	selective catalytic reduction
SHPO	State Historic Preservation Officer
SIL	significant impact level
SLOSH	Sea, Lake, and Overland Surge from Hurricanes
SO_2	sulfur dioxide
SONRIS	Strategic Online Natural Resources Information System
SPCC	Spill Prevention, Control, and Countermeasure
SSA	Sole Source Aquifer
SSE	Safe shutdown earthquake
SSURGO	Soil Survey Geographic Database
SWEL	stillwater elevation
SWLA	Southwest Louisiana
TAP	toxic air pollutants
TETCO	Texas Eastern Transmission Company
TGP	Tennessee Gas Pipeline
tpy	tons per year
TSS	total suspended solids
UDP	Unanticipated Discoveries Plan
U.S.	United States
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish & Wildlife Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VOC	volatile organic compound
Williams	Williams Pipeline Company
WRP	Wetland Reserve Program
WSA	Waterway Suitability Assessment

EXECUTIVE SUMMARY

INTRODUCTION

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared this final Environmental Impact Statement (EIS) to fulfill 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 (CFR) Part 380 (18 CFR 380). On March 31, 2017, Driftwood LNG, LLC (DWLNG) filed an application with the Commission for authorization under Section 3(a) of the Natural Gas Act (NGA) and part 153 of the Commission's regulations. In Docket No. CP17-117-000, DWLNG requests authorization to site, construct, and operate a natural gas liquefaction and export facility at a proposed site on the west bank of the Calcasieu River near Carlyss, Calcasieu Parish, Louisiana.

Also on March 31, 2017, Driftwood Pipeline, LLC (DWPL) filed an application with FERC for a Certificate of Public Convenience and Necessity (Certificate) under Section 7(c) of the NGA and part 157 of the Commission's regulations. In Docket No. CP17-118-000, DWPL requests authorization to construct, install, and operate new natural gas pipeline, compression, meter stations (MS), and associated facilities (Pipeline) that would facilitate the delivery of natural gas to DWLNG's proposed liquefied natural gas (LNG) terminal (LNG Facility) for liquefaction and export of LNG. The LNG Facility and Pipeline are referred to collectively as the "Driftwood LNG Project" or "Project."

The purpose of the EIS is to inform FERC decision-makers, the public, and the permitting agencies about the potential environmental impacts of the proposed Project and alternatives and recommend mitigation measures that would reduce adverse impacts to the extent practicable.

We [1] prepared this final EIS to assess the environmental impacts associated with construction and operation of the Project. Our analysis was based on information provided in Driftwood's applications, and further developed from data requests; field investigations; scoping; literature research; correspondence/consultation from federal, state, and local agencies; and public comments.

The FERC is the lead federal agency responsible for authorizing interstate natural gas transmission facilities under the NGA and is the lead federal agency for preparation of this final EIS in compliance with the requirements of NEPA. The United States (U.S.) Army Corps of Engineers (COE), U.S. Coast Guard (USCG), U.S. Department of Energy, U.S. Department of Transportation (DOT), and U.S. Environmental Protection Agency (EPA) are participating in the NEPA review as cooperating agencies.[2]

PROPOSED ACTION

The Driftwood LNG Project consists of two main components: 1) the construction and operation of the LNG Facility, which includes five LNG plant facilities to liquefy natural gas, three tanks to store the

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

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

LNG, LNG carrier loading/berthing facilities (Marine Facility), and other appurtenant facilities at a site near Carlyss, Calcasieu Parish, Louisiana; and 2) the construction and operation of about 96 miles of pipeline, three new compressor stations, and 15 new meter stations in Calcasieu, Jefferson Davis, Acadia, and Evangeline Parishes, Louisiana to deliver natural gas to the LNG Facility. The Project would produce up to 27.6 million (metric) tonnes per annum (MTPA) of LNG for export on an average of one LNG carrier per day, or 365 carriers per year.

Subject to the receipt of FERC authorization and all other applicable permits, authorizations, and approvals, DWLNG anticipates starting construction of the liquefaction facility in 2019. The liquefaction plants[3] would be constructed in three phases with full service anticipated within seven years of a FERC Order authorizing the projects. DWPL anticipates construction of the Pipeline would begin approximately one year after receiving the FERC Order and proceed in three phases, continuing over about 30 months.

PUBLIC INVOLVEMENT

On June 6, 2016, the FERC began its pre-filing review of the Driftwood LNG Project and established pre-filing Docket No. PF16-6-000 to place information related to the project into the public record. The pre-filing process ended on March 31, 2017, when Driftwood filed its applications with the FERC. The pre-filing review process provides opportunities for interested stakeholders to become involved early in project planning, facilitates interagency cooperation, and assists in the identification and resolution of issues prior to a formal application being filed with the FERC.

On October 3, 2016, the FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Driftwood LNG Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Sessions* (NOI for the Driftwood LNG Project). The NOI was sent to about 1,600 interested parties, including federal, state, and local officials; agency representatives; conservation organizations; Indian Tribes; local libraries and newspapers; and property owners near the planned Project facilities. Publication of the NOI for the Driftwood LNG Project established a 30-day scoping period for the submission of comments, concerns, and issues related to the environmental aspects of the planned Project. Scoping sessions were held in Kinder (October 25, 2016), Sulphur (October 26, 2016), and Eunice (October 27, 2016). During the scoping sessions, we received over 40 comments about the Project.

During the scoping period, we received 279 comments. Transcripts of the scoping sessions were placed into the public record for this proceeding and are available for viewing under pre-filing docket number PF16-6-000. Driftwood filed its formal application on March 31, 2017, and it was assigned Docket Nos. CP17-117-000 (LNG Facility) and CP17-118-000 (Pipeline). Comments received after the applications were filed can be found under those dockets.

During the public comment period for the draft EIS, we received 383 comments. The draft EIS for the Project was issued for public review on September 14, 2018, and the Notice of Availability (NOA) for the draft EIS was published in the Federal Register on September 21, 2018 (83 FR 47918, pages 47918-

[3] A liquefaction plant is a facility that converts natural gas from its gaseous form (as it is transported in pipelines) into its liquefied form, known as LNG. In its liquefied form, natural gas occupies about 1/600th of the volume it does in its gaseous form, which makes it possible to transport large volumes of natural gas by LNG carriers.

47920). The NOA included a notice of public comment sessions on October 9, 10, and 11, 2018, in Kinder, Opelousas, and Sulphur, Louisiana, respectively. The NOA also provided summary information regarding the draft EIS and requested submission of all comments by November 5, 2018. At the comment sessions, the FERC received written comments from four individuals and 14 verbal comments from 13 individuals. The verbal comments were recorded and transcribed by a court reporter. Transcripts and all written comments that we received on the draft EIS are part of the public record for the Project.

In addition to receiving written and verbal comments at the draft EIS comment sessions, the FERC received 44 comment letters from various parties including federal, state, and local agencies; interested parties; tribes; businesses; elected officials; and Driftwood. All comments directly pertaining to the draft EIS, the transcripts of verbal comments presented at the draft EIS comment sessions, and responses to comments are presented in Appendix F.

ENVIRONMENTAL IMPACTS AND MITIGATION

In section 4.0 of this EIS, we evaluate the potential environmental impacts of construction and operation of the Project on geology; soils; water resources; wetlands; vegetation; wildlife and aquatic resources; 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 recommend additional mitigation measures to minimize or avoid these impacts. Sections 5.1 and 5.2 contain our impacts conclusions and a compilation of our recommended mitigation measures, respectively.

Construction and operation of the LNG Facility would affect about 720 acres of land. An additional 165 acres of land would be temporarily affected to support construction activities. Constructing and operating the Pipeline would affect about 1,880 and 684 acres of land, respectively. Dredging and general construction at the LNG Facility would generally be conducted 24 hours a day, and some horizontal directional drilling (HDD) and construction activities for the Pipeline would generally be conducted during daytime hours. Occasionally, unexpected delays during HDD construction could require that construction extend beyond normal working hours for short periods of time. Temporarily affected lands would be restored per landowner agreement, and as applicable, in accordance with the Driftwood *Upland Erosion Control, Revegetation & Maintenance Plan* (Driftwood Plan) and the Driftwood *Wetland & Waterbody Construction & Mitigation Procedures* (Driftwood Procedures) and returned to their pre-construction land use.

Geology

The Project is in an area with historically low seismic risk and minimal seismic activity, and we do not anticipate that earthquakes and related seismic hazards would have an impact on the LNG Facility or the Pipeline. The presence of growth faults (rapid subsidence) were identified as an issue of concern for the Pipeline; however, the rate of movement from growth faults near the Pipeline is relatively low and we do not anticipate that the Pipeline would be affected by growth faults.

Soils

About 385 acres of the LNG Facility site contains soils that meet the National Resources Conservation Service's criteria for "prime farmland;" however, these soils are currently zoned for heavy industrial use and are not being farmed. Construction and operation of the Pipeline and associated access roads would affect 1,622 and 135 acres of prime farmland soils, respectively. Because the construction workspace and permanent easement would be restored to pre-construction conditions in accordance with the Driftwood Plan and the Driftwood Procedures, most impacts on prime farmland soils from construction of the pipeline would be short-term and would not affect the potential use of prime farmland for future agricultural purposes.

Water Resources

The entire Driftwood LNG Project lies within the Chicot Aquifer System, which is designated as a sole-source aquifer. However, we have determined that the Project would not have a significant effect on groundwater drawdown in the Chicot Aquifer System.

The Pipeline would cross six wellhead protection areas and there are eight active private water wells within 150 feet of Pipeline workspace. DWPL's implementation of the mitigation measures in the Driftwood Plan and Procedures would ensure that construction and operation of the Pipeline does not result in significant impacts on public and private water supplies.

Dredging activities in support of the Marine Facility, pioneer docks, and materials offloading facility (MOF) would occur in the Calcasieu River and Intracoastal Waterway (ICW). For the Marine Berth, Driftwood would use a cutterhead suction dredge, which minimizes turbidity at the dredging site compared to mechanical dredging methods, such as clamshell and dragline dredges. Dredged material would be pumped in a slurry form from the dredging location to Beneficial Use of Dredged Material (BUDM) areas through a pipeline. Prior to placement of dredged materials, silt curtains and/or hay bales would be installed to reduce the amount of sediment exiting the BUDM areas.

An area of known contamination was identified adjacent to the LNG Facility, but would not be dredged or directly disturbed.

During operation, LNG carriers would withdraw and discharge engine cooling and ballast water from and into the Calcasieu River. These withdrawals and discharges could affect water quality; however, due to the naturally occurring variability in water quality, the regular movements and currents of the river, and the relatively small volumes of water compared to the total volume in the Calcasieu River, we anticipate that water quality impacts would be temporary and minor.

Inadvertent spills or leaks of hazardous materials used during construction and operation of the LNG Facility and Pipeline pose a potential risk of contamination to groundwater and surface waters near the Project. Driftwood's Procedures and construction Spill Prevention, Control, and Countermeasure (SPCC) Plan and to be developed operations SPCC Plan would minimize the potential for impacts associated with an inadvertent spill or leaks of hazardous materials.

The Pipeline would cross 317 waterbodies. Waterbodies would generally be crossed using open-cut construction methods. HDDs would be used to cross 15 waterbodies. Implementation of the Driftwood Procedures and HDD Contingency and Fluid Monitoring Plan, and performance of the work according to applicable permits would ensure that impacts on waterbodies would be minor and temporary.

Fisheries and Aquatic Resources

The Calcasieu River supports both commercial and recreational fishing. Dredging and construction of the Marine Facility, pioneer docks, and MOF including pile driving would temporarily affect fisheries and aquatic resources. Impacts on fisheries and aquatic resources would vary by species; however, many of these species are mobile and would be able to avoid dredging and pile driving activities. Impacts from pile driving include injury or trauma to fish, sea turtles, and other animals. To reduce impacts on fisheries and aquatic species from pile driving, we recommend that DWLNG develop an In-water Pile Driving Plan in consultation with the National Marine Fisheries Service (NMFS) that will identify mitigation measures that, when implemented, will reduce peak noise levels below 206 decibels (re: 1 μPa). Additionally, LNG carrier cooling water intakes would result in impingement and entrainment of juvenile fish and other small organisms. However, based on the high abundance of planktonic fish and shrimp in estuarine waters and the natural mortality of these early life stages, we conclude that these impacts would not be significant. Due to the existing shipping activities within the Calcasieu Ship Channel, Driftwood's proposed mitigation measures, and our recommended mitigation, we conclude that construction and operation of the Project would not have significant effects on fisheries and aquatic resources.

Open cut construction of waterbodies along the Pipeline would result in temporary and minor impacts on fish and aquatic species. DWPL would minimize these impacts by implementing the mitigation measures within the Driftwood Procedures to ensure that the Pipeline does not result in any significant impacts.

Wetlands

Construction and operation of the LNG Facility would result in the permanent loss of about 319.3 acres of wetlands. Constructing and operating the Pipeline would temporarily and permanently impact about 425.9 and 78.1 acres of wetlands, respectively.

To mitigate wetlands impacts, Driftwood would contribute dredged material to Louisiana's BUDM Program and purchase compensatory wetland mitigation credits in adherence to guidelines established by the Louisiana Wetland Rapid Assessment Method and prescribed by the COE New Orleans District Wetland Mitigation Plan. Final compensatory mitigation requirements would be subject to review and approval by the COE New Orleans District as part of the Section 404/10 permit process. We recommend that DWPL revise its HDD crossing of the Calcasieu River to avoid impacts on a forested wetland complex.

Because Driftwood would follow its Procedures during construction to minimize impacts on wetlands, and provide mitigation through its Section 404/10 permit, we conclude that impacts on wetlands would not be significant.

Vegetation Resources

In total, about 551.3 acres of vegetation would be permanently cleared and converted to at the LNG Facility site. About 1,623.7 acres of vegetation would be cleared for the construction of the proposed Pipeline, including workspaces and access roads. Following Pipeline construction, 557.5 acres of vegetation would be maintained as permanent easement or converted to permanent access roads. About 127.6 acres of vegetation would be cleared for construction of the Pipeline aboveground facilities. Following construction, about 86.2 acres would be converted to industrial use associated with operation of the compressor stations and meter stations.

Based on the amount of temporary and permanent impact and the abundance of similar vegetation in the Project area, and the use of the Driftwood Plan and Procedures to minimize impacts, we conclude that Project impacts on vegetation would not be significant.

Wildlife Resources

Wildlife habitat at the LNG Facility and Pipeline aboveground facility sites would be permanently affected. Wildlife would generally avoid the construction and operations activities associated with the Project. The greatest effect on wildlife habitat would result from cutting, clearing, and/or removal of existing vegetation, which would reduce the amount of available wildlife habitat. As a result of the Project, wildlife would experience increased rates of stress, injury, and mortality. However, because abundant similar habitat is available for wildlife adjacent to the affected areas, we conclude that the Project would not significantly affect wildlife. We recommend that Driftwood file a final set of measures, developed in consultation with the U.S. Fish and Wildlife Service, to mitigate migratory bird impacts.

Additionally, staff received numerous comments concerning LNG Facility-related lighting impacts on wildlife. During construction, Driftwood would direct all nighttime lighting towards construction activity and use the minimum light level necessary to ensure site safety and security. LNG Facility lighting would be chosen to minimize the horizontal emission of light away from intended areas, and shielding would help minimize impacts on birds and other wildlife while providing the illumination needed to ensure safe operation.

Special Status Species

Based on information obtained from the U.S. Fish and Wildlife Service and NMFS, 16 federally listed species may occur within the parishes affected by the Project. Of these, 12 are marine species (five sea turtle species, four whale species, two fish species, and the West Indian manatee) that may occur in the Calcasieu Ship Channel in Cameron Parish, Louisiana, or off the Gulf Coast. Therefore, potentially suitable habitat for these species is limited to barge and LNG carrier transit in Cameron Parish and the Gulf of Mexico.

The primary threat to these marine species occurring along the LNG carrier transit routes would be an increased risk of carrier strikes during operation. Barges and LNG carriers would use established and well-traveled shipping lanes. Driftwood proposes to provide LNG carrier captains with the NMFS-issued document *Vessel Strike Avoidance Measures and Reporting for Mariners*, which outlines collision-avoidance measures. Based on the carrier's use of existing, highly traveled shipping lanes and proposed mitigation measures during LNG carrier transit, we have determined that construction and operation of the LNG Facility *may affect, but is not likely to adversely affect* these marine species. This finding also applies to the protected marine mammals in the Gulf of Mexico.

Of the four remaining federally protected species, we have determined, based on the range, habitat requirements, and Project activities, that the Project would have *no effect* on the piping plover, red knot, and American chaffseed, and *may affect, but is not likely to adversely affect* the red-cockaded woodpecker.

Land Use

Land use in, adjacent to, and surrounding the LNG Facility consists of undeveloped lands, rural residential lands, and developed lands including other industrial facilities. Construction of the facilities would require about 883.1 acres (718.6 acres onsite, and 165.0 acres temporary offsite construction areas). About 659 acres would be directly affected by construction and operation of the LNG Facility. About 300 acres of the LNG Facility and 12 acres of maintenance buildings and warehouses would be surrounded with security fence.

The nearest residences are about 100-200 feet northeast of the LNG Facility site and also lie within 25 feet of Pipeline construction area and are discussed in relation to the Pipeline below. The nearest residential communities include the Driftwood Community (0.25 mile north of the LNG Facility) and a residential area 0.8 mile west of the LNG Facility. To minimize visual impacts on residences near the LNG Facility, DWLNG would maintain vegetation and trees at a height of 25-30 feet southeast of the Driftwood Community, as well as vegetation and trees at Dutch Cove cemetery adjacent to the LNG Facility as natural screening. Driftwood has committed to planting additional vegetation screening to further minimize visual impact from the Driftwood Community. The visual buffers would reduce the impact on visual resources, and the LNG Facility would be consistent with the visual character of the industrial developments along the Calcasieu Ship Channel. The LNG Facility would be minimally visible above the intervening trees during daytime and normal nighttime operations, and the LNG Facility would not be a significant visual impact on the nearby Driftwood Community.

There are eight structures within 25 feet of the Pipeline construction right-of-way, two of which would be purchased by DWPL. DWPL has developed site-specific plans for the remaining six locations. We reviewed these site-specific plans, and have concluded that DWPL's mitigation measures would minimize impacts on the affected residences. Overall, we conclude that Project impacts on residential land would be minor and temporary, but not significant.

Recreation

The recreational areas closest to the LNG Facility include the Intracoastal Park (about 1.3 miles southwest) and Calcasieu Point Landing (about 1.4 miles east) that is associated with use of the Calcasieu River and Calcasieu Lake for boating, fishing, and birding. Construction and operation of the LNG Facility would increase the number of vessels using the Calcasieu Ship Channel. LNG carriers are required by USCG regulations (33 CFR 165.805) to maintain a moving security zone two miles ahead and one mile behind from channel edge to channel edge. Based on one LNG carrier per day, the impact on recreational boating and fishing would not be significant.

One state-managed Scenic River, the Calcasieu River, would be crossed by the Pipeline near MP 37.5 using the HDD construction method. We conclude the Pipeline would not result in any significant impact on recreational resources.

Visual Resources

The primary existing receptors in the viewshed of the LNG Facility include residential areas, recreational areas associated with the Calcasieu River, and a portion of the Creole Nature Trail All-American Road (Highway 27). The north edge of the LNG Facility perimeter berm would be about 2,500 feet from the Driftwood Community. The distance to the residential area to the west is about 4,000 feet to the edge of the LNG Facility perimeter berm. Residences along the shores of Calcasieu Lake, Calcasieu Ship Channel, and recreational boaters and fishermen would also be within the viewshed of the LNG Facility and the associated ship traffic.

Prominent features visible within the LNG Facility would include the LNG storage tanks, flare stacks, LNG plants, and LNG carriers. The LNG Facility would require outdoor lighting for safety and security and lights on tall structures for aircraft warnings, that would be visible to nearby residences at night. In addition, nearby residents and viewers of the LNG Facility would see the flares during the occasional flaring events at night.

Once the LNG Facility is completed, the aesthetics would be consistent with other existing industrial developments along the Calcasieu Ship Channel such as Cameron LNG and Lake Charles LNG facilities. The Driftwood LNG Project's flare stacks (approximately 351 feet above mean sea level) would be consistent with nearby facilities (e.g., 420 feet at Cameron LNG, 201-350 feet at Lake Charles LNG). Federal Aviation Administration-required lighting on the flare stacks would be visible to the general population (e.g., the Driftwood Community, residential areas to the west, and Highway 27), but would be consistent with lighting on other tall structures in the area. Actual flares would be employed only during process upset conditions (i.e., about five hours during startup, about 12 hours during the first year, about 6 hours per subsequent year, generally in 15-30 minute flaring events). These intermittent, temporary events would not have a significant visual impact on nearby residences. The areas between the LNG Facility and some residences, including the Driftwood Community, consist of forested and scrub-shrub habitats (about 1,250 feet wide with trees 25-30 feet tall), which would remain in place and provide visual buffers. Driftwood has committed to planting additional vegetation screening to further minimize visual impact from the Driftwood Community. Based on updated visual renderings from Driftwood and on the proposed mitigation measures, the LNG Facility would be minimally visible above the intervening trees during daytime and normal nighttime operations. In addition, the LNG Facility would be consistent with the visual character of the industrial developments along the Calcasieu Ship Channel. Therefore, the visual impact on the nearby Driftwood Community would not be significant.

DWPL would not disturb intervening vegetation present at Compressor Stations 01 and 03. In addition, there is an existing compressor station between Compressor Station 03 and the nearest residence. Compressor Station 02 is about 1,850 feet from the nearest residence. Outdoor lighting of compressor stations would be designed to minimize visual effects at night, including directional shielding and downward direction where practicable. Additional lighting would only be necessary when active maintenance operations at the compressor stations require nighttime work. As a result, the nighttime appearance of the compressor stations would not have a significant impact on visual resources. Although the visual impacts during compressor station operations would be permanent, they would not be significant due to the mitigation proposed by DWPL, distance from visual receptors, presence of similar industrial facilities in the viewshed, and the use of downlighting to shield aboveground facility lighting at night.

Socioeconomics

Construction of the Driftwood LNG Project would require an estimated peak workforce in construction month 35 of 5,400 personnel for the LNG Facility and 1,030 for the Pipeline. Driftwood anticipates hiring about 30 percent of required workers locally; non-local personnel are expected to be highly skilled tradesmen. The peak construction workforce for the LNG Facility would represent a 2.8 percent increase to the local population if all 5,400 workers were housed within Calcasieu Parish. There is abundant transient housing in Calcasieu Parish. Housing of those workers and family members would result in a moderate, short-term impact on housing availability in the Project area that would last about 6 years. Operation of the LNG Facility and Pipeline would require a permanent workforce of 539 new employees, with an estimated 64 percent to be hired locally. This increase in population would represent a minor permanent impact on the local population.

Driftwood estimates spending a total of $14.5 billion to construct the LNG Facility, of which $3.8 million would be spent within the Lake Charles Metropolitan Statistical Area, generating increased local, state, and federal sales tax revenue in the Project area. After construction, Driftwood would pay parish property taxes on its LNG Facility, Pipeline, and associated equipment, although on December 14, 2018, DWLNG received approval to participate in Louisiana's Industrial Tax Exemption Program, which would reduce the amount of property tax paid to Cameron Parish. There also would be long-term increases in sales tax revenue from expenditures on materials, goods, and services by Driftwood and the operational workforce.

During construction of the LNG Facility, local roadway traffic volume would increase, creating additional delays at several of the intersections analyzed. Driftwood has committed to coordinating improvements to Burton Shipyard Road, including a right-hand turn lane to the north onto Highway 27 and a left-hand turn lane on Highway 27 for traffic turning onto Burton Shipyard Road, and connecting Olson Road directly to Highway 27 at a location to the south of Stine Road to allow local traffic to avoid Burton Shipyard Road. These measures would help alleviate traffic concerns near the LNG Facility.

Environmental Justice

During operation, the Project is expected to have positive economic effects on the general community, as well as on minority and economically disadvantaged populations through job creation, economic activity, and tax payments. No environmental justice communities would be crossed by the Project.

Cultural Resources

Cultural surveys were performed for the LNG Facility and Pipeline, consisting of about 718 acres to address the direct area of potential effect (APE) for the LNG Facility in Calcasieu Parish, Louisiana, and about 3,474.1 acres to address part of the direct APE for the Pipeline in Calcasieu, Jefferson Davis, Acadia, and Evangeline Parishes, Louisiana. The State Historic Preservation Officer (SHPO) accepted reports on these surveys with no additional comments. Due to restricted access, surveys of approximately 400 acres for the Project remain incomplete. The indirect APE reviewed for the LNG Facility was 0.5 mile; however, the height of the structures at the LNG Facility has been revised since previous consultation on the Project was submitted to the SHPO. Based on the height of some structures, we recommend that DWLNG increase the indirect APE to a radius of 1.0 mile for the LNG Facility and request comment from the SHPO. We recommend that DWLNG and DWPL file complete survey reports and complete consultation for cultural resources.

Air Quality and Noise

Construction emissions for the LNG Facility would occur for an estimated 86 months of construction. The construction emissions would not be a permanent source of emissions, and, therefore, not have a long-term effect on air quality in the area. The primary impact on residents during construction would be local increases in fugitive dust and tailpipe emissions, which may result in intermittent, localized impacts near the construction areas during the construction period associated with the LNG Facility. During the three years of concurrent commissioning, construction, and operation of the LNG Facility, emissions levels may result in exceedances of the National Ambient Air Quality Standards in the immediate vicinity of the LNG Terminal during these construction years. These exceedances would not be persistent at any one time during these years due to the dynamic and fluctuating nature of construction activities within a day, week, or month.

Residents near the Pipeline and compressor station construction areas may experience elevated emission levels during the period of construction, primarily from fugitive dust. The magnitude of emissions from compressor station construction would be much lower than the emissions from construction of the

LNG Facility. Pipeline construction emissions would occur at any given location for only a short period, as construction moves along the route.

Driftwood provided operational air quality modeling for the LNG Facility and the compressor stations that demonstrate the operational impacts would be below the National Ambient Air Quality Standards. Therefore, with the mitigation measures that Driftwood has proposed, we conclude there would be no regionally significant impacts on air quality.

Noise levels associated with construction activity would vary depending on the phase of construction in progress at any time, with the highest level of construction noise at the LNG Facility occurring during earth-moving and pile-driving work. Driftwood has indicated that it plans to construct at the LNG Facility 24 hours a day. Should this occur, we recommend Driftwood file additional information to ensure nearby residents are not exposed to excessive noise.

Pile driving, which would occur for three years at the LNG Facility, was estimated to produce 24-hour equivalent sound levels (L_{eq}) that are below our noise criterion of 55 A-weighted decibels (dBA). However, calculated maximum sound levels (L_{max}) of pile driving (i.e., each hammer strike) would be well above the existing ambient levels. Although pile driving would be clearly audible at nearby residences when ambient sound levels are low, it would only occur from 7 a.m. to 7 p.m. Pile driving would be clearly audible outside of residences, and potentially indoors in the numerous homes near the LNG Facility. To ensure that impacts due to maximum pile driving noise levels at the LNG Facility would be minimized, we recommend that DWLNG prepare and follow a pile-driving noise management plan including sound level monitoring, and evaluation and use of noise mitigation to limit noise levels at the nearest noise sensitive area (NSA).

Sound-level increases during Pipeline construction would be intermittent and generally would occur between 7:00 a.m. and 7:00 p.m.. HDDs may continue into nighttime hours and could operate 24 hours per day for several days. HDDs are proposed at 11 locations (two of the 12 HDD crossings would be installed at a single location where the mainline and a lateral pipeline run parallel), seven of which have NSAs within 0.5 mile. DWPL has proposed sound mitigation measures at these sites. Noise analysis indicates that the proposed mitigation is insufficient to meet our thresholds at four sites, and we recommend that DWPL prepare and follow a noise mitigation plan for HDD locations at four HDD sites.

During operation, the LNG Facility would generate noise levels that would occur throughout the life of the Project. Noise would be produced continually by a number of sources that include various types of compressors, combustion turbines, cooling fans, pumps and piping. Operational noise levels were modeled for Plants 1 and 2, and then incrementally for the remaining three plants. Driftwood has proposed noise mitigation measures to achieve compliance with our 55 dBA day-night averaged (L_{dn}) criterion. Because the noise levels identified for Plants 4 and 5 without mitigation exceeded our threshold, Driftwood has committed to conducting a post construction noise survey after commissioning Plant 1 of the LNG Facility. In addition to Driftwood's commitment to a post-construction noise survey of Plant 1 while it is operating under full load, we recommend that Driftwood file full power load noise surveys at the LNG Facility no later than 60 days after placing Plants 2 through 5 in service. Additional noise controls would be required if actual conditions exceeds an L_{dn} of 55 dBA at any nearby NSAs.

During Pipeline operation, the Pipeline compressor stations would contain combustion turbines, compressors, cooling fans, and other noise generating sources. Additionally, the meter stations would contain control valves and ultrasonic meters. Noise analyses predicts that the noise attributable to each compressor station would be under 55 dBA L_{dn} at the nearby NSAs.. Similarly, noise analysis of the meter stations indicate that the noise would be below our noise level threshold.

We recommend that DWPL file noise surveys at certain meter stations, and at each of the compressor stations, no later than 60 days after placing these facilities in service. Additional noise controls would be required, if actual conditions exceeds an L_{dn} of 55 dBA at any nearby NSAs.

Based on our noise analyses and our mitigation recommendations, we conclude that operation of the Project would not have a significant impact on the noise environment near the LNG Facility, any of the Pipeline compressor stations, or other aboveground facilities.

Safety and Reliability

We assessed the potential impact to the human environment in terms of safety and whether the proposed facilities would operate safely, reliably, and securely.

As a cooperating agency, the DOT assists the FERC by determining whether DWLNG's proposed design would meet the DOT's 49 CFR 193 Subpart B siting requirements. The DOT reviewed information submitted by DWLNG and on December 11, 2017, and as clarified on July 13, 2018, provided a letter to FERC staff stating that the DOT had no objection to DWLNG's methodology to comply with the 49 CFR 193 siting requirements for the proposed LNG liquefaction facilities. On December 18, 2018, DOT provided a Letter of Determination on the Project's compliance with 49 CFR 193, Subpart B. This is provided to the Commission as further consideration on its decision and final action on the Project applications. If the LNG 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.

As a cooperating agency, the USCG also assisted the FERC staff by reviewing the proposed LNG Facility and the associated LNG carrier traffic. The USCG reviewed a Waterway Suitability Assessment (WSA) submitted by DWLNG that focused on the navigation safety and maritime security aspects of LNG carrier transits along the affected waterway. On April 25, 2017, the USCG issued a Letter of Recommendation to FERC staff indicating the Calcasieu Ship Channel would be considered suitable for accommodating the type and frequency of LNG marine traffic associated with the Project, based on the WSA and in accordance with the guidance in the USCG's Navigation and Vessel Inspection Circular (NVIC) 01-2011. If the LNG Facility is authorized and constructed, the facility would be subject to the USCG's inspection and enforcement program to ensure compliance with the requirements of 33 CFR 105 and 33 CFR 127.

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 this review, we recommend a number of mitigation measures to be implemented prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout life of the facility, to enhance the reliability and safety of the facility to mitigate the risk of impact on the public. Based on our external impact analysis and preliminary evaluation of the engineering design, and with the incorporation of our recommended mitigation measures and oversight, we conclude that the LNG Facility's 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.

The Pipeline and associated aboveground facilities would be constructed, operated, and maintained in compliance with DOT standards published in 49 CFR 192. These regulations are intended to minimize the potential for natural gas facility accidents and protect the public and environment. The DOT specifies material selection and qualification; minimum design requirements; and protection from internal, external, and atmospheric corrosion. We conclude that the Pipeline would have a small increase in the risk of a pipeline accident; however, this risk would be minimized based on compliance with DOT regulations. Therefore, the Pipeline would not have a significant impact on public safety.

Cumulative Impacts

As described throughout this final EIS, constructing and operating the Project would have both temporary and permanent effects on the environment. Potential cumulative impacts were identified for the following resources: land use (where some landowners have multiple rights-of-way on their property, resulting in an overall reduction of options on their lands); visual aesthetics; socioeconomics, including traffic and marine traffic; air quality (where pipeline construction occurs concurrently with other pipelines), and climate change.

Because structures other than the Pipeline's aboveground facilities would not be allowed within the permanent Pipeline right-of-way, where multiple existing or future pipelines are collocated on developable property, the restrictions on structures could cumulatively represent a substantial restriction to individual landowners for future uses.

The Driftwood LNG Facility, when considered with the existing Cameron LNG, existing Lake Charles LNG import terminal, approved Lake Charles LNG export terminal, and approved Magnolia LNG Projects, would cumulatively contribute to impact on visual resources in the area. The primary existing receptors in the viewshed of the LNG Facility include residential areas, recreational areas associated with the Calcasieu River, and a portion of the Creole Nature Trail All-American Road (Highway 27). Nighttime viewers of the LNG Facility would see lighting and occasional natural-gas flares. Once the LNG Facility was completed, the aesthetics would be consistent with other existing and proposed industrial developments along the Calcasieu Ship Channel, and although the LNG Facility represents an increase to visual impacts, it would be consistent with the existing nature of the area and with planned projects in the area.

Other projects occurring within the cumulative impact area for socioeconomics include six FERC-jurisdictional projects, two pipeline projects, two energy projects, four industrial projects, nine transportation (including port and road improvement) projects, and 34 residential and commercial developments.

Traffic from other projects in the vicinity that occur within the same timeframe, when considered in combination with traffic from the Project, could further contribute to traffic congestion problems and increased traffic safety risks. The traffic volumes modeled in Driftwood's Traffic Impact Study are based on future projections of existing traffic and therefore include traffic from existing industrial activities, including construction traffic for the Cameron LNG Project, which is anticipated to taper off during the first year of the construction schedule for the Driftwood LNG Project. Based on the proposed mitigation for existing and modeled traffic congestion included in Driftwood's Traffic Management Plan and the anticipated reduction in traffic from other large projects, we conclude the Driftwood LNG Project would have minimal negative impact on road traffic and may improve area road traffic.

Cumulative marine traffic in the Calcasieu Ship Channel was assessed by an independent study, conducted for the Port of Lake Charles. Results of the study indicate that although vessel wait times may increase due to the Project, the ship channel has the capacity to accommodate this cumulative increase in vessel traffic, provided that the channel is appropriately maintained.

The air quality permitting process requires dispersion modeling to assess the cumulative impact of operation of New Source Review and Protection from Significant Deterioration (PSD) projects when considered with other New Source Review and PSD projects in the same area. Construction of the other projects with operational air emissions requiring permits for point source emissions would result in air quality impacts similar to the Driftwood LNG Project. These projects that are considered to be major sources of air emission would be required to conduct a PSD analysis, and meet similar permit requirements as the Driftwood LNG Project. In addition, any other potential future projects that are considered to be major sources of air emissions would be required to conduct a PSD analysis. Should operation of a new project result in a significant impact on air quality, the Louisana Department of Environmental Quality would enforce operational limitations or require emissions controls that ensure compliance with the state implementation plan and attainment with the National Ambient Air Quality Standards. In addition, the Driftwood LNG Project would be required to comply with any Louisana Department of Environmental Quality permit conditions during operation their facilities. Therefore, the cumulative impacts from the Driftwood LNG Project on air quality, when considered in conjunction with the impacts from the projects listed above, would not be significant.

Pipeline construction for both the Driftwood LNG Project and the Lake Charles LNG Project are scheduled to begin at similar times, and fugitive dust emissions could interact to produce a cumulative impact where the two pipelines are within 0.25 mile (i.e., at milepost 47.9). Similarly, construction vehicle exhaust could interact at this location. If such an interaction occurs, the effects would be short-term, ending after construction at that location is complete.

There is no generally accepted significance criteria for greenhouse gas (GHG) emissions under NEPA. In addition, we cannot determine a project’s incremental physical impacts on the environment caused by GHG emissions. Therefore, we cannot determine whether a project’s contribution to climate change would be significant. There is no standard methodology to determine whether, and to what extent, a project’s incremental contribution to GHG emissions would result in physical effects on the environment for the purposes of evaluating the Project’s impacts on climate change, either locally or nationally. However, the Project’s emissions would increase the atmospheric concentration of GHGs, in combination with past and future emissions from all other sources, and contribute incrementally to climate change.

Alternatives Considered

In accordance with NEPA and FERC policy, we evaluated a range of alternatives. The range of alternatives evaluated include the no-action alternative, system alternatives, pipeline route alternatives, compressor station alternatives, and facility configuration alternatives. In addition, process, construction, and dredge material disposal alternatives were considered for the LNG Facility.

Under the no-action alternative, the environmental impacts of the Project, both positive and negative, would not occur; however, the stated purpose of the Driftwood proposal would not be met. We conclude that the no-action alternative does not meet the Project objective and an alternative project to meet the market demand would not likely provide a significant environmental advantage over the proposed action.

We reviewed existing, approved, proposed, and planned liquefaction projects within the Southeast/Gulf Coast region as system alternatives for the LNG Facility. All of these system alternatives were eliminated from further consideration for technical feasibility or lack of evidence that the alternative system offers a significant environmental advantage over the proposed action. We also evaluated six potential alternative sites for the LNG Facility within the Gulf Coast region. In general, these sites did not provide clear evidence of a significant environmental advantage to Driftwood's proposed site. We evaluated six alternative LNG Facility configurations. Based on our review of the alternatives for site plan configurations, Driftwood's proposed configuration for the LNG Facility would have the least potential for noise and visual impact on nearby residents.

We also considered two existing pipeline systems as alternatives for the Driftwood Pipeline. Neither of these systems had sufficient capacity to meet the need of the Project and are not technically feasible alternatives to the proposed action. We reviewed three major pipeline route alternatives. These alternatives did not provide a significant environmental advantage to the proposed route.

We evaluated five minor route variations for the potential to reduce environmental impacts from the proposed Pipeline route. For the Burton Shipyard Road route at about milepost 0.0, we found that the variation would result in more disturbance, affect more landowners, and would be within 50 feet of one additional residence. For the Aucoin variation at about MP 75.4, we found that, while alternative routes we developed provided a small reduction in disturbance, they also resulted in construction disturbance within 50 feet of residences. For the Longleaf Pine Savanna Variation, we determined alternative routes would result in more overall disturbance and affect more landowners. Therefore, for the Burton Shipyard Road, Aucoin, and Longleaf Pine Savanna route variations, we determined these alternative routes would not provide a significant environmental advantage. For the MP 12.9 route variation, we found the variation would be shorter, would further reduce disturbance based on construction by HDD, and would also reduce the number of affected landowners. For the Port Arthur Route Variation, we found minimal differences in the environmental impact due to the Driftwood LNG Project; however, the environmental impact when considered cumulatively with the proposed Port Arthur Pipeline would be reduced. Therefore, we recommend that Driftwood adopt the MP 12.9 Route Variation and the Port Arthur Route Variation as the proposed route.

For Compressor Station 01, the environmental impacts were minor, and no alternative sites were analyzed. For Compressor Station 02, we evaluated three alternative sites. The primary differences between alternative locations were the length of suction laterals and the corresponding additional disturbance and compression horsepower, (resulting in additional air emissions and noise) required, the type of existing land use, and the residences within 0.5 mile. For Compressor Station 03, we evaluated one alternative site. The primary differences between the Compressor Station 03 alternative location was the need for a lateral pipeline, the existing land use, and number of residences within 0.5 mile. We found the alternate locations did not provide a significant environmental advantage over the proposed locations.

Conclusions

We determined that construction and operation of the Driftwood LNG Project would result in adverse environmental impacts; however, impacts on the environment would be reduced to less than significant levels with the implementation of Driftwood's proposed impact avoidance, minimization, and mitigation measures and the additional measures recommended by FERC staff. We based our conclusions upon information provided by Driftwood and through data requests; field investigations; literature research; geospatial analysis; alternatives analysis; public comments and scoping sessions; and coordination with federal, state, and local agencies and Indian Tribes.

The following factors were also considered in our conclusions:

- The LNG Facility site would be in an area currently zoned for heavy industrial use, which is consistent with other industrial facilities along the Calcasieu Ship Channel.
- Driftwood would maintain forested and scrub-shrub habitats between the LNG Facility and nearby residences, which would provide visual buffers, and has committed to planting additional vegetation screening to further minimize visual impact.
- The Pipeline would parallel or be collocated with other disturbed right-of-way corridors (with pipelines or utilities) for about 68 miles (about 70 percent of the route).
- Trenchless methods (HDD) would be used to cross the majority of natural major waterbodies (i.e., rivers over 100 feet crossing width).
- Driftwood would follow the Project-specific Construction Environmental Control Plan, Driftwood Plan, Driftwood Procedures, construction SPCC Plan; *Unanticipated Discoveries Plan* (appendix H); HDD Contingency and Fluid Monitoring Plan; Erosion and Sedimentation Control Plan; and Fugitive Dust Management Plan. Driftwood would develop and implement an SPCC Plan during operation.
- The USCG issued an Letter of Recommendation indicating the Calcasieu Ship Channel would be considered suitable for the LNG marine traffic associated with the Project.
- The LNG Facility 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.
- The Pipeline and associated aboveground facilities would be constructed, operated, and maintained in compliance with DOT standards published in 49 CFR 192.

FERC staff would complete consultations with resource agencies to ensure compliance with

- Section 7 of the Endangered Species Act; and
- Section 106 of the National Historic Preservation Act

Driftwood would follow an environmental inspection program, including Environmental Inspectors, to ensure compliance with the mitigation measures that become conditions of the FERC authorization. FERC staff would conduct inspections throughout construction, commissioning, and restoration of the Project.

In addition, we developed recommendations that Driftwood should implement to further reduce the environmental impacts of the Project, including recommendations that Driftwood should implement specific to engineering, vulnerability, and detailed design of the LNG Facility, and ongoing recommendations relating to inspections, reporting, notification, and non-scheduled events that would apply throughout the life of the LNG Facility.

We are recommending mitigation measures to further reduce adverse impacts associated with the Project. Some of our conclusions of the impact are based on the implementation of these measures. Therefore, we recommend that these mitigation measures be attached as conditions to any authorization issued by the Commission. These recommended mitigation measures are presented in Section 5.2 of this final EIS.

1.0 INTRODUCTION

On March 31, 2017, Driftwood LNG LLC (DWLNG) filed an application with the Federal Energy Regulatory Commission (Commission or FERC) for authorization under Section 3(a) of the Natural Gas Act (NGA) and part 153 of the Commission's regulations. In Docket No. CP17-117-000, DWLNG requests authorization to site, construct, and operate their proposed liquefied natural gas (LNG) terminal (LNG Facility) to liquefy natural gas at a proposed site on the west bank of the Calcasieu River near Carlyss, Calcasieu Parish, Louisiana.

Also on March 31, 2017, Driftwood Pipeline LLC (DWPL) filed an application with FERC for a Certificate of Public Convenience and Necessity (Certificate) under Section 7(c) of the NGA and part 157 of the Commission's regulations. In Docket No. CP17-118-000, DWPL requests authorization to construct, install, and operate new natural gas pipeline, compression, meter stations (MS), and appurtenant facilities (Pipeline) that would allow the delivery of natural gas to DWLNG's proposed LNG Facility. The proposed pipeline would be within Evangeline, Acadia, Jefferson Davis, and Calcasieu Parishes, Louisiana.

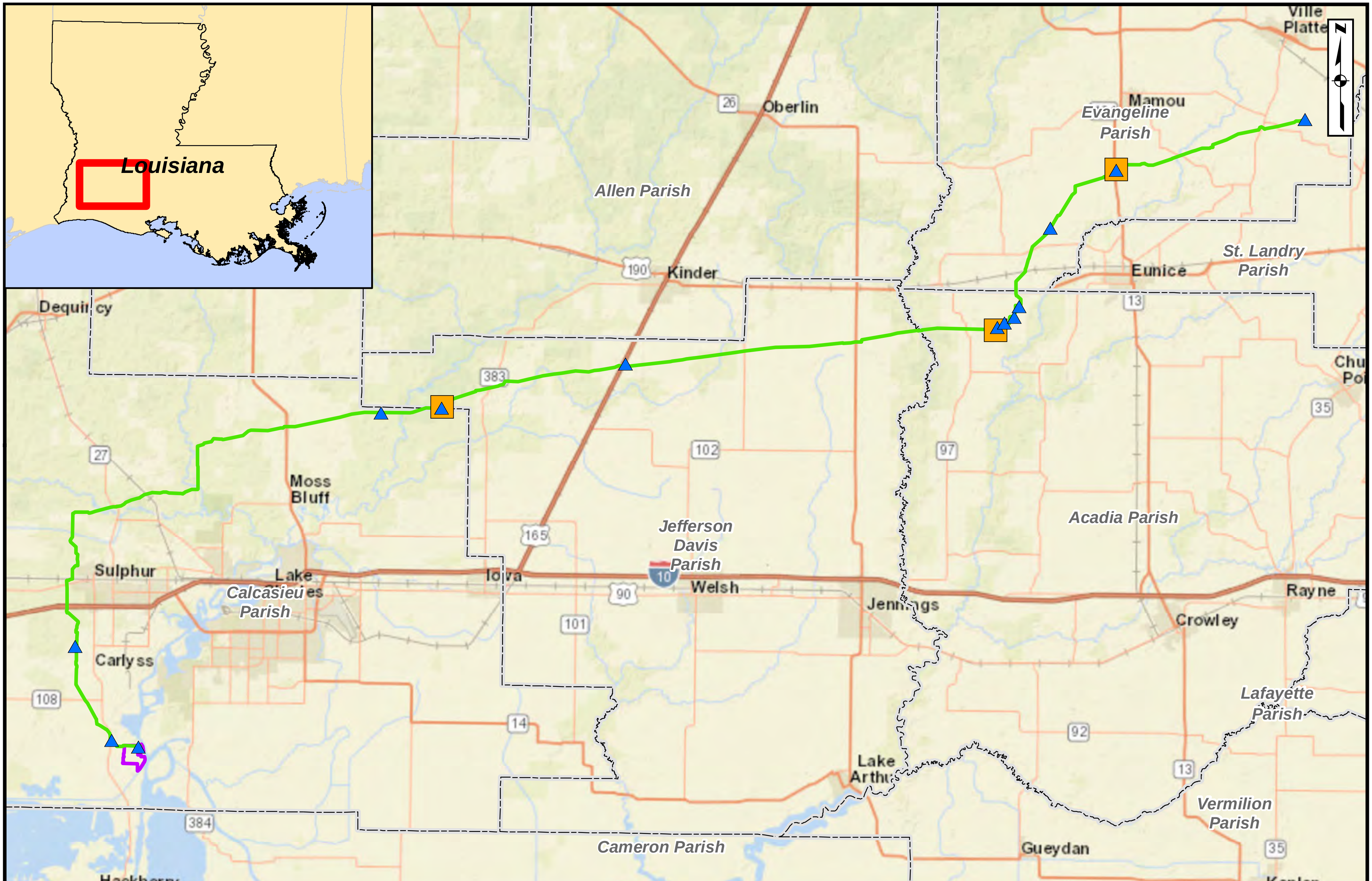
DWLNG and DWPL are referred to collectively as "Driftwood," and the actions and facilities proposed by Driftwood are referred to collectively in this final Environmental Impact Statement (EIS) as the "Driftwood LNG Project" or "Project."

As part of the Commission's examination of these applications, we [4] prepared this final EIS to assess the potential environmental impacts resulting from construction and operation of the project as described in the requirements of the National Environmental Policy Act of 1969 (NEPA).

The LNG Facility would be on about 720 acres of a 790-acre site on the west bank of the Calcasieu River, about five miles south of the city of Carlyss, Louisiana. The LNG Facility would produce a nominal capacity of about 27.6 million (metric) tonnes per annum (MTPA) of LNG. The natural gas would be liquefied using five liquefaction plants and stored on site in three aboveground full-containment LNG storage tanks with a net capacity of about 235,000 cubic meters (m^3) each. The LNG Facility would include a dredged turning basin and three LNG carrier berths. During operation of the Project, DWLNG expects that an average of 365 marine vessels would make port calls at the LNG Facility each year.

The vertical line in the margin identifies text that is new or modified in the final EIS and differs materially from corresponding text in the draft EIS. Changes were made to address comments from cooperating agencies and other stakeholders on the draft EIS, incorporate modifications to the Project after publication of the draft EIS, update information included in the draft EIS, and incorporate information filed by Driftwood in response to our recommendations in the draft EIS.

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



Legend

- Currently Proposed Meter Stations
- Currently Proposed Compressor Stations
- Pipeline Route
- Parish Boundary
- Facility Boundary

0 2.5 5 10 Miles

NOTES:

Aerial Imagery: ESRI World Street Map

Reproduced under license in ArcGIS 10.3.1

Figure 1.0-1: Project Location Map

Driftwood LNG Project

Driftwood LNG LLC and Driftwood Pipeline LLC

Calcasieu, Jefferson Davis, Acadia, and Evangeline Parishes, Louisiana

Natural gas would be supplied to the LNG Facility via DWPL's proposed 96-mile long, 36- to 48-inch-diameter pipeline that would connect the terminal with various existing interstate pipeline systems. A 3.4-mile long 30-inch-diameter lateral pipeline, three compressor stations (compressor station 01/Gillis Station [CS-01], compressor station 02/Basile Station [CS-02], and compressor station 03/Mamou Station [CS-03]) with a total of 269,500 horsepower (hp) of compression, and up to 15 meter stations (MS-01 through MS-15) would be associated with the Pipeline designed to provide an annual average of 4 billion standard cubic feet per day (Bcf/d) of natural gas to the LNG Facility. Figure 1.0-1 provides an overview of the Driftwood LNG Project. More detailed information regarding specific facility components is provided in section 2.0.

Subject to the receipt of FERC authorization and all other applicable permits, authorizations, and approvals, Driftwood anticipates mobilizing for construction of the LNG Facility during the first quarter of 2019. The first liquefaction plant would be completed approximately five years after receiving the FERC Order. The remaining four liquefaction plants would be commissioned at intervals after completion of the first liquefaction plant, with full service anticipated after a total construction period of 86 months. DWPL anticipates construction of the Pipeline would begin approximately one year after receiving the FERC Order and proceed in three phases, continuing over about 30 months. Export of LNG could begin as soon as the first liquefaction plant and pipeline were completed.

1.1 PURPOSE AND NEED

Driftwood's stated purpose and need is transporting, receiving, and liquefying 27.6 MTPA of domestic natural gas for export via ocean-going LNG carriers to foreign markets under the authorities granted it by the U.S. Department of Energy, Office of Fossil Energy (DOE). The Pipeline would provide the LNG Facility with an annual average of about 4.0 Bcf/d of gas for subsequent liquefaction and export of up to 27.6 MTPA. According to Driftwood, the increase in domestic natural gas production has created a market with sufficient natural gas inventories to sustainably accommodate both domestic need and international export demand in the form of LNG, and according to the U.S. Energy Information Administration's Annual Energy Outlook 2017, the U.S. stands to be a net exporter of natural gas to foreign markets by 2020 via LNG. This trend is projected to continue through the end of the projection period to 2040.

The Pipeline would interconnect with 14 interstate pipelines and is designed to provide access to a broad array of natural gas supplies from various geographic, and geologically diverse, sources. In addition to providing feed gas to the LNG Facility, Driftwood states that the Pipeline would enhance the competitive transportation alternatives for all shippers in the region by providing another open-access pipeline in the interstate natural gas pipeline network. DWPL announced a Binding Open Season on September 11, 2017 for the Pipeline, with the LNG Facility as the primary delivery point; other deliveries would be secondary.

Under Section 3 of the NGA, FERC considers as part of its decision to authorize natural gas facilities all circumstances bearing on the public interest. Specifically, regarding whether to authorize natural gas facilities used for importation or exportation, 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.

1.2 PURPOSE AND SCOPE OF THIS STATEMENT

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 to identify 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 LNG Facility and the Pipeline). The topics addressed in this final 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 Project, and compares the Project's potential impact to that of the alternatives. This EIS also presents our conclusions and recommended mitigation measures.

1.2.1 Cooperating Agencies

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

1.2.1.1 Federal Energy Regulatory Commission

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

As the lead federal agency for the Driftwood LNG Project, FERC is required to comply with Section 7 of the Endangered Species Act (ESA), as amended; the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA); 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 final EIS. FERC will use this document to consider the environmental impacts that could result if it issues an authorization to DWLNG under Section 3(a) of the NGA and a Certificate to DWPL under Section 7(c) of the NGA.

1.2.1.2 U.S. Army Corps of Engineers

The COE has jurisdictional authority under Section 404 of the Clean Water Act (CWA) (Title 33 of the United States Code [USC], Section 1344 [33 USC 1344]), which governs the discharge of dredged or fill material into waters of the United States (U.S.), and Section 10 of the Rivers and Harbors Act (33 USC 403), which regulates any work or structures that potentially affect the navigable capacity of a waterbody. Because COE would need to evaluate and approve several aspects of the Project and must comply with the requirements of NEPA before issuing permits under the above statutes, it has elected to participate as a cooperating agency in the preparation of this final EIS. COE would adopt the EIS according to 40 CFR 1506.3 if, after an independent review of the document, it concludes that the EIS satisfies COE's comments and suggestions. The Project occurs within the New Orleans District of the COE Mississippi Valley Division. Staff from this COE district participated in the NEPA review and will evaluate COE authorizations, as applicable.

The primary decisions to be addressed by COE include:

- issuance of a Section 404 Permit for dredge and fill of Waters of the U.S. associated with construction of the LNG Facility and Pipeline; and
- issuance of a Section 10 Permit for construction activities within navigable waters of the U.S.

This EIS contains information needed by COE to reach decisions on these issues. Through the coordination of this document, COE will obtain the views of the public and natural resource agencies prior to reaching its decisions on the Project.

As an element of its review, COE 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 values and functions. COE would prepare a Record of Decision to formally document its decisions on the proposed action, including Section 404(b)(1) analyses and required environmental mitigation commitments.

1.2.1.3 U.S. Coast Guard

The USCG is the federal agency responsible for determining the suitability of waterways for LNG marine traffic. The USCG exercises regulatory authority over LNG facilities that affect the safety and security of port areas and navigable waterways under Executive Order 13143 (which amends Executive Order 10173); 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 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 regulation 33 CFR 127.009, 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). Driftwood submitted a Follow-on WSA for the Project to the USCG on January 17, 2017. The USCG completed its review on April 25, 2017, and provided the LOR to FERC (FERC eLibrary accession number 20170620-4005), which recommends the Calcasieu Ship Channel be considered suitable for accommodating the type and frequency of LNG marine traffic associated with the Project.

1.2.1.4 U.S. Department of Energy

Section 3(c) of the NGA, as amended by section 201 of the Energy Policy Act of 1992 (Public Law 102-486), requires that applications to DOE requesting authorization of the import and export of natural gas, including LNG, from and to a nation with which there is in effect a free trade agreement requiring national treatment for trade in natural gas, be deemed consistent with the public interest and granted without modification or delay. The DOE Office of Fossil Energy must meet its obligation under Section 3 of the NGA to authorize the import and export of natural gas, including LNG, unless it finds that the import or export is not consistent with the public interest. DWLNG filed an application (82 FR 3760) on September 28, 2016, requesting to export LNG from the LNG Facility to any country (1) with which the U.S. has, or in the future may have, a free trade agreement requiring national treatment for trade in natural gas; (2) with which the U.S. 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 U.S. law or policy.

On February 28, 2107, the DOE issued Order No. 3968[5] granting authorization to DWLNG (82 Fed. Reg. 17647) to engage in long-term, multi-contract exports of LNG equivalent to about 1,496.5 Bcf/y of domestically produced natural gas from the LNG Facility for a 30-year term, to any country which has or in the future develops the capacity to import LNG via ocean-going carrier and with which the U.S. has, or in the future enters into, a free trade agreement requiring national treatment for trade in natural gas.

Authorization from DOE for DWLNG to export LNG to countries with which the U.S. has not entered a free trade agreement is pending. DOE published the notice of application on January 12, 2017 (Federal Register docket number 82 FR 3760), to begin the NEPA process. An authorization may be granted, conditioned on the satisfactory completion of this environmental review of DWLNG's Project under NEPA and on issuance by DOE of a finding of no significant impact or a Record of Decision under NEPA. In accordance with 40 CFR 1506.3, after an independent review of the EIS, the DOE may adopt it prior to issuing a Record of Decision on DWLNG's application for authority to export LNG.

[5] DOE Docket No. 16-144-LNG

1.2.1.5 U.S. Department of Transportation

The DOT has prescribed the minimum federal safety standards for LNG facilities according to 49 USC 60101. Those standards are codified in 49 CFR 193 and apply to the siting, design, construction, operation, maintenance, and security of LNG facilities. The National Fire Protection Association (NFPA) Standard 59A, "Standard for the Production, Storage, and Handling of Liquefied Natural Gas," is incorporated into these requirements by reference, with regulatory preemption in case of conflict. In accordance with the 1985 Memorandum of Understanding (MOU) on LNG facilities, which was updated on August 31, 2018, and the 2004 Interagency Agreement on the safety and security review of waterfront import/export LNG facilities, the DOT participates as a cooperating agency. The DOT does not issue a permit or license, but as a cooperating agency, assists FERC staff in evaluating whether or not an applicant's design would meet the DOT requirements.

1.2.1.6 U.S. Environmental Protection Agency

Pursuant to Section 309 of the Clean Air Act (CAA), EPA has a responsibility to review and comment in writing on the environmental impact of the Project as identified through the NEPA process. In addition to responsibilities associated with the CAA, EPA requested cooperating agency status with an email to FERC's project manager on February 10, 2017, and formally accepted the invitation to be a cooperating agency in a letter dated September 12, 2017. EPA particularly reviewed descriptions of resources regulated by EPA based on descriptions provided within Driftwood's Application and the EIS, including wetlands, water, and air resources, as well as disposal of hazardous waste, and compliance with environmental justice.

1.3 PUBLIC REVIEW AND COMMENT

1.3.1 Pre-filing Process and Scoping

On May 11, 2016, Driftwood filed a request with FERC to use our pre-filing review process. The Project was in the preliminary design stage, and Driftwood had not filed formal applications with FERC. We approved Driftwood's request to use our pre-filing review process on June 6, 2016, and established pre-filing docket number PF16-6-000 for the LNG Facility and Pipeline. Information and documents filed by Driftwood for the Project, as well as related documents were placed into the public record. The pre-filing review process provides opportunities for interested stakeholders to become involved early in project planning, facilitates interagency cooperation, and assists in the identification and early resolution of issues, prior to a formal application being filed with the FERC.

Driftwood held initial open house meetings to describe their Project and the pipeline route filed July 6, 2016, in Sulphur, Oberlin, Eunice, and Lake Charles, Louisiana, on July 18, 19, 20, and 21, 2016, respectively. Driftwood held an additional open house meeting in Kinder, Louisiana on September 15, 2016, to ensure members of the public were informed of updates to the Pipeline route filed July 15, 2016. FERC staff participated in these meetings to describe FERC process and provide those attending with information on how to file comments with FERC. In addition, FERC staff visited the LNG Facility site on July 21, along with representatives from USCG, National Marine Fisheries Service (NMFS), Louisiana Department of Natural Resources (LDNR), and the Lake Charles Pilots Association. During this period we received comments regarding surface water displacement and flooding, light and noise issues, effects on property values, traffic impacts and safety on roadways and waterways, pipeline alignments on private lands, and economic impact.

On October 3, 2016, FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Driftwood LNG Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Sessions (NOI)*. This notice was sent to about 1,600 interested parties, including property owners; state and local government; tribal governments; local, state, and federal regulatory agencies; libraries; local emergency responders; and local newspapers in the Project area. 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.

We conducted public scoping sessions to provide an opportunity for the public to learn more about the Project and provide oral and written comments on environmental issues to be addressed in the EIS. Scoping sessions were held in Kinder, Sulphur, and Eunice, Louisiana, on October 25, 26, and 27, 2016, respectively. During this period, FERC staff visited the LNG Facility site and reviewed the Pipeline alignment, including compressor station sites. During the meetings, we received oral comments from 20 individuals that were transcribed by a court reporter, as well as written comments. Additional comments were submitted either by letter or electronically. All comments we received were posted to the Commission's public record through the FERC's online eLibrary system.[6]

On August 18, 2016, we held an interagency coordination meeting attended by representatives of Federal Emergency Management Agency (FEMA), COE, USCG, and U.S. Fish & Wildlife Service (USFWS). Additional agencies, including NMFS, EPA, LDNR, Louisiana Department of Environmental Quality (LDEQ), Louisiana Department of Wildlife and Fisheries (LDWF), and Louisiana State Historic Preservation Officer (SHPO) were invited, but unavailable to attend. We discussed the status of the Project, concerns specific to agencies, coordination of agency review and permit requirements, and each agency's interest in participating in our environmental review as a cooperating agency. On February 2, 2017, we held an interagency coordination call with USCG, COE, and LDEQ (Air Quality Division) in attendance. Other invited agencies that were not able to attend included LDNR and LDEQ (Water Quality Division). In addition to discussions during these meetings, agencies that provided written comments included FEMA Region VI, USFWS, Organization of the Petroleum Exporting Countries, West Calcasieu Port and Port of Vinton, Cameron Parish Police Jury and West Cameron Port Authority, LDWF, NMFS (Southeast Regional Office), EPA Region VI. The Jena Band of Choctaw Indians and the Choctaw Nation of Oklahoma, both Federally-recognized Tribes, also provided written comments.

Issues identified during the pre-filing process and public and agency scoping are summarized in table 1.3-1. Locations within this final EIS where these issues are addressed also are identified. Issues identified that are outside of the scope of the analysis of this final EIS, either because they are not environmental considerations or because they were outside of our jurisdiction, are summarized in table 1.3-2, and are not addressed further within this final EIS.

[6] To access the public record for this proceeding, go to FERC's Internet website (http://www.ferc.gov), click on "Documents & Filings" and select the "eLibrary" feature. Click on "General Search" from the eLibrary menu and enter the docket number excluding the last three digits in the field (i.e., PF16-6, CP17-117, or CP17-118). Select an appropriate date range.

Table 1.3-1

Issues Identified During the Pre-filing Process and Public Scoping

Category	Issue	EIS Section
General	Impacts on landowners due to preferred route or aboveground-facility location; address ways to minimize total impact where multiple rights-of-way cross a single property	3.4; 3.5; 3.6; 3.7; 4.9.2 (Land Use)
Project Description	Plans for abandonment, including cleanup of structures and contaminated soils	2.8
	Full description of construction methods and reclamation/revegetation	2.5
Alternatives	Refinements to respond to landowners, and using existing or proposed LNG plants and/or an existing pipeline	3.2; 3.4; 3.5; 3.6; table 1.3-3, appendix A
Soils	Erosion control	2.5; 4.2.4
Water Resources	Changes in surface water flow and potential flooding of nearby structures associated with the Project under normal conditions and during a hurricane	4.1.4.3
Wetlands and Vegetation	Impacts on specific types of vegetation, including wetlands, loblolly and longleaf pine habitats, and coastal prairie locations	Wetlands, 4.4; other types of vegetation, 4.5; table 4.5-1, appendix A:
Wildlife	Impacts on endangered and protected species (including the red cockaded woodpecker, American chaffseed, migratory birds, colonial nesting birds, bald eagles)	4.6; 4.8
Fisheries	Impacts on EFH	4.7.4
Land Use and Visual Resources	Timely and full restoration of croplands after construction.	4.5.2; 4.9.2.4
	Impact on crop production, rotation, and existing and planned trees, including fruit trees	4.5.2; 4.9.2.4
	Light pollution, during normal operation of the LNG Facility and compressor stations, and during flaring	4.9.2.10
Socioeconomics	Ship navigation hazards and traffic impacts; suitability of the existing navigation channel, including navigation simulations and potential mitigation	1.2.1.3; 2.6.2, 4.10.7
	Road traffic concerns associated with the LNG Facility, including infrastructure, access, traffic volume, and safety	1.4.1.4; 1.4.1.5; 2.5.1; 2.5.2.1; 2.5.2.7; 2.5.3.1; 4.10.6; 4.10.10
	Changes in property values due to construction of the Project	4.10.5
	Creation of temporary and permanent jobs, with associated economic, housing, and community impact	4.10
	Local workers vs. relocated workers for temporary and permanent jobs	4.10.2
Cultural Resources	Government-to-government consultation between the FERC and Indian Tribes prior to ground-disturbing activities	4.11.3
	Protection of Native American artifacts or human remains	4.11.4
Noise	Noise pollution and vibration from the LNG Facility and aboveground facilities, including flaring Noise from aboveground facilities in addition to noise from existing facilities	4.12.2.2; table 4.12-14
Reliability and Safety	Potential for gas explosions at the LNG Facility	4.13.1
Cumulative Impacts	Impacts from multiple existing and proposed LNG facilities and pipelines	4.14

Table 1.3-2

Identified Issues Outside the Scope of the EIS Process

Issue/Specific Comment	Explanation
Safety of docks associated with other area LNG Facilities.	FERC's review of the safety and reliability of the Project is limited to the proposed project before the Commission; therefore, safety of operations at other facilities falls outside the scope of this final EIS. Safety of the waterway that would be used by LNG carriers in transit to and from the LNG Facility is under the jurisdiction of the USCG and is assessed in the WSA (section 1.2.1.3).
Liability or fund to cover potential damages due to the LNG Facility	FERC's review of the Project is limited to the economic and environmental impacts of the proposed project before the Commission; bonding or liability funds is outside the FERC's jurisdiction.
Leveling trade deficits; impact on local/regional/national energy costs	FERC's review of the Project is limited to the economic and environmental impacts of the proposed project before the Commission; therefore, national economic impacts of this project or of natural gas imports or exports in general are outside of the scope of this final EIS.

DWPL received many suggestions and requests from landowners, stakeholders, and FERC staff during the pre-filing process. DWPL addressed these suggestions and requests, where possible. The landowner comments are summarized in table 1.3-3 (appendix A), along with how they were addressed or an explanation of why they could not be accommodated.

1.3.2 Additional Agency Interactions

In a letter to the U.S. Department of Defense (DOD) Siting Clearinghouse dated March 28, 2017, the Commission requested the DOD's comments on whether the Project could potentially have an impact on the testing, training, or operational activities of an active military installation, or if military establishments in the Project area could be affected by the Project. The DOD provided a response for the LNG Facility and Pipeline dated June 15 and 16, 2017, respectively, noting the Project would have minimal impact on military operations conducted in the area.

1.3.3 Public Review of the Draft EIS

The draft EIS for the Project was issued for public review on September 14, 2018, and the Notice of Availability (NOA) for the draft EIS was published in the Federal Register on September 21, 2018 (83 FR 47918, pages 47918-47920). The NOA included a notice of public comment sessions on October 9, 10, and 11. 2018 in Kinder, Opelousas, and Sulphur, Louisiana, respectively. The NOA also provided summary information regarding the draft EIS and requested submission of all comments by November 5, 2018. At the comment sessions, the FERC received written comments from four individuals and 14 verbal comments from 13 individuals. The verbal comments were recorded and transcribed by a court reporter. Transcripts and all written comments that we received on the draft EIS are part of the public record for the Project.[7]

In addition to receiving written and verbal comments at the draft EIS comment sessions, the FERC received 44 submissions from parties including federal, state, and local agencies; interested parties; tribes; businesses; elected officials; and Driftwood. The majority of comments received on the draft EIS were related to socioeconomics, surface water, wetlands, air quality, noise, aquatic species, traffic, safety, and alternatives. All comments directly pertaining to the draft EIS, the transcripts of verbal comments presented at the draft EIS comment sessions, and responses to comments are presented in Appendix F. Substantive changes in the final EIS that were made in response to comments on the draft EIS or as a result of updated information that became available after issuance of the draft EIS are indicated by vertical bars in the margins.

1.3.4 Final EIS

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

1.4 NON-JURISDICTIONAL FACILITIES

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

Non-jurisdictional actions associated with the Project were identified in association with both the LNG Facility and the Pipeline; details follow. Available environmental data further characterizing the impacts of the non-jurisdictional facilities is provided in our cumulative impacts analysis (section 4.14).

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[7] Available on FERC eLibrary. To access the public record for this proceeding, go to FERC's Internet website (http://www.ferc.gov), click on "Documents & Filings" and select the "eLibrary" feature. Click on "General Search" from the eLibrary menu and enter the docket number excluding the last three digits in the field (i.e., PF16-6, CP17-117, or CP17-118).

1.4.1 Non-jurisdictional Facilities Associated with the LNG Facility

1.4.1.1 Water Supply

The LNG Facility would require connections to the applicable Calcasieu Parish Waterworks District No. 9 of Ward 4 (Calcasieu Parish Waterworks) for potable water. A preliminary investigation indicates there is sufficient water supply for the LNG Facility, including an existing 10-inch-diameter connection pipeline within the LNG Facility property. No additional upgrades to this system outside the service connection at the LNG Facility are required as part of this service request; therefore, construction of the LNG Facility water supply is not further addressed within this document.

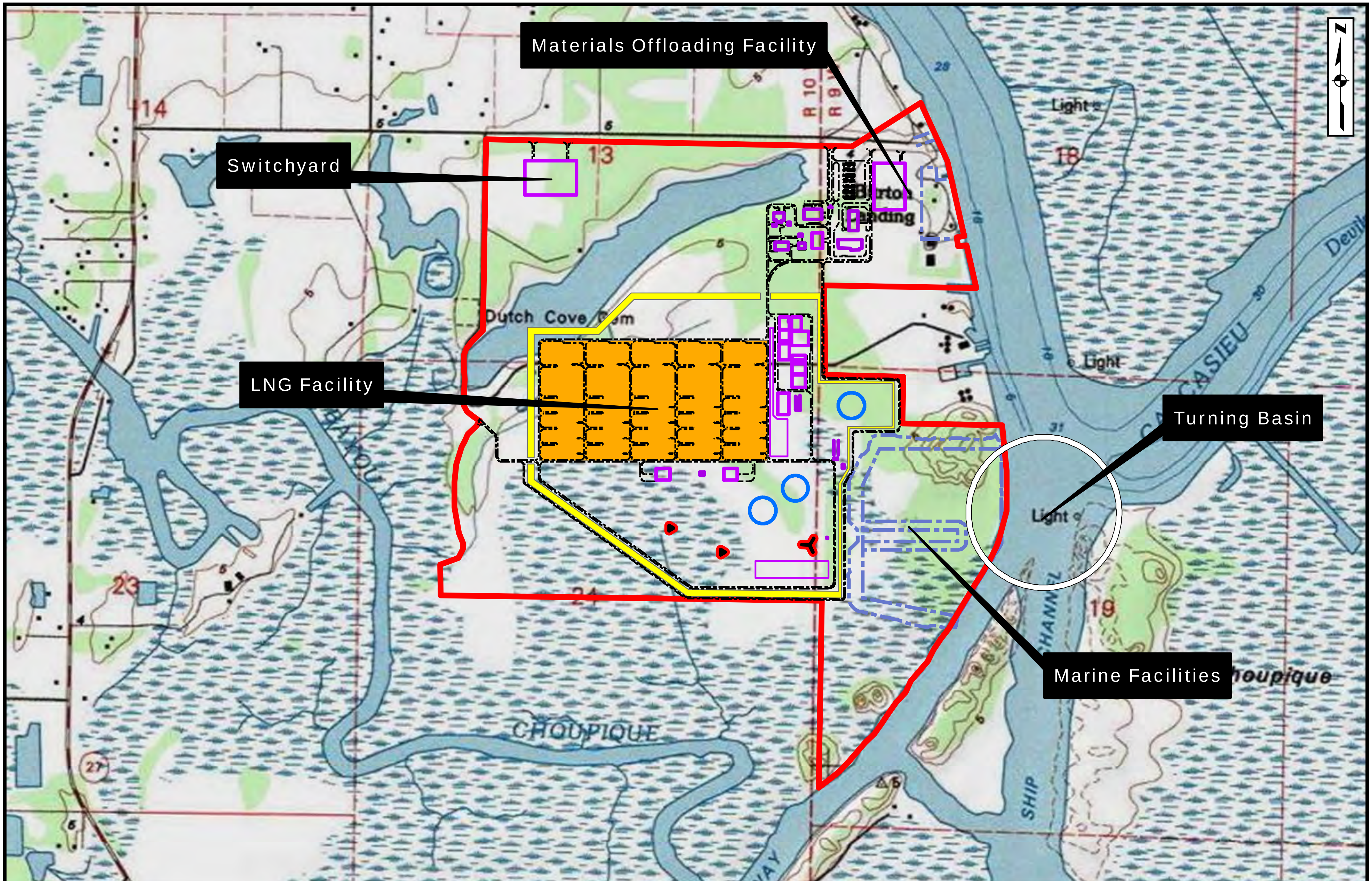
Water supply for the compressor stations would be provided as part of the building subcontractor package (warehouse/workshop buildings) for the purposes of drinking, washing, cooking, and showering for a maximum of six people. It is anticipated that water would be sourced from well water at each compressor station location and then stored on site.

1.4.1.2 Power

An estimated 167 MW of electrical power would be required for LNG Facility operations. Power would be imported to the LNG Facility from Entergy Louisiana, LLC (Entergy). Entergy would be responsible for all permits to construct a new transmission line and switchyard, and DWLNG would reimburse the utility company for the costs.

Transmission lines would connect the switchyard via the existing Mud Lake 230 kV substation and the planned Big Lake 230 kV substation located south of the Facility in Cameron Parish. The transmission lines from those substations would be approximately 5.6 and 5.0 miles long, respectively. The switchyard would include transformers to step down the 230 kV transmission line voltage to 34.5 kV for distribution to the LNG Facility's main substation. The switchyard would be within DWLNG-controlled property at the perimeter fence (and is therefore accounted for in our environmental review of the LNG Facility), such that the local provider would have unimpeded access to the switchyard/substation as shown on the Plot Plans (figures 1.4-1 and 1.4-2). The LNG Facility's main substation would then distribute the incoming power to downstream substations throughout the LNG Facility for end process users, buildings, electrical equipment, lighting, and instrumentation. Each substation would have appropriate transformers, switchgear, control gear, and electrical equipment required to supply power to all nearby end-user equipment.

Backup power within the LNG Facility would be provided by sufficient diesel generation capacity to operate critical systems and allow a safe and orderly shutdown in the event of a power failure from the main grid. The diesel generators would provide emergency power for systems such as egress lighting, controllers of shutdown and safety systems, firewater pumps, and stormwater drainage pumps, which may be required during storm events or emergency situations.



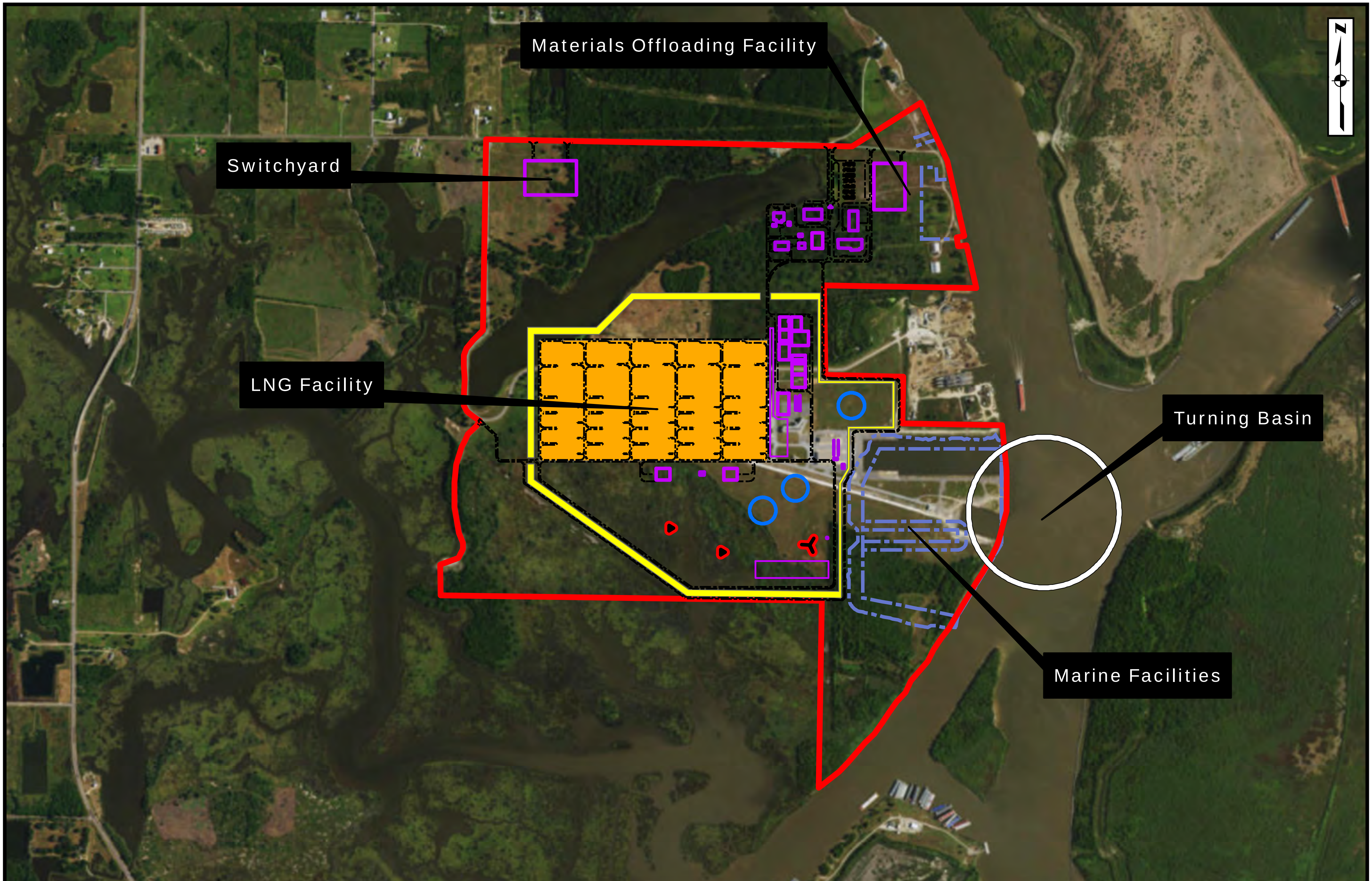
Legend

- Facility Boundary
- Berm
- Process Flares/Marine Flare
- LNG Tanks
- LNG Plant

0 500 1,000 2,000 Feet

NOTES:
Topographic Imagery: ESRI USA Topo Maps
Reproduced under license in ArcGIS 10.4

Figure 1.4-1: Plot Plan Topographic Map
Driftwood LNG Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana



Legend

- Facility Boundary
- Berm
- Process Flares/Marine Flare
- LNG Tanks
- LNG Plant

0 500 1,000 2,000 Feet

NOTES:
Aerial Imagery: ESRI World Imagery (NAIP 2015)
Reproduced under license in ArcGIS 10.4

Figure 1.4-2: Plot Plan Aerial Photograph
Driftwood LNG Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

Power during operation of the compressor stations, meter stations, and Mainline Valve (MLV) facilities would be provided through local/nearby sources at a location on each facility perimeter.

1.4.1.3 Williams Pipeline Relocation

An existing 6-inch pipeline for hydrocarbon transport traverses the LNG Facility for about 7,000 feet. The pipeline is owned by Williams Pipeline Company (Williams) and is maintained within a 30-foot right-of-way. The Williams pipeline would be relocated to avoid complications with LNG Facility construction and operations. Williams would complete the pipeline relocation within the LNG Facility property along the western and northern perimeter. Disturbance associated with this relocation is captured within disturbance for the LNG Facility.

1.4.1.4 Bollinger Shipyard Property Access Road

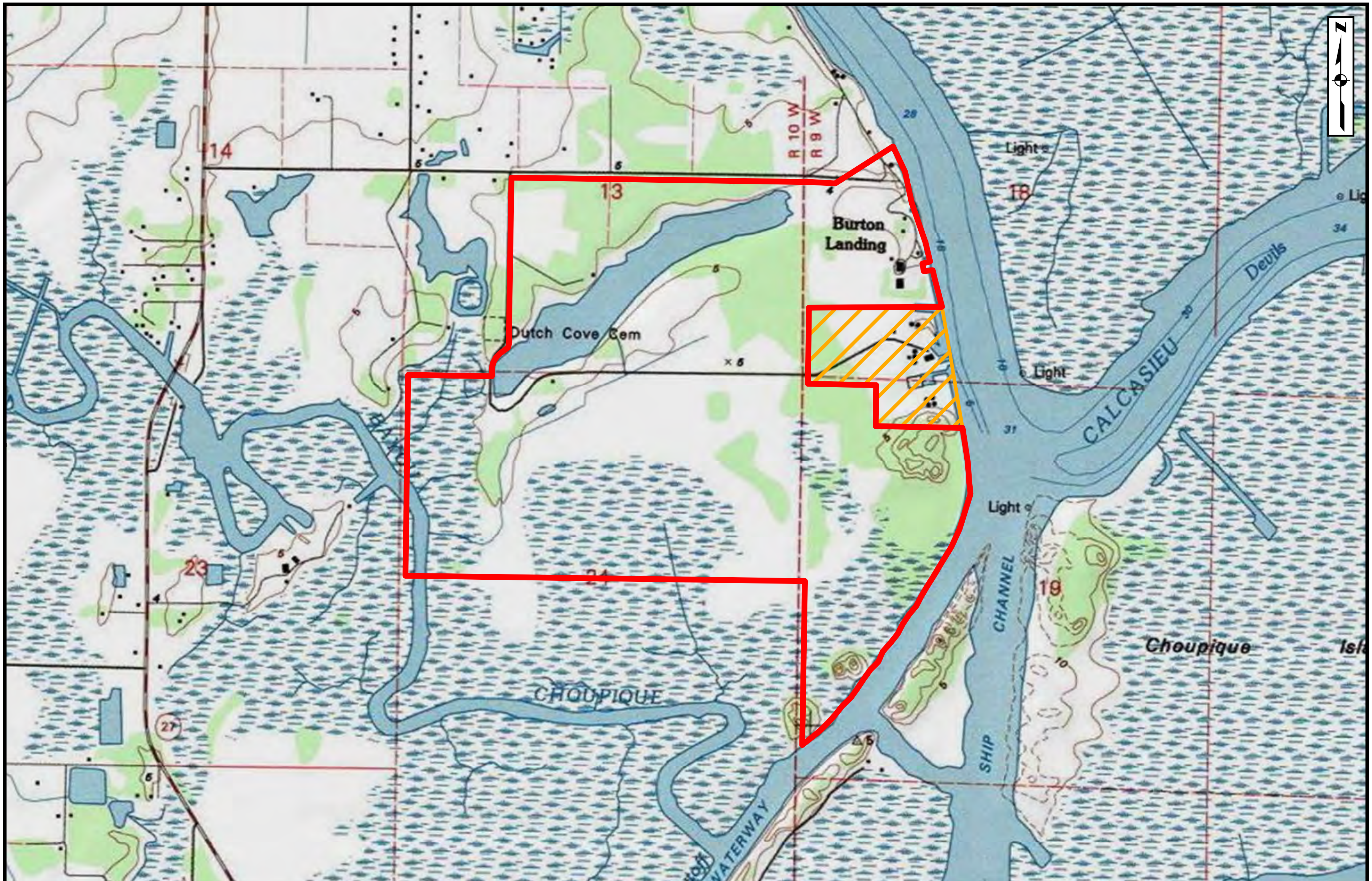
The Bollinger Shipyard tract is surrounded by but outside of the boundary on the eastern side of the LNG Facility. The Bollinger Shipyard tract is about 60 acres and is bounded on the north, south, and west by the LNG Facility and on the east by the Calcasieu Ship Channel. This tract is associated with a former marine fabrication, repair, and cleaning facility that is no longer in operation (figures 1.4-3 and 1.4-4). The tract is currently used for offloading of materials by an independent party. Current access to the Bollinger Shipyard tract is from Global Drive, which runs through the center of the LNG Facility layout. A new access road from Burton Shipyard Road, within the northeast corner of the LNG Facility site, would be constructed to provide access to the tract during construction and operation of the LNG Facility. No Project facilities would be sited on this tract of land.

1.4.1.5 Roadway Improvements

Discussions with local stakeholders, including local elected officials, residents, and Calcasieu Parish staff, have identified traffic as a major concern in the area of the LNG Facility. Specific issues identified include:

- congestion on Highway 27;
- industrial traffic on Burton Shipyard Road; and
- no alternate egress for area residents other than Burton Shipyard Road.

Each of these issues has been a longstanding concern for the area. Items 1 and 2 are a result of existing construction in the region. Item 3 has frequently been mentioned by residents as a general safety concern for the area.



Legend

Property Boundary (~790 acres)

Bollinger Property

0 500 1,000 2,000 Feet

NOTES:

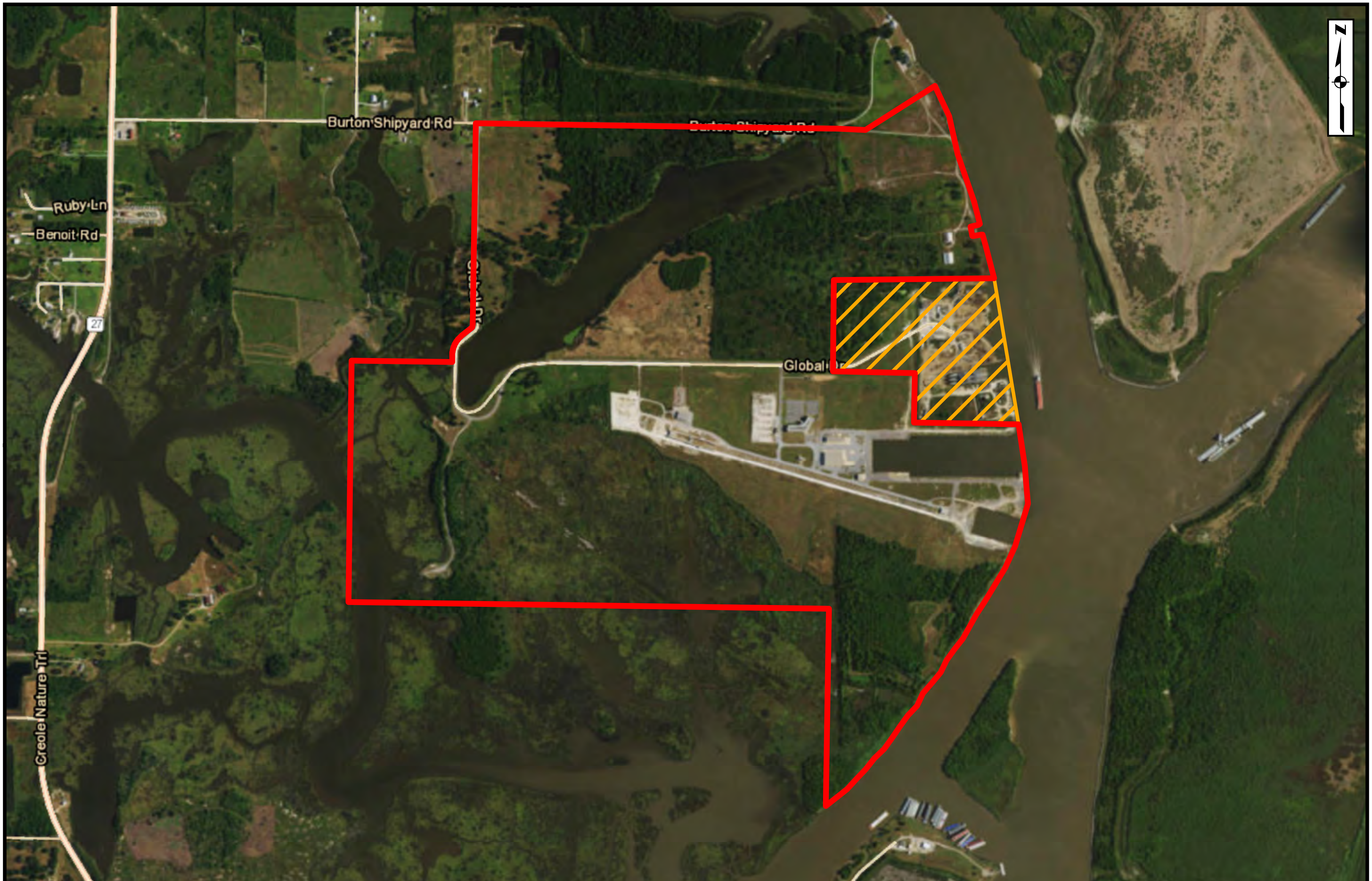
Topographic Imagery: ESRI USA Topo Maps
Reproduced under license in ArcGIS 10.3.1

Figure 1.4-3: LNG Facility Topographic Map

Driftwood LNG Project

Driftwood LNG LLC and Driftwood Pipeline LLC

Calcasieu Parish, Louisiana



Legend

Property Boundary (~790 acres)

Bollinger Property

0 500 1,000 2,000 Feet

NOTES:

Aerial Imagery: ESRI World Imagery and Transportation (NAIP 2015)
Reproduced under license in ArcGIS 10.3.1

Figure 1.4-4: LNG Facility Aerial Photograph
Driftwood LNG Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

The Project's traffic impact study reflects that the traffic along Highway 27 is currently graded at a level of service (LOS) of F (FERC eLibrary accession number 20170621-5139). LOS F is characterized by forced or breakdown of traffic flow requiring mitigation. This LOS most likely relates to ongoing construction in the area. As reflected in the Traffic Management Plan, DWLNG has proposed road upgrades to alleviate these traffic and safety concerns. These upgrades include:

- Widening of Highway 27 and/or improving the intersections from Interstate 10 through Burton Shipyard Road;
- Widening, upgrading, and resurfacing of Burton Shipyard Road; and
- Connecting Olsen Road directly to Highway 27 at a location south of Stine Road to provide alternative egress to Highway 27 for area residents.

The Louisiana Department of Transportation and Development (LADOTD) plans to widen Highway 27 from Interstate 10 south to Dave Dugas Road (which is about 5 miles north of Burton Shipyard Road); the planned construction was slated to begin in 2018. LADOTD and the Parish have expressed a need to improve numerous intersections between I-10 and Burton Shipyard Road to further improve traffic flow in the region; however funding is not currently available for such improvements. Similarly, an extension of Stine Road or similar alternative to connect Highway 27 with Olsen Road has been discussed in the Parish for numerous years, but funding has not been available. A brief description of each upgrade project is provided below:

Improvements to Highway 27, including south of Dave Dugas Road: There will be an engineering analysis conducted by the LADOTD and Calcasieu Parish to determine whether widening of the road or improvements to the intersections at Carlyss Drive, Route 1133, Walker Road, Dave Dugas Road, Stine Road, and Burton Shipyard Road are the most efficient improvements to alleviate the congestion on Highway 27. Calcasieu Parish and LADOTD are responsible for the design, permitting, and construction of these improvements, including acquiring right-of-way. Driftwood would participate through stakeholder coordination and partial funding.

Improvements to Burton Shipyard Road: Calcasieu Parish currently has resources allocated for a resurfacing of Burton Shipyard Road from Global Drive west to the road's terminus. Due to increased industrial traffic in the area, that project will likely be expanded to include a widening and resurfacing of the entire roadway beginning at Highway 27. Preliminary plans include widening the roadway from its current 22 feet to 30 feet and adding a right-turn lane at the intersection with Highway 27. Driftwood would provide funding and perform project coordination to ensure roadway modifications are designed and constructed to Parish standards.

Connection between Olsen Road and Highway 27: Residents living along Olsen Road, those in the Driftwood Community, and those living along Moss Lake Lane have only one available route for egress to Highway 27. They must drive south to Burton Shipyard Road before turning west and ultimately reaching Highway 27. This limited access has been a longstanding safety concern for area residents in case of a natural disaster or other emergency. To improve overall traffic flow and access, to provide an alternate route for emergency response vehicles, and to segregate industrial traffic along Burton Shipyard Road from the area's residential traffic, Driftwood evaluated the potential to connect Stine Road to Olsen Road but found that it was not a viable option. In their comments on the draft EIS, Driftwood provided an alternative to connect Highway 27 directly to Olsen Road at a location to the south of Stine Road (FERC eLibrary accession number 20181019-5180). The new connector road would be approximately 0.5-mile-long and would be located approximately 0.4 mile north of Burton Shipyard Road. The new connector road would serve the same purpose as the originally planned Stine Road Extension.

1.4.2 Pipeline

DWPL is currently conducting preliminary planning and design for power and water required for construction of the Pipeline and its associated compressor stations and meter stations. It is anticipated that DWPL would contract with a local power provider to provide any necessary power. FERC would be provided with this information when available.

1.5 PERMITS, APPROVALS, AND REGULATORY REVIEWS

The major permits, approvals, and consultations for the Project are identified in table 1.5-1 (appendix A). Letters from agencies documenting permits, approvals, or consultations that have been completed are included in Appendix G. Driftwood is responsible for all permits and approvals required for the Project, regardless of whether they appear in table 1.5-1. However, any state or local permits issued regarding jurisdictional facilities must be consistent with the conditions of any authorization the Commission may issue. Although the FERC encourages cooperation between applicants and state and local authorities, this does not mean that state and local agencies, through application of state and local laws, may prohibit or unreasonably delay the construction or operation of facilities approved by the FERC.

1.5.1 Endangered Species Act

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 is required to determine whether any federally listed or proposed endangered or threatened species or their designated critical habitat occur near the Project and conduct consultations with the USFWS and/or NMFS, if necessary. If, upon review of existing data or data provided by Driftwood, the FERC determines that these species or habitats may be affected by the Project, the FERC is required to prepare a biological assessment to identify the nature and extent of adverse impact, and to recommend measures that would avoid the habitat and/or species, or would reduce potential impact to acceptable levels. Section 4.8 provides information on the status of this review.

1.5.2 Magnuson-Stevens Fishery Conservation and Management Act

The MSFCMA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104- 267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a federal fisheries management plan. The MSFCMA 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 (MSFCMA §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 prepared an assessment of impacts on EFH, which is provided in section 4.7.4.

1.5.3 National Historic Preservation Act

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 pre-contact or historic sites, districts, buildings, structures, objects, or properties of traditional religious or cultural importance, and to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on the undertaking. Driftwood, as a non-federal party, is helping the FERC meet its obligations under Section 106 by preparing the necessary information, analyses, and recommendations under ACHP regulations in 36 CFR 800. Section 4.11.5 of this final EIS provides information on the status of this review.

1.5.4 Clean Water Act

Driftwood 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 National Pollutant Discharge Elimination System / LPDES permit (Section 402) issued by the LDEQ. The COE 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 COE and has Section 404(c) veto power for wetland permits issued by the COE. The Section 404 permitting process regulates the discharge of dredged and fill material associated with the construction of project facilities in or 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 (40 CFR 230.11). The FERC, in the NEPA review represented by this final EIS, has analyzed all technical issues required for the Section 404(b)(1) guideline analysis, including analysis of natural resources and cultural resources that would be affected by the Project, as well as analyses of alternatives. The results of our analysis of alternatives are provided in section 3.0, and a summary of wetland impacts are provided in section 4.4 of this final EIS. In addition to CWA responsibilities, the COE has jurisdiction over Section 10 permits, which would be required for all construction activities in navigable waterways under the Rivers and Harbors Act of 1899. Waterbody crossing methods and impacts are summarized in section 4.3.3 of this final EIS.

Section 404 and Section 10 permits are required for both the LNG Facility and Pipeline portions of the Project. Driftwood submitted a Joint Permit Application to the COE and LDNR in March 2017; review by the COE is ongoing, and LDEQ issued the CWA Section 401 Water Quality Certification on September 7, 2018.

1.5.5 Energy Policy Act of 2005

EPAct 2005 and Section 3 of the NGA require us to consult with the DOD to determine whether there would be any impacts associated with the Project on military training or activities on any military installations (see section 1.3.2 for details).

1.5.6 Coastal Zone Management Act

The CZMA calls for the "effective management, beneficial use, protection, and development" of the nation's coastal zone and promotes active state involvement in achieving those goals. As a means to reach those goals, the CZMA requires participating states to develop management programs that demonstrate how those states will meet their obligations and responsibilities in managing their coastal areas. In Louisiana, the LDNR administers the Coastal Zone Management Program (CZMP) and conducted a consistency determination concurrent with Driftwood's filling of an application for a CUP. The LNG

Facility site lies adjacent to but outside the designated coastal zone, the Pipeline lies outside the coastal zone, and the only portion of the Project within the coastal zone are the BUDM sites (LDNR, 2012), which are part of a separate established program as discussed in section 2.5.2.6. However, following removal of the temporary barrier and dredging the materials offloading facility (MOF) and marine berth, the coastal zone management area would extend into the newly dredged areas. The LDNR issued the Coastal Use Permit (CUP), which includes CZMA consistency determination, on May 29, 2018. The CZMP is discussed further in section 4.9.4.

1.5.7 Clean Air Act

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 because 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 LDEQ in Louisiana. As noted in table 1.5-1 (appendix A), LDEQ issued a Title V Permit and a PSD Permit to Driftwood for the LNG Facility on July 10, 2018, and issued a general construction permit for CS-01 on October 2, 2017. Driftwood anticipates submittal of applications for CS-02 and CS-03 during the first quarter of 2019 and fourth quarter of 2019, respectively. Air quality impacts that could occur because of construction and operation of the Project are evaluated in section 4.12.1 of this final EIS.

1.5.8 Federal Aviation Administration

The Federal Aviation Administration (FAA) has the responsibility under 14 CFR 77, 49 U.S.C. Section 44718 (structures interfering with air commerce) to determine if constructing or altering a structure may result in an obstruction of navigable airspace or cause interference with air navigation facilities. Driftwood submitted their project for review on May 19, 2017; FAA provided a decision on all 11/06/2017. In a communication dated 11/06/2017, the FAA determined that, based on the height of 2 Stack Wet Flares and 2 Stack Dry Flares, all at 351 feet above mean sea level and on the proximity and configuration of the nearby Southland Field Airport in Sulphur, Louisiana, this flare would be obstructions under 14 CFR 77 standards. In communications dated 6/27/2017 and 11/06/2017, the FAA determined the remainder of the LNG Facility would not qualify as an obstruction to air transportation. Further analysis by FAA determined that the flares would have no adverse effect on arrival, departure, or en-route procedures for public use or military aircraft, and therefore would not have a substantial adverse effect on the safe and efficient use of navigable airspace by aircraft. FAA determined the flares would not be hazards to air navigation provided Driftwood follows the FAA condition that the Stack Wet Flares and Stack Dry Flares would be lighted according to the FAA Advisory Circular 70/7460-1L Change: 2 (August 18, 2018), Obstruction Marking and Lighting – Chapters 4 (Lighting Guideline), 5 (Red Obstruction Light System), and 12 (Marking and Lighting Equipment and Information).

2.0 PROPOSED ACTION

2.1 PROPOSED FACILITIES

The Project consists of a LNG Facility in Calcasieu Parish, Louisiana; and an approximately 96-mile Pipeline in Calcasieu, Jefferson Davis, Acadia, and Evangeline Parishes.

2.1.1 Liquefied Natural Gas Facility

2.1.1.1 LNG Facility Site

The LNG Facility would be about 5 miles south of Carlyss, Calcasieu Parish, Louisiana, onshore along the west bank of the Calcasieu River between mile markers 22 and 23 (figures 1.0-1, 1.4-1, and 1.4-2). The LNG Facility property comprises four parcels of land totaling about 790 acres, which have been secured through lease/purchase agreements. One parcel of land, (totaling about 480 acres) is currently owned by the Lake Charles Harbor and Terminal District, the second parcel (about 170 acres) is owned by a private company, and the remaining two parcels (about 140 acres) are owned by DWLNG. The leases on the 480- and 170-acre tracts each have an option to enter into longer-term lease for a total duration of 50 years consisting of an initial term of 20 years and 6 options to renew for 5 years each. This lease term covers the operational life of the LNG Facility, including the initial contracts for supply, which are expected to have a term up to 20 years. The LNG Facility site would be in an area zoned for heavy industrial use, consistent with other industrial facilities along the Calcasieu River. Land use in, adjacent to, and surrounding the LNG Facility consists of undeveloped lands, rural residential lands, and developed lands including other industrial facilities. About 300 acres of the LNG Facility and 12 acres of maintenance buildings and warehouses would be surrounded with security fence. In addition to the lands within the boundary of the LNG Facility, DWLNG has secured land use agreements with the remaining industrial parcel to the east of Global Drive and with parcels adjacent to the LNG Facility to the north of Burton Shipyard Road (FERC eLibrary accession number: 20180705-5100). These agreements would prohibit building or activities on these lands throughout the design life of the LNG Facility.

2.1.1.2 LNG Facility Components List

Major LNG Facility components include the items listed below:

- processing facilities;
- inlet gas receiving facility;
- acid gas removal and solvent regeneration;
- molecular sieve dehydration and mercury removal;
- heavy hydrocarbon (also referred to as “heavies”) removal and condensate stabilization;
- refrigeration and liquefaction, including mixed refrigerant (MR) compressor turbines;
- LNG storage, loading and boil off gas (BOG) compression;
- utilities and support facilities;

- wet and dry gas flares, marine flare, and acid gas thermal oxidation;
- hydrogen sulfide (H_2S) removal system;
- refrigerant storage;
- condensate storage and loading;
- diesel storage;
- ammonia system;
- aqueous ammonia storage;
- fuel gas system, including defrost gas;
- electric power grid connection;
- electric power distribution (within the LNG Facility);
- firewater systems;
- hot oil system using waste heat from MR compressor gas turbine exhaust;
- plant/instrument air;
- nitrogen generation and liquid nitrogen storage;
- selective catalytic reduction (SCR) of MR compressor gas turbine exhaust;
- potable water;
- water demineralization;
- provisions for security;
- wastewater collection;
- sewage collection;
- miscellaneous storage (chemicals and lube oil); and
- earthen berm and stormwater handling system.

2.1.1.3 Major Features of the LNG Facility

Liquefaction Facility

The LNG Facility would consist of five LNG plants, each consisting of one gas pre-treatment unit (Acid Gas Removal Unit, Dehydration Unit, and Mercury Removal Unit), one Condensate Stabilization Unit, and four heavy hydrocarbon removal and liquefaction units. Each plant is supported with a fuel gas, closed-loop heating medium (hot oil); H_2S removal/acid gas incineration; and SCR systems. The LNG storage, loading, and BOG compression unit and all other utilities and support systems listed above (e.g., plant/instrument air, nitrogen generation, and water demineralization) are common to the entire LNG Facility. In total, the LNG Facility would produce up to 27.6 MTPA of LNG for export.

Feed Gas Pre-treatment Units

The pipeline-quality feed gas would be pre-treated prior to liquefaction in five identical pre-treatment units, one in each LNG plant. Each pre-treatment unit would consist of:

Acid gas removal – an amine unit would remove carbon dioxide (CO_2) and H_2S. The CO_2 and H_2S are removed in an absorber column where lean amine contacts the feed gas. This amine stream, which contains various concentrations of CO_2 and H_2S, flows to the regeneration portion of the unit for CO_2 and H_2S removal before recycling back to the absorber. After CO_2 and H_2S removal, the water-saturated gas flows through a knockout vessel before entering a dehydration unit, which contains dryer vessels filled with a high-performance molecular sieve.

Dehydration – a dehydration unit would remove water from the gas.

Mercury removal – the dehydrated gas then flows downstream to two mercury guard beds, containing sulfur-impregnated activated carbon to remove any trace amounts of mercury to concentrations below detectable limits (0.01 microgram per normal m^3).

Liquefaction Units

Refrigeration necessary for the liquefaction process would be provided by three MR streams, derived from a single recirculating refrigerant mixture. Use of an MR system makes the refrigeration system inherently flexible, simple, and efficient. Initially, a low-pressure combination of the three refrigerant streams would be compressed first to an intermediate pressure and finally to a high pressure. The MR compressor would comprise two sections to support inter-cooling, which maintains discharge temperatures within acceptable ranges. Inter-cooling also improves the efficiency of the compression process. The air-cooled inter-cooler for the MR compressor partially condenses the intermediate pressure discharge stream to produce a liquid, which forms the “warm” refrigerant stream. After separation from the liquid, the remaining vapor would be further compressed in the second section to a high, final-discharge pressure. This warm high-pressure discharge would be partially condensed in an air-cooler, with the liquid forming the “mid” refrigerant stream and the remaining vapor forming the “cold” refrigerant stream.

These three refrigerant streams would feed the liquefaction exchanger in the cold box and ultimately provide refrigeration for the natural gas liquefaction process. Each of these refrigerant streams would be chilled by flowing through independent passages in the liquefaction exchanger. After chilling in the exchanger, the three refrigerant streams would be fed to separate Joule-Thomson expansion valves. Expanding the refrigerant streams across the valves causes a reduction in the refrigerant temperature, providing a driving force for refrigeration of the treated feed gas in the liquefaction exchanger. These cold, low-pressure refrigerant streams would be returned to various points in the liquefaction exchanger and heated against the feed gas, as well as the incoming high-pressure refrigerant streams. After warming to a temperature approaching the warm streams entering the liquefaction exchanger, the combined refrigerant stream would return to the suction of the MR compressor to complete the “refrigerant side” of the liquefaction cycle.

Heavy Hydrocarbon Removal Units

Immediately upstream of the liquefaction cold box is the heavy hydrocarbon removal unit, which consists of a heavies-removal cold box. The heavies-removal cold box contains a heavies-removal scrub column, heavies-removal reflux drum, and a heavies-removal exchanger. The heavies-removal reflux pumps would be on a separate skid adjacent to the heavies-removal cold box. A slipstream of the refrigerant compressor second-stage warm high-pressure discharge would be routed to the heavies-removal exchanger and cooled. The refrigerant would then be expanded across a Joule-Thomson valve and routed back to the heavies-removal exchanger to provide refrigeration. The process feed gas is fed to the heavies-removal exchanger and cooled before being routed to the heavies-removal column. The heavies-removal column separates the heavy hydrocarbon components and other freezing hydrocarbon constituents as a liquid stream, which is routed to the condensate stabilization unit. The lean scrub column overhead vapor product is routed to the heavies-removal exchanger and is partially condensed to provide reflux to the heavies-removal column. The overhead product from the heavies-removal reflux drum that is not condensed is routed back through the exchanger to recover the refrigerant capacity of the cold product gas prior to being routed to the LNG coldbox for liquefaction.

Condensate Stabilization System

The scrub column bottom would be further fractionated in the condensate stabilization system to remove C5+ components (hydrocarbons containing five or more carbon atoms), and the overhead liquefied petroleum gas product from the condensate stabilization unit would be reinjected into the feed gas just upstream of each LNG coldbox. The stabilized liquid condensate product from the condensate stabilization unit is sent to the condensate storage system. There would be a single-bay truck-loading facility where stabilized condensate could be loaded into a transfer truck to be sold into the market. Condensate would be loaded into the tanker trucks through a bottom tank system that would meter in a preset volume. Truck loading would take place on a concrete spill pad connected to a spill sump. Dry-type couplers would be used to minimize spills and emissions. Trucks would have high-level-overfill protection via an umbilical from the truck to the loading system.

Truck Transport

Condensate would be periodically transported from the LNG Facility via road tankers with a capacity of 8,000-12,000 gallons. The precise number of road tankers per day would depend on the inlet feed-gas quality. At the design feed gas composition, it is estimated there would be about five 10,000-gallon road tankers per day.

In addition to the condensate, there would be other materials delivered to, or removed from the LNG Facility by truck. Aqueous ammonia (a reactant in the SCR units) would be delivered to the LNG Facility on a daily basis. An estimated one tanker truck of aqueous ammonia would be required daily. Oily wastewater and spent H_2S scavenger would be removed from the LNG Facility on an as-needed basis.

Oily wastewater is typically generated during maintenance activities or process upsets. It is estimated that one vacuum truck per week would remove accumulated oily wastewater for transport to a licensed disposal facility. It is estimated that two trucks per week would be required to remove accumulated H_2S scavenger. The H_2S scavenger would either be returned to the manufacturer for treatment and regeneration or sent to a licensed disposal facility.

Bio-mass that accumulates in the sanitary waste treatment unit would be removed every month via vacuum truck. The bio-mass would be transported to a licensed wastewater treatment unit which can digest or treat the solids for final disposition.

Replacement refrigerants would also be required on a periodic basis to make up refrigerant losses from the process units. On average, 1 to 2 tanker trucks per month would be required for the delivery of replacement refrigerants. Replacement amine and heat transfer oil would also be required on a periodic basis. About twice per month, amine would be delivered to the LNG Facility. Hot oil would be delivered only on an as-needed basis, about one truck, once or twice per year.

To minimize disruption to the operation of the liquefaction plants and increase safety, the LNG Facility site has been arranged so that trucks can travel safely to and from the loading points. With the exception of specialty chemicals in totes, such as anti-foam, corrosion inhibitors and similar additives and amine, trucks delivering or removing materials would not need to enter the process areas. The truck loading/unloading areas would be arranged such that trucks do not need to reverse to access the loading/unloading point. Loading/unloading points for the trucks would include paved and curbed areas to allow for spill containment.

Dry goods, equipment, chemical totes, drums, and hardware would be delivered by truck to the various workshops, warehouses, or storage yards dedicated for materials storage and handling. The workshop and warehouse area would be separate from the operating LNG facilities.

Liquefied Natural Gas Storage

The three LNG storage tanks would be a full-containment design, with a 9-percent nickel steel inner tank, post-tensioned concrete outer tank and roof, and suspended insulation support deck. Each tank would have a net capacity of 235,000 m^3 (gross capacity of 247,650 m^3). The LNG would be contained within the inner tank, while the outer tank would serve as secondary containment, should the inner tank experience liquid leakage. The inner and outer tanks would be supported on a common foundation.

Liquefied Natural Gas Storage Tank Protection Systems

An earthen berm would be constructed around the liquefaction facilities to provide storm surge protection and provide tertiary LNG containment. The berm would be initially constructed to about 15 feet high (North American Vertical Datum of 1988 [NAVD88]), to maintain a 14-foot crest elevation after a maximum of 1-foot settlement.

Marine Facilities

Marine Berths

We received comments during scoping regarding alternative configurations or locations to ensure safe transit of LNG carriers. The Marine Facility berths would be located close to the confluence of the Calcasieu Ship Channel and the ICW, which would provide sufficient space for the turning basin required for LNG carriers to maneuver. The LNG Facility site provides only limited options for other marine berth configurations and locations. In addition, the USCG has determined the proposed location would provide sufficient space to construct recessed marine berths, which would allow LNG carriers to be berthed in a protected slip, out of the way of regular traffic traversing the Calcasieu Ship Channel. Based on the USCG determination, we did not further evaluate alternate locations or alignments further. The marine berths would be located in a dredged slip, positioned with adequate recess from the Calcasieu Ship Channel and designed to allow the safe berthing and un-berthing of three LNG carriers up to 216,000 m^3 each. LNG carriers would be berthed stern-first and oriented about 90 degrees to the main channel shipping lanes.

The marine facilities would have cryogenic piping and loading arms for loading LNG carriers. At each berth, a vapor management system, including a vapor arm, would be installed to transfer BOG from the LNG carriers to the storage tanks, which in turn would go to the BOG handling system. The BOG handling system is used to compress the BOG and transfer to the high pressure fuel gas system to allow BOG to be used as fuel for the MR gas turbine drivers. The LNG storage tanks would be fitted with pumps to transfer LNG to ships at each berth at a loading rate of up to 12,000 m^3 per hour, per ship, for two berths simultaneously. The loading rate equates to one 216,000 m^3 ship loaded in about 18 to 22 hours. At full capacity, the LNG Facility would load one ship a day or about 365 ships per year.

Turning Basin

The turning basin would be adjacent to the marine berths within the Calcasieu Ship Channel. The basin would be about 1,750 feet in diameter and the same operational depth as the Calcasieu Ship Channel (41.9 feet below NAVD88) (figures 1.4-1 and 1.4-2).

Materials Offloading Facility

The MOF would be a two-berth facility on the western bank of the Calcasieu Ship Channel to the north of the LNG marine berths, where barges ferrying prefabricated modules and bulk construction supplies can be moored and safely off-loaded. In their comments on the draft EIS, Driftwood has adjusted the depth to which the MOF would be dredged; this comment reduces the proposed depth of the MOF. The MOF would be dredged to a maximum depth of 20 feet NAVD88, which includes 2 feet of advance maintenance dredging, and would receive both Roll-On/Roll-Off and Load-On/Load-Off vessels, as well as barges. It would be a permanent feature of the LNG Facility.

Pioneer Docks

During construction, three pioneer docks (i.e., spud barges used as temporary docks during construction) would be established. Each would be comprised of a spud barge (about 120 feet by 35 feet by 8 feet) placed parallel and as close as possible to the shoreline. Spud barges are moored by through-deck pilings ("spuds") at each end to create a stable work platform. The platforms would be connected to the shore by ramps or bridges for use as pioneer docks. The two pioneer docks south of the Marine Facilities would require minor dredging within the sideslope of the existing Calcasieu Ship Channel to establish a depth of -11 feet NAVD88 to allow barge access. The spud barges would be removed when their useful operation is complete.

2.1.1.4 Other Infrastructure

Administration Area

The LNG Facility would include an administrative area outside of the earthen berm. Occupied buildings in the administration area include the following:

- operations center (includes main control room);
- maintenance building;

- warehouse building;
- laboratory building;
- foam trailer storage shed; and
- main gate guardhouse.

In addition to the buildings listed above, the administrative area would include the associated infrastructure necessary to support operations (e.g., roads, parking lots, drainage, utilities). Because the administrative area would be outside the earthen berm, each of the administrative buildings listed above would be elevated to 14 feet (NAVD88), with the building area pad elevation at 13 feet (i.e., 1 foot lower than finish floor elevation).

Water and Waste

The LNG Facility would connect to the local parish municipality for water services through Calcasieu Parish Waterworks. Connection to the municipal systems would not require modifications to the existing municipal infrastructure outside the LNG Facility boundary. DWLNG would be responsible for pipeline connection(s) from the LNG Facility site to the existing 10-inch-diameter water line that extends along Global Drive and Burton Shipyard Road, immediately adjacent to the LNG Facility fenceline. From this 10-inch-diameter water line, there is an existing 6-inch-diameter connection into the site. If the existing connection is not optimal for the LNG Facility, DWLNG would install a jumper connection to the existing municipal water line in a more desirable location within the Project site. About 259,200 gallons per day would be used for potable services (e.g., lavatories, kitchens, and emergency showers and eyewash stations), utility uses (unit washing), and to fill the firewater storage tank(s).

There are no parish sanitary waste sewers near the LNG Facility. Sanitary wastewater from lavatories and kitchens would flow to a packaged sanitary treatment unit. Extended aeration or other suitable biological digestion technology would be used to treat the sanitary wastewater according to the LDEQ and the Louisiana Department of Health regulations. Treated sanitary wastewater would be discharged to the Calcasieu River via a permitted LPDES outfall.

Process wastewater from the Molecular Sieve Dehydrators would be collected in the Process Wastewater Tank. The wastewater would be pumped from the Process Wastewater Tank to the Process Wastewater Treatment Package. The treatment package would be designed to remove any free-floating oils or hydrocarbons prior to discharge through a permitted outfall. In upset conditions, process wastewater from the Molecular Sieve Dehydrators would be collected in the Process Wastewater Tank and then trucked out by vacuum truck for offsite treatment or disposal by an appropriately licensed facility.

Process wastewater from the Acid Gas Removal Unit Solvent Regeneration Reflux Drum would be collected in the Waste Oil/Amine Tank and then trucked out by vacuum truck for offsite treatment or disposal by an appropriately licensed facility. It is anticipated that the gas chromatograph laboratory would not produce any contaminated water, therefore, no contaminated water from the laboratory would be discharged on site. Separate slop/waste oil collection drains and drums would be supplied if there is anticipated to be wet chemistry analysis which could generate contaminated wastewater. Process wastewater would be sent to a licensed waste operator who could treat and/or dispose of the wastewater.

Wastes would be generated during both construction and operation of the Project. Wastes would be collected in designated areas of the laydown and construction yards. The majority of construction waste would be classified as non-hazardous. Spent absorbents from vehicle/ equipment hydraulic spills during construction would be disposed of as described in applicable regulations. Where non-hazardous materials are not able to be recycled, they would be taken to licensed disposal facilities. Hazardous and chemical wastes generated by the Project during operation could include abrasive blasting and paint waste streams, waste strainers and filters, generator/compressor fluids (i.e., hydraulic/mineral/synthetic oils), and air/oil filters and separators. The LNG Facility would register as a hazardous waste generator, likely small quantity, and construct onsite temporary collection and storage facilities according to applicable regulations. Disposal of hazardous and chemical wastes would be through licensed and registered disposal companies.

2.1.2 Pipeline Facilities

The Pipeline would extend westward from an interconnect with Columbia Gulf Transmission (CGT) about 4.5 miles south of Ville Platte, Louisiana, then traverse four parishes (Evangeline, Acadia, Jefferson Davis, and Calcasieu) for 96 miles to the LNG Facility near the city of Carlyss, Louisiana. The Pipeline would interconnect with 14 interstate pipelines, which would ensure access to adequate gas feedstock for the LNG Facility. The Pipeline would parallel or be collocated with other disturbed right-of-way corridors (with pipelines or utilities) for about 68 miles (about 70 percent of the route). Maps showing the alignment of the Pipeline are available through FERC eLibrary (FERC eLibrary accession number 20171017-5114). Topographic maps of the pipeline alignment are included as figures 2.1-1 in appendix D of this document.

2.1.2.1 Pipeline Segments

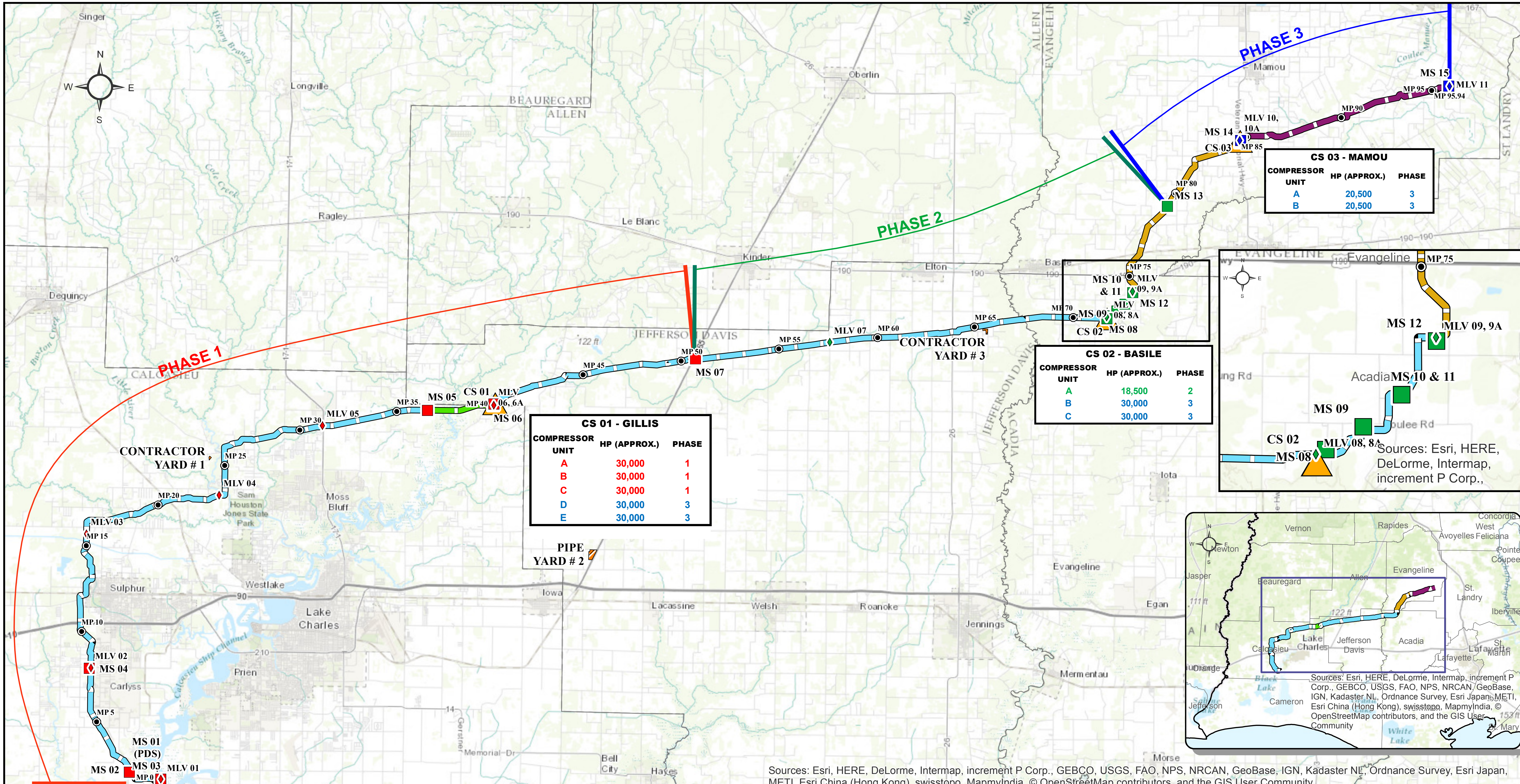
The Pipeline would provide the LNG Facility with an annual average of about 4.0 Bcf/d of supply feed gas for liquefaction and export. The multiple pipeline interconnections described would enable DWPL to source feed gas from a variety of U.S. natural gas production areas. The Pipeline would be designed with a maximum allowable operating pressure (MAOP) of 1,440 psig, but would predominantly be operated at lower pressures and would consist of three mainline segments plus one lateral pipeline. The Pipeline segments are summarized in Table 2.1-1 and illustrated in figure 2.1-2. The pipeline would be constructed in three phases to provide sufficient feed gas for the liquefaction units placed in service. See section 2.3 for details of the phased construction schedule.

Table 2.1-1

Pipeline Segments

Segment/Diameter	Parish	Milepost Begin	Milepost End	Length (miles)
Mainline Pipeline				
Segment 1/48-inch	Calcasieu, Jefferson Davis, Acadia	0	36.5	74
		36.5 [a]	39.9 [a]	
		39.9	74	
Segment 2/42-inch	Acadia, Evangeline	74	84.6	10.6
Segment 3/36-inch	Evangeline	84.6	95.9	11.3
Total Pipeline	Calcasieu, Jefferson Davis, Acadia, Evangeline	0	95.9	95.9
Lateral				
30 inch [a]	Calcasieu and Jefferson Davis	36.5	39.9	3.4

[a] Lateral is collocated with the 48-inch mainline pipeline (Segment 1).



LEGEND / NOTES

- COMPRESSOR STATION
- PHASE 1: PIPELINE & METER STATION SITES
- PHASE 2: PIPELINE & METER STATION SITES
- PHASE 3: PIPELINE & METER STATION SITES
- PHASE 1: MAINLINE VALVE SITES
- PHASE 2: MAINLINE VALVE SITES
- PHASE 3: MAINLINE VALVE SITES
- MILEPOST EVERY 5 MILES
- LNG FACILITY
- PIPE & CONTRACTOR YARDS
- 36" PIPELINE
- 42" PIPELINE
- 48" AND 30" LATERAL PIPELINES
- 48" PIPELINE

5 2.5 0 5
Miles

NOTES:
1. ALL LOCATIONS ARE APPROXIMATE. THIS IS A PRELIMINARY MAP AND IS INTENDED FOR PROJECT OVERVIEW ONLY.

MILEPOST	TAG	SITE NAME	PHASE
0.00	MS 01	PDS	1
1.80	MS 02	CREOLE TRAIL	1
0.00	MS 03	KMLP	1
7.78	MS 04	CAMERON	1
36.54	MS 05	TRUNKLINE	1
39.93	CS 01	COMPRESSOR STATION NO. 1 (GILLIS)	SEE TABLE
39.93	MS 06	TETCO 1	1
50.76	MS 07	TENN-KINDER	1
71.70	CS 02	COMPRESSOR STATION NO. 2 (BASILE)	SEE TABLE
71.70	MS 08	EGAN	2
72.38	MS 09	TEXAS GAS	2
73.14	MS 10	FGT	2
73.14	MS 11	PINE PRAIRIE	2
74.03	MS 12	ANR	2
79.21	MS 13	TETCO 2	2
84.60	CS 03	COMPRESSOR STATION NO. 3 (MAMOU)	SEE TABLE
84.60	MS 14	TRANSCO	3
95.94	MS 15	CGT	3

DRIFTWOOD PIPELINE PROJECT

CURRENTLY PROPOSED ROUTE

FIGURE 2.1-2 PIPELINE SEGMENTS

COORDINATE SYSTEM: NAD 1983 2011 STATEPLANE LOUISIANA SOUTH FIPS 1702 FT US
PROJECTION: LAMBERT CONFORMAL CONIC
UNITS: FOOT US

COUNTY/PARISH: CALCASIEU, JEFFERSON DAVIS, ACADIA & EVANGELINE PARISHES

STATE: LOUISIANA

SCALE: 1"=5 Miles | CLIENT DWG No: _ | _

SIZE: | BECHTEL DWG No: 26101-100-R0-0000-00001 | _ | REV. 001

_	_	_	_	_	_	_
001	02/09/17	ISSUE FOR FERC	AG3	PML	MB/SS	JT
000	01/20/17	ISSUE FOR FERC	AG3	PML	MB/SS	JT
00C	01/17/17	ISSUE FOR INFORMATION	AG3	PML	MB/SS	JT
00B	10/27/16	ISSUE FOR REVIEW	AG3	PML	MB/SS	JT
00A	10/13/16	ISSUE FOR REVIEW	AG3	PML	MB/SS	JT
REV	DT	DESCRIPTION	DSG	CHK	ENG	APR

48-inch Pipeline Segment, Calcasieu, Jefferson Davis, and Acadia Parishes, Louisiana

The first pipeline segment would consist of about 74 miles of a single, 48-inch-diameter pipeline, CS-01 at MP 39.9, CS-02 at MP 71.7, and 12 new meter stations. Each meter station would connect into the existing third-party pipelines through a hot-tapped connection. The pipeline segment starts at the Pipeline Delivery Station (PDS) scraper trap at MP 0.0 and ends at a scraper trap at MS-12 (at MP 74.0), which interconnects with American Natural Resources (ANR) Pipeline.

42-inch Pipeline Segment, Acadia and Evangeline Parishes, Louisiana

The second pipeline segment would consist of about 11 miles of a single 42-inch-diameter pipeline. It begins at a scraper trap at MS-12 and ends at a scraper trap at CS-03 at MP 84.6. The segment includes one meter station (MS-13). The meter station site would connect into the existing pipeline through a hot-tapped connection.

36-inch Pipeline Segment, Evangeline Parish, Louisiana

The third pipeline segment would consist of about 11 miles of a single 36-inch-diameter pipeline and begins at a scraper trap at CS-03 at MP 84.6 and ends at a scraper trap at MS-15 at MP 95.9. The segment includes two meter station sites (MS-14 and MS-15). The meter station sites would connect into the existing pipeline through a hot-tapped connection.

30-inch Pipeline Lateral, Calcasieu and Jefferson Davis

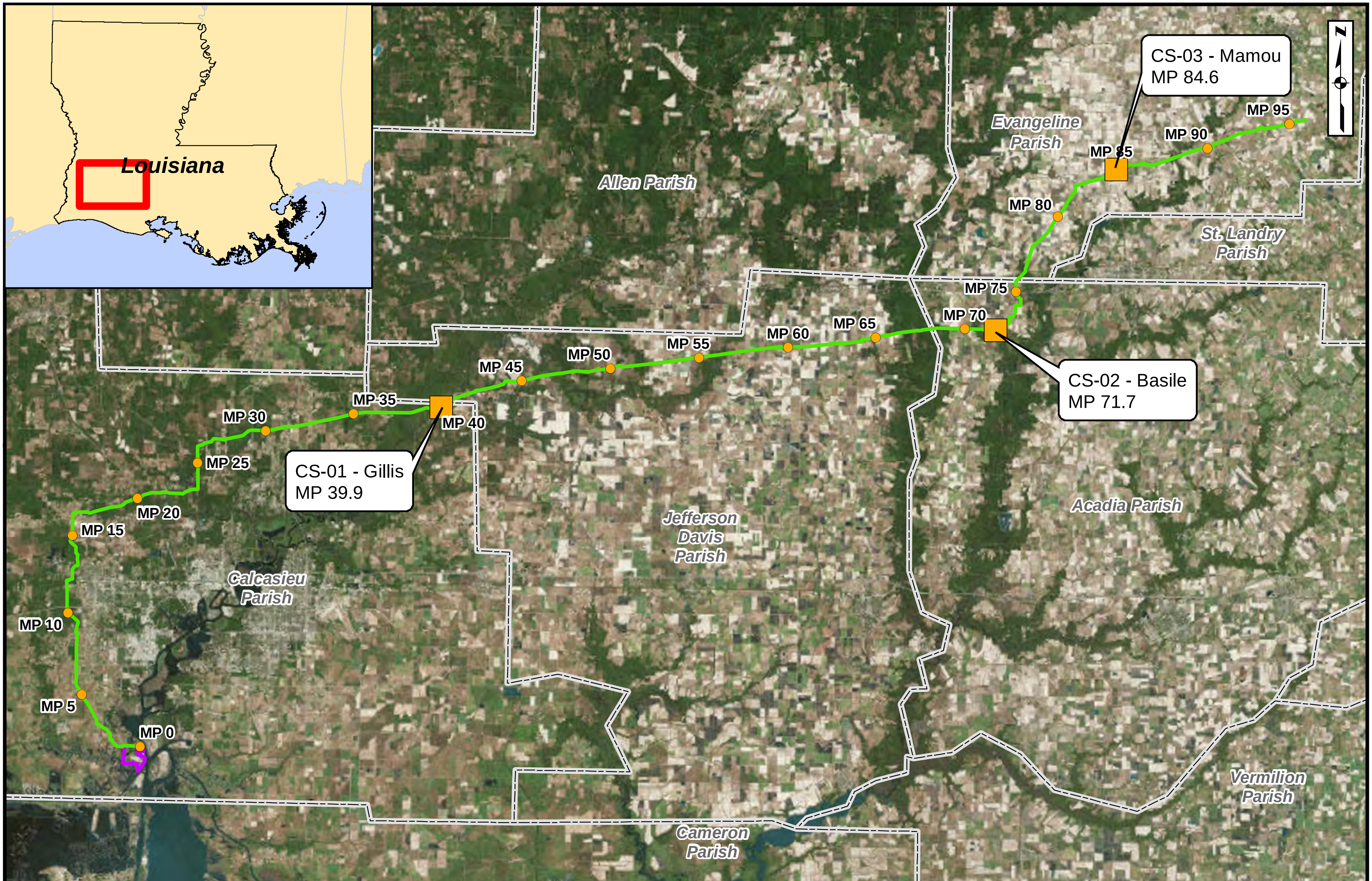
The lateral pipeline would include about 3.4 miles of 30-inch-diameter pipeline lateral between the Trunkline meter station (MS-05) and CS-01 (figure 2.1-2). The lateral would contain two lateral line valves as well as two MLVs: MLV L001 (at MP 36.5) and MLV L002 (at MP 39.9), as seen in figure 2.1-2. The lateral would be within the Pipeline right-of-way and parallel the 48-inch mainline from MP 36.5 to 39.9, maintaining a separation distance of 25 feet between centerlines.

The Pipeline would parallel or be collocated with existing disturbed corridors (pipelines, utilities, power lines, public and private roads, and other infrastructure) for about 68 miles (about 70 percent of the entire length of the Pipeline). Where the Pipeline route parallels existing foreign pipelines, DWPL would seek to maintain a minimum separation distance of 50 feet from foreign pipeline centerlines, unless approved otherwise. If operational or construction constraints arise, a lesser offset may be agreed upon with the existing pipeline operator.

The Pipeline would be made of carbon steel manufactured in accordance with the American Petroleum Institute (API) specifications for seamless and welded steel line pipe, for use in the natural gas pipeline industry (API 5L). The pipe would be protected from corrosion by a factory-applied external coating, and the welds would be protected by field-applied coating and an impressed current cathodic protection system.

2.1.2.2 Pipeline Aboveground Facilities

The pipeline aboveground facilities are summarized in table 2.1-2 and illustrated in figures 2.1-3, 2.1-4, 2.1-5, 2.1-6, and described in more detail below.



Legend
- Currently Proposed Compressor Stations
- Milepost
- Pipeline Route
- Parish Boundary
- Facility Boundary

0 2.5 5 10 Miles

NOTES:
Aerial Imagery: ESRI World Imagery (NAIP 2015)
Reproduced under license in ArcGIS 10.3.1

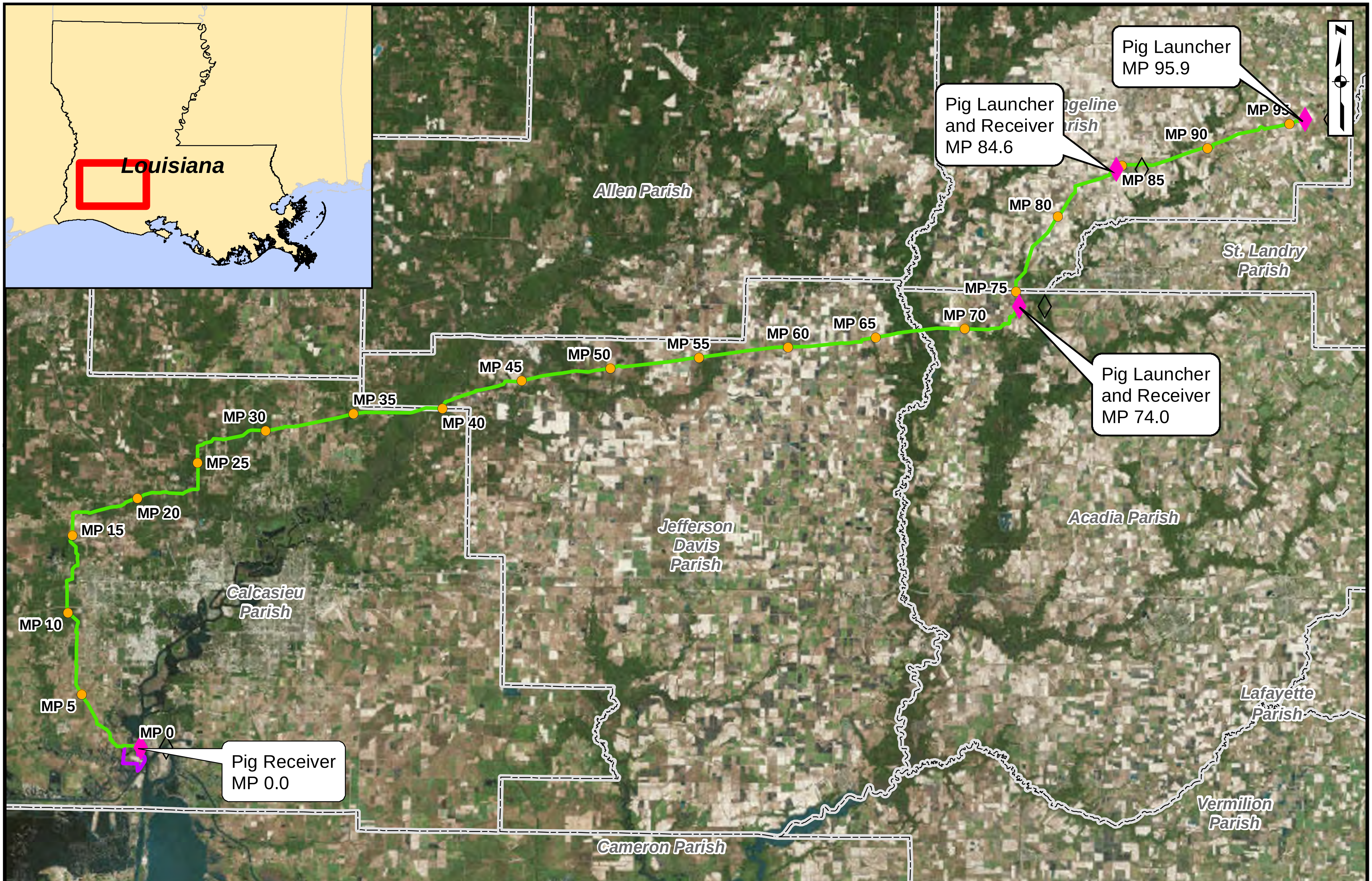
Figure **2.1-3**: Compressor Station Locations Map Driftwood LNG Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu, Jefferson Davis, Acadia, and Evangeline Parishes, Louisiana

Legend
- Currently Proposed Meter Station
- Milepost
- Pipeline Route
- Parish Boundary
- Facility Boundary

0 2.5 5 10 Miles

NOTES:
Aerial Imagery: ESRI World Imagery (NAIP 2015)
Reproduced under license in ArcGIS 10.3.1

Figure **2.1-4**: Meter Station Locations Map Driftwood LNG Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu, Jefferson Davis, Acadia, and Evangeline Parishes, Louisiana



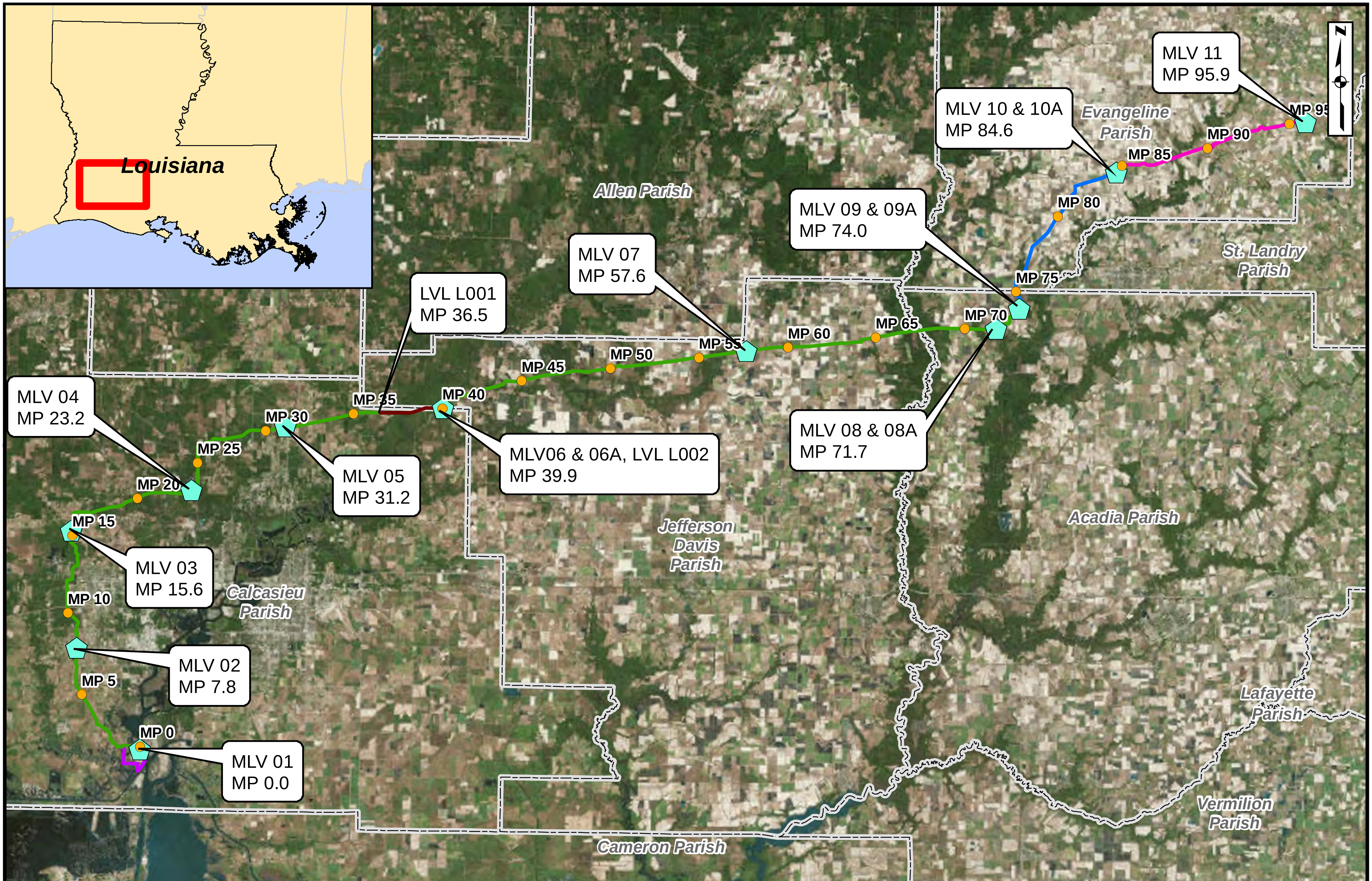
Legend

- Pig Launcher/Receiver
- Milepost
- Pipeline Route
- Parish Boundary
- Facility Boundary

0 2.5 5 10 Miles

NOTES:
Aerial Imagery: ESRI World Imagery (NAIP 2015)
Reproduced under license in ArcGIS 10.3.1

Figure **2**.1-**5**: Pig Launcher and Receiver Locations Map Driftwood LNG Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu, Jefferson Davis, Acadia, and Evangeline Parishes, Louisiana



Legend

- Mainline Valve
- Milepost
- Parish Boundary
- Facility Boundary

Pipeline Diameter

- 36" Pipeline
- 42" Pipeline
- 48" Pipeline
- 30" Lateral Pipeline

0 2.5 5 10 Miles

NOTES:
Aerial Imagery: ESRI World Imagery (NAIP 2015)
Reproduced under license in ArcGIS 10.3.1

Figure **2.1-6**: Mainline Valve Locations Map Driftwood LNG Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu, Jefferson Davis, Acadia, and Evangeline Parishes, Louisiana

Table 2.1-2

Aboveground Facilities for the Pipeline

Facility Type and Name	Approximate Milepost	Parish	Description
Compressor Stations			
CS-01	39.9	Jefferson Davis	Install new station with five natural gas powered compressor turbines. Total rated capacity is about 150,000 horsepower
CS-02	71.7	Acadia	Install new station with three natural gas powered compressor turbines. Total rated capacity is about 78,500 horsepower
CS-03	84.6	Evangeline	Install new station with two natural gas powered compressor turbines. Total rated capacity is about 41,000 horsepower
Meter Stations			
MS-01 and -03	0.0	Calcasieu	PDS in the LNG Facility and interconnect with Kinder Morgan Pipeline
MS-02	1.8	Calcasieu	Interconnect with Creole Trail Pipeline
MS-04	7.8	Calcasieu	Interconnect with Cameron Pipeline
MS-05	36.5	Calcasieu	Interconnect with Trunkline Pipeline
MS-06	39.9	Jefferson Davis	Interconnect with TETCO 1 Pipeline
MS-07	50.8	Jefferson Davis	Interconnect with Tennessee-Kinder Pipeline
MS-08	71.7	Acadia	Interconnect with Egan Pipeline
MS-09	72.4	Acadia	Interconnect with Texas Gas Pipeline
MS-10 and -11	73.1	Acadia	Interconnect with Florida Gas Transmission and Pine Prairie Pipeline
MS-12	74.0	Acadia	Interconnect with ANR Pipeline
MS-13	79.2	Evangeline	Interconnect with TETCO 2 Pipeline
MS-14	84.6	Evangeline	Interconnect with Transcontinental Gas Pipeline
MS-15	95.9	Evangeline	Interconnect with CGT Pipeline
Pig Launchers and Receivers			
PY-1601	0.0	Calcasieu	48-inch Receiver
PY-1602 and PY-1603	74.0	Acadia	48-inch Launcher and 42-inch Receiver
PY-1604 and PY-1605	84.6	Evangeline	42-inch Pig Launcher and 36-inch Receiver
PY-1606	95.9	Evangeline	36-inch Pig Launcher
Mainline Valves			
MLV 01	0.0	Calcasieu	Included on the 48-inch pipeline segment
MLV 02	7.8	Calcasieu	Included on the 48-inch pipeline segment
MLV 03	15.6	Calcasieu	Included on the 48-inch pipeline segment
MLV 04	23.2	Calcasieu	Included on the 48-inch pipeline segment
MLV 05	31.2	Calcasieu	Included on the 48-inch pipeline segment
MLV L001	36.5	Calcasieu	Included on the 30-inch pipeline segment
MLV 06	39.9	Jefferson Davis	Included on the 48-inch pipeline segment
MLV 06A	39.9	Jefferson Davis	Included on the 48-inch pipeline segment
MLV L002	39.9	Jefferson Davis	Included on the 30-inch pipeline segment
MLV 07	57.6	Jefferson Davis	Included on the 48-inch pipeline segment

Table 2.1-2

Aboveground Facilities for the Pipeline

Facility Type and Name	Approximate Milepost	Parish	Description
MLV 08	71.7	Acadia	Included on the 48-inch pipeline segment
MLV 08A	71.7	Acadia	Included on the 48-inch pipeline segment
MLV 09	74.0	Acadia	Included on the 42-inch pipeline segment
MLV 09A	74.0	Acadia	Included on the 42-inch pipeline segment
MLV 10	84.6	Evangeline	Included on the 42-inch pipeline segment
MLV 10A	84.6	Evangeline	Included on the 36-inch pipeline segment
MLV 11	95.9	Evangeline	Included on the 36-inch pipeline segment

Compressor Stations

DWPL would construct and operate three compressor stations along the Pipeline. The compressor stations would include gas turbine driven centrifugal compressors to boost Pipeline pressure, as well as associated separators, discharge air coolers, valves, and utility systems as required for operation and maintenance purposes. Compression equipment would be provided with noise and emissions control features to comply with regulatory requirements. Compressor stations would be fenced to provide security and safety and to prevent uncontrolled entry.

Meter Stations

The interconnect facilities would include interconnect valves and piping, metering, gas composition analysis (as required), flow control and/or pressure control functionality (as required), launcher/receiver capability (as required), system isolation, as well as safety and security equipment. The interconnect facilities would be fenced to provide security and safety and to prevent uncontrolled entry.

Pig Launchers and Receivers

Pig launchers and receivers would be installed as part of the Pipeline design to allow for cleaning and inspection. They would be designed to withstand an internal pressure equal to or exceeding that of the adjoining pipe. All pig launchers and receivers would be within appropriately fenced and gated areas of larger aboveground facilities.

Mainline Valves

MLV facilities would be provided to stop the flow of gas and to isolate sections of the Pipeline during maintenance, repair, and if a leak is detected. MLV locations would be spaced along the Pipeline to meet DOT requirements, 49 CFR 192. Figure 2.1-6 illustrates the locations for each MLV along the Pipeline. The class location determines the design factor used in identifying required minimum wall thickness of the pipe, as well as the depth of cover over the Pipeline and the frequency of leak surveys and transmission line patrolling. The class locations for the pipeline are summarized below:

- There are no Class 4 locations.
- Each point on the Pipeline in a Class 3 location would be within 4 miles of a valve, with about 2.9 miles of Class 3 locations.

- Each point on the Pipeline in a Class 2 location would be within 7.5 miles of a valve; with about 8.0 miles designated as Class 2 locations.

- Each point on the Pipeline in a Class 1 location would be within 10 miles of a valve, with about 85.0 miles of the Pipeline designated as Class 1 locations.

MLVs would be equipped with remote operation capabilities to close all valves from the control console at a Gas Control Center; however, all valves would have to be opened manually. MLV sites would be graveled, accessible to work crews, and fenced to provide safety and controlled entry.

2.2 LAND REQUIREMENTS

Land requirements for construction and operation of the Driftwood LNG Project are summarized in table 2.2-1. The following discussion provides a more detailed description and breakdown of land requirements and use.

Table 2.2-1

Summary of Land Requirements

Facility	Parish	Land Affected During Construction (acres) [a, b]	Land Affected During Operation (acres) [a]
LNG Facilities			
LNG Facility [c]			
Liquefaction Facility	Calcasieu	277.5	277.5
Marine Berths [d]	Calcasieu	77.6	77.6
MOF [d]	Calcasieu	4.9	4.9
Construction Laydown (incl. temporary facilities) [e]	Calcasieu	104.3	104.3
Other Facilities (outside the berm) [f]	Calcasieu	230.1	230.1
Roads	Calcasieu	23.7	23.7
Total within LNG Facility Boundary		*718.1*	*718.1*
Temporary Offsite Construction Areas			
Chennault Airport Site	Calcasieu	85.5	0.0
Burton Shipyard Rd Property	Calcasieu	28.0	0.0
Park-and-Ride Sites	Calcasieu	51.5	0.0
Total Outside LNG Facility Boundary		*165.0*	*0.0*
Total Land Requirements for LNG Facility		*883.1*	*718.1*
Pipeline Facilities			
Pipeline ROW (including lateral within the ROW) [g]	Calcasieu, Jefferson Davis, Acadia, Evangeline	1,313.7	575.0
ATWS	Calcasieu, Jefferson Davis, Acadia, Evangeline	195.0	0.0
Pipe Yard	Jefferson Davis	90.0	0.0
Contractor Yard 1	Calcasieu	7.7	0.0
Contractor Yard 3	Jefferson Davis	34.9	0.0
Access Roads	Calcasieu, Jefferson Davis, Acadia, Evangeline	93.8	14.3
Total Pipeline		*1,735.10*	*589.3*

Table 2.2-1

Summary of Land Requirements

Facility	Parish	Land Affected During Construction (acres) [a, b]	Land Affected During Operation (acres) [a]
Aboveground Facilities			
Compressor Stations	Jefferson Davis, Acadia, Evangeline	100.8	63.1
Meter Stations [f]	Calcasieu, Jefferson Davis, Acadia, Evangeline	39.3	32.0
MLVs [h]	Calcasieu, Jefferson Davis, Acadia, Evangeline	n/a	n/a
Total Aboveground Facilities		*140.1*	*95.1*
Total Land Requirements for Pipeline		*1,875.2*	*684.4*
PROJECT TOTAL		***2,758.3***	***1,402.5***

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

[b] Land affected during construction includes both temporary and permanent work areas.

[c] Land use assumes all areas within the LNG Facility boundary would be permanently affected.

[d] Dredging of existing open water areas for the Turning Basin, Pioneer Docks, and approach channels for the MOF and LNG Berth would disturb about 31.6 acres of existing water bottoms, not included in this table.

[e] Spud barges used as Pioneer docks would temporarily occupy 0.3 acre of existing open water, not included in this table.

[f] Acreages include MS-01 and -03 and 1 mile of pipeline ROW within the LNG Facility boundary.

[g] Acreage excludes land required for 1 mile of the Pipeline ROW within the LNG Facility boundary.

[h] All MLV, Pig Launcher and Pig Receiver land use impacts are accounted for within the land use impacts created by the Pipeline ROW and/ or metering station footprints. No additional land would be required for construction and operation of these facilities.

2.2.1 LNG Facility

2.2.1.1 Facility and Marine Berths

Construction of the LNG Facility would require about 718.1 acres of the 790-acre Driftwood LNG site. Of the 718.1 acres, about 77.6 acres of land would be converted to open water for creation of the slip. The current site and the proposed development are shown in figures 1.4-4 and 1.4-2, respectively.

2.2.1.2 LNG Facility Offsite Construction Areas

Offsite construction areas would include temporary disturbance associated with park-and-ride facilities, the Chennault Airport Site, and the Burton Shipyard Road property, as shown on figures 2.2-1 and 2.2-2. Disturbance would occur during construction of the LNG Facility.

Driftwood would lease land for four park-and-ride facilities, which would occupy a total of 51.5 acres of land. The park-and-ride facilities would require grading and stabilization, prior to use. Portions of the park-and-ride locations may be used for additional offsite pre-assembly and laydown areas. Following construction, these areas would be returned to the owners in their developed condition.

Driftwood would also use two offsite construction areas, identified as the Chennault Airport site and the Burton Shipyard Road site. These offsite construction areas total about 108 acres. They are both previously developed industrial fabrication facilities and would require only minor upgrades/maintenance, such as clearing, grading, and soil stabilization prior to use. Following construction, these areas would be returned to the owners in their developed condition.

2.2.2 Pipeline Facilities

The first mile of the pipeline and one of the MSs are within the LNG Facility site and are not included in the total acreage shown in table 2.2-1. Following construction, the construction right-of-way would be restored per the Driftwood *Upland Erosion Control, Revegetation & Maintenance Plan* (Driftwood Plan) (discussed in section 2.5).

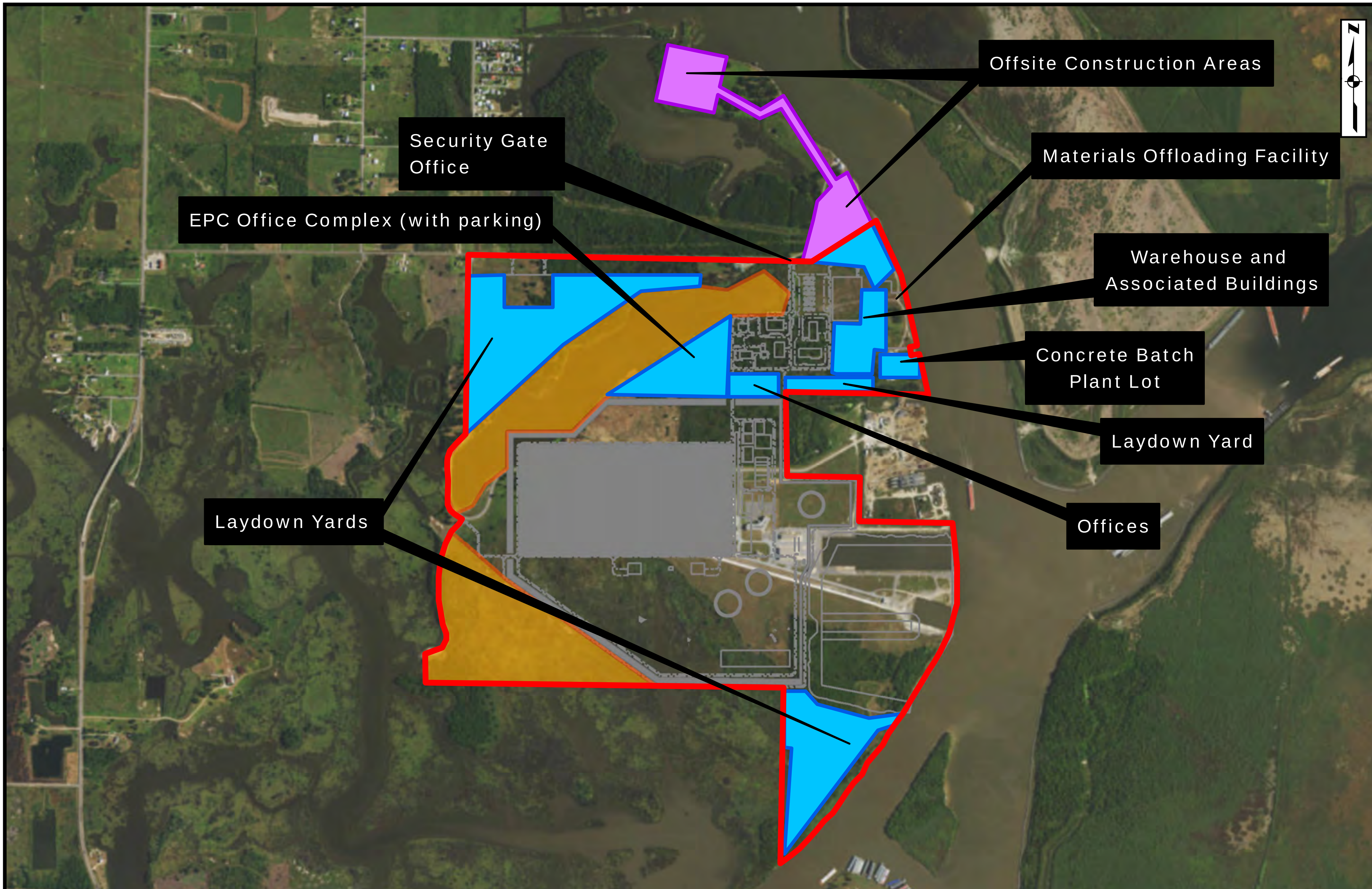
2.2.2.1 Compressor Stations

DWPL would construct and operate three compressor stations along the Pipeline. The compressor stations would include gas turbine driven centrifugal compressors to boost Pipeline pressure. CS-01 would be located at about MP 39.9 in Jefferson Davis Parish, would include five natural gas powered compressor turbines, and would have a total rated capacity of about 150,000 hp. CS-02 would be located at about MP 71.7 in Acadia Parish, would include three natural gas powered compressor turbines, and would have a total rated capacity of about 78,500 hp. CS-03 would be located at about MP 84.6 in Evangeline Parish, would include two natural gas powered compressor turbines, and would have a total rated capacity of about 41,000 hp.

Compression would be installed in phases, as described in section 2.3.2 for pipeline segments.

2.2.2.2 Meter Stations

At each location where the Pipeline intersects third-party pipelines, a meter station, including interconnect valves and piping, would be installed. Up to fifteen meter stations would be installed along the Pipeline. Locations for the meter stations, as well as details about interconnects are provided in table 2.1-2.



Legend

- Facility Boundary (~718 acres)
- Permanent Structures and Areas
- Temporary Areas inside Facility Boundary
- Temporary Areas outside Facility Boundary
- Indirectly Impacted Area

0 500 1,000 2,000
Feet

NOTES:
Topographic Imagery: ESRI USA Topo Maps
Reproduced under license in ArcGIS 10.4

Figure **2.2-1**: Location Map for Temporary Facilities
Driftwood LNG Project
Driftwood LNG LLC and Driftwood Pipeline LLC Calcasieu Parish, Louisiana

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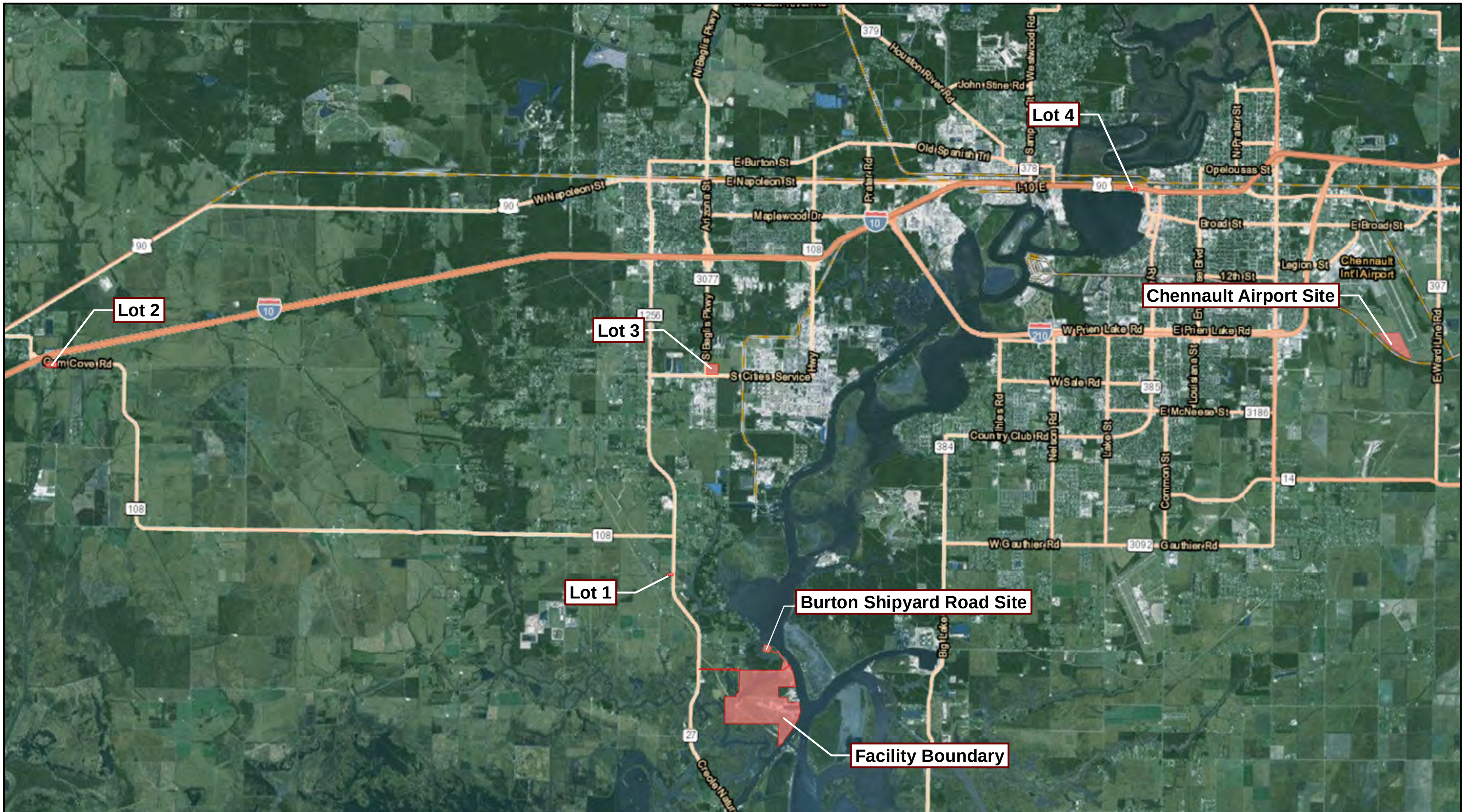
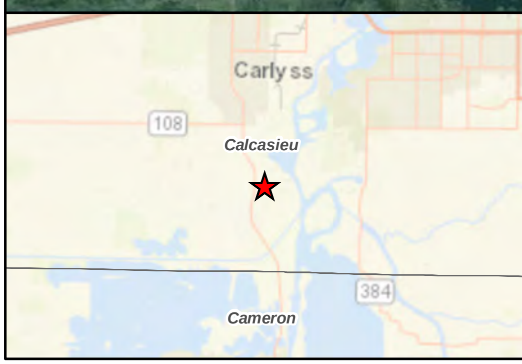




Facility Boundary

0 2.5 5 Miles

Figure 2.2-2
Offsite Facilities
Driftwood LNG Project
Driftwood LNG and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

Page 1 of 1	Scale: 1:170,000
NAD1983 LA S 1702 ft	Date: November, 2017

Document Path: P:\GIS\Client\Tellurian\Driftwood_LNG\Maps\ENV\FERC\Cumulative\20170124\MXD\20171114_Offsite_Cumulative_Mapping.mxd

DRAWN: GIS

2.2.2.3 Pipeline Segments

In general, the construction right-of-way would use the following widths:

- 130 feet for the 48- and 42-inch pipelines in uplands (figure 2.2-3);
- 110 feet for the 48-inch pipeline in wetlands (figure 2.2-4);
- 110 feet for the 42-inch pipeline in wetland crossings greater than 500 feet long (figure 2.2-4);
- 75 feet for the 42-inch pipeline in wetland crossings of less than 500 feet (figure 2.2-5);
- 150 feet for the parallel 48-inch mainline and 30-inch lateral in uplands (figure 2.2-6);
- 130 feet for the parallel 48-inch mainline and 30-inch lateral in wetlands (figure 2.2-7);
- 100 feet for the 36-inch pipeline in uplands (figure 2.2-8);
- 75 feet for the 36-inch pipeline in wetlands (figure 2.2-5).

FERC guidance requires site-specific justification for a construction right-of-way greater than 75 feet in wetlands; these locations are identified in Table 2.2-2. The mainline Pipeline would parallel or be collocated with other linear features for about 68 miles (about 70 percent of the route). Additional Temporary Workspace (ATWS) would be required to accommodate construction at sensitive features, points of inflection, foreign pipeline crossings, road and railroad crossings, and for spoil storage and vehicular maneuvering. Although Driftwood has identified areas where extra workspace would be required, additional or alternative areas could be identified in the future due to changes in site-specific construction requirements. Driftwood would be required to file information on each of those areas for review and approval prior to use.

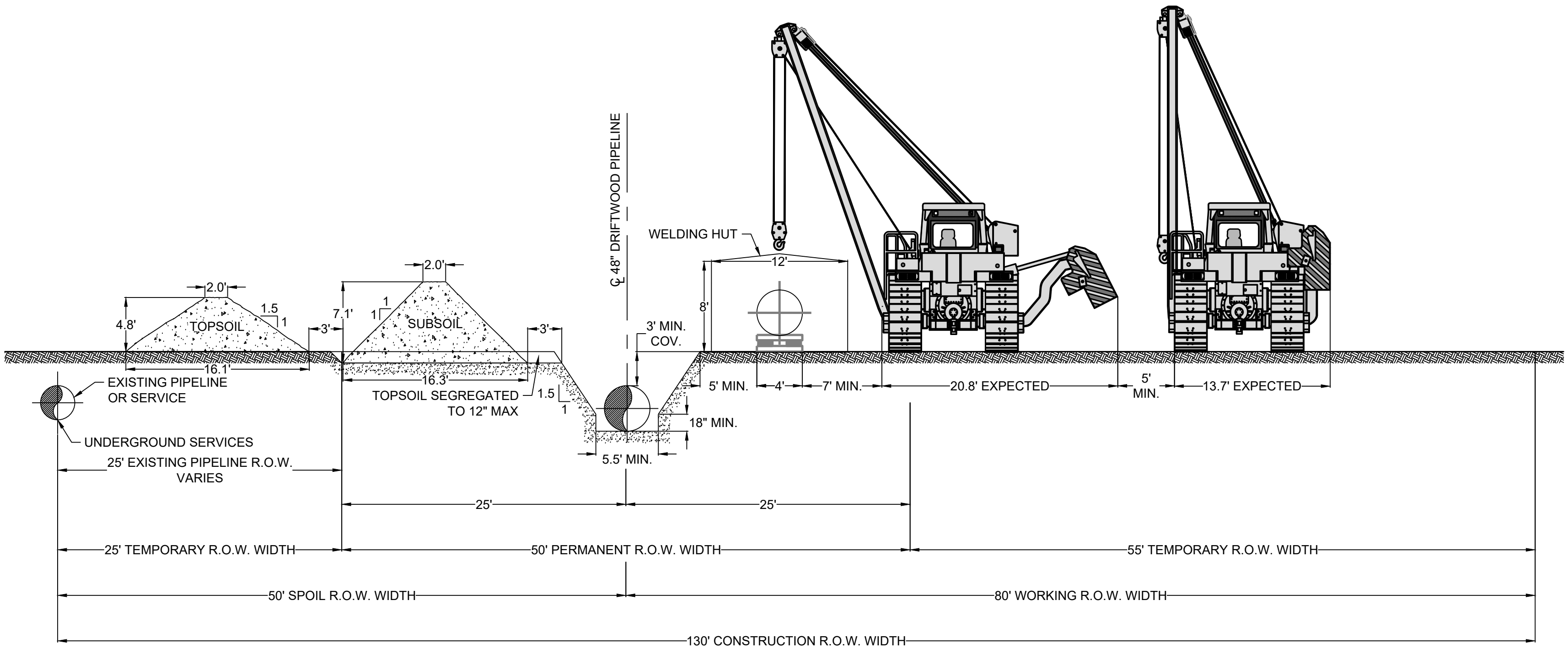
Following construction, a 50-foot-wide permanent easement would be retained during operation of the Pipeline, with the exception of the area between MP 36.5 and 39.9 where a lateral would be installed adjacent to the mainline. In that location, a 65-foot-wide permanent easement would be retained. The easement would be maintained following DOT requirements (49 CFR 192) to allow for routine pipeline inspection and maintenance.

2.2.2.4 Pig Launchers and Receivers, Mainline Valves

Pig launchers and receivers would be installed as part of the Pipeline design to allow for cleaning and inspection; locations of these pipeline facilities are summarized in table 2.1-2. A receiver would be located at MP 0.0, a launcher and receiver would be located at MP 74.0, a launcher and receiver would be located at MP 84.6, and a launcher would be located at MP 95.9.

MLV facilities would be sited at the inception and terminus of the pipeline, at MP 0.0 and MP 95.9, respectively. Fifteen other MLVs would be spaced along the Pipeline to meet DOT requirements, for a total of 17 MLVs (including the two MLVs on the lateral pipeline). MLVs would be equipped with remote operation capabilities to close all valves; however, all valves would have to be opened manually.

MAINLINE UPLAND CONSTRUCTION RIGHT-OF-WAY



1. DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
2. EXISTING PIPELINES AND/OR CABLES NEED TO BE PROTECTED ACCORDING TO OPERATOR STANDARDS.
3. THE TOPSOIL SHALL NOT BE COMPACTED.
4. THIS DRAWING SHALL BE USED IN CONJUNCTION WITH THE PIPELINE CONSTRUCTION SPECIFICATION 26101-100-3PS-R000-00001.

REV.	DATE	DESCRIPTION	DES.	CHK.	ENG	APR.
002	06MAR17	RE-ISSUE FOR FERC	LJ	PL	SPS	MB / JT
001	03JAN17	RE-ISSUE FOR FERC	LJ	PL	SPS	MB / JT
000	14OCT16	ISSUE FOR FERC	LJ	PL	SPS	MB / JT

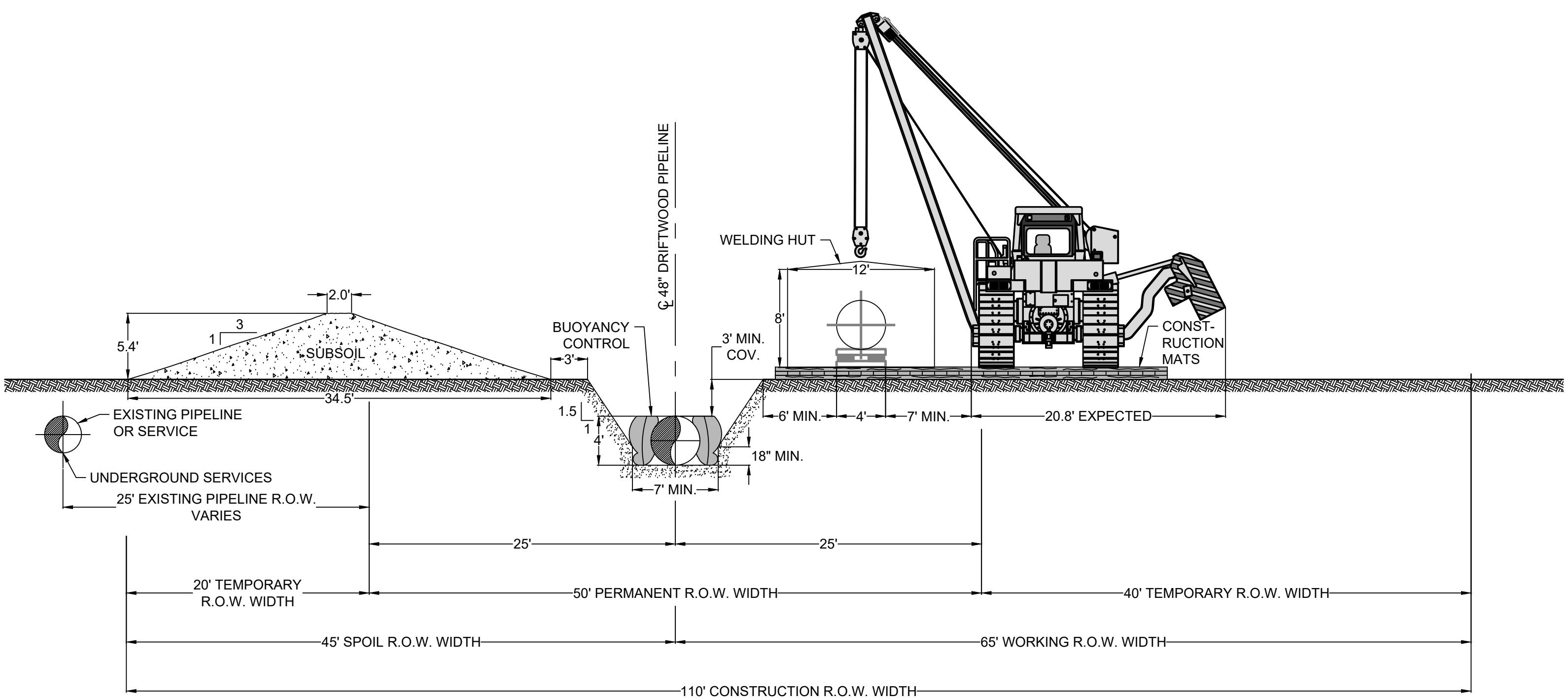
N O T E S / L E G E N D / M A T E R I A L S

Figure 2.2-3
Typical Right-of-way: 48-inch, Upland, Parallel Feature

1"=10'

SIZE: ANSI_B | 26101-100-R5-0000-00055 | REV. 002

MAINLINE WETLAND CONSTRUCTION RIGHT-OF-WAY



1. DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
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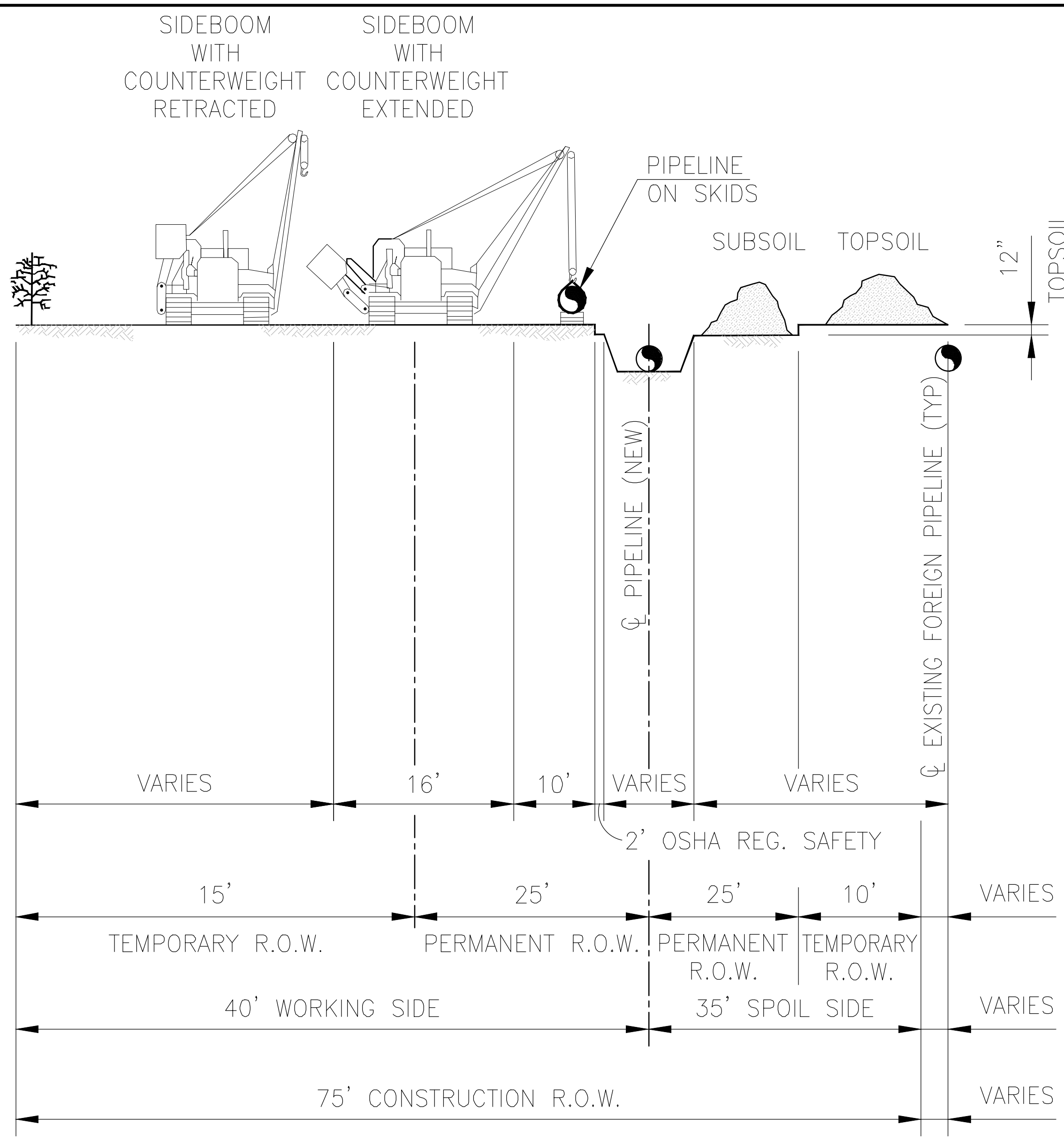
NOTES / LEGEND / MATERIALS

REV.	DATE	DESCRIPTION	DES.	CHK.	ENG	APR.
002	06MAR17	RE-ISSUE FOR FERC	LJ	PL	SPS	MB / JT
001	03JAN17	RE-ISSUE FOR FERC	LJ	PL	SPS	MB / JT
000	14OCT16	ISSUE FOR FERC	LJ	PL	SPS	MB / JT

Figure 2.2-4
Typical Right-of-way: 48-inch, Wetland, Parallel Feature

1"=10'

SIZE: ANSI_B 26101-100-R5-0000-00021 REV. 002



SPOIL SIDE (FT.)	WORKING SIDE (FT.)	CONSTRUCTION R.O.W. (FT)
35	40	75

NOTES:

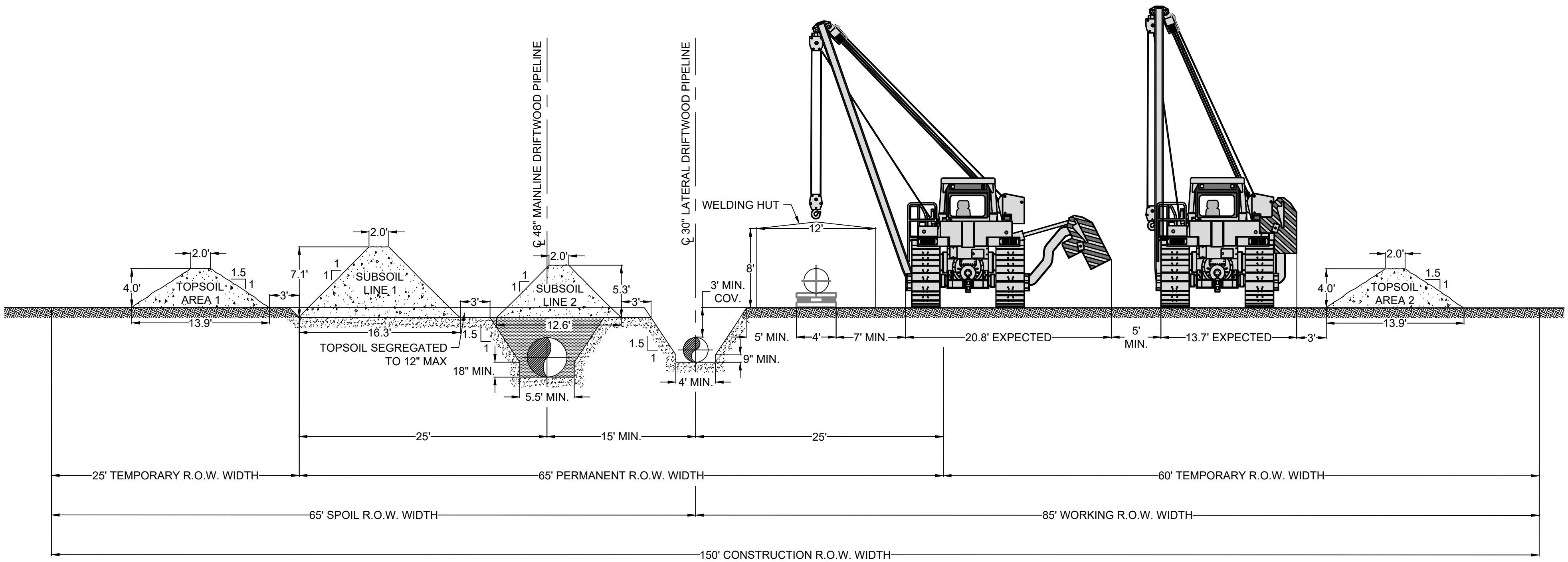
1. DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
2. EXISTING PIPELINES AND/OR CABLES NEED TO BE PROTECTED ACCORDING TO OPERATOR STANDARDS.
3. THE TOPSOIL SHALL NOT BE COMPACTED.
4. THIS DRAWING SHALL BE USED IN CONJUNCTION WITH THE PIPELINE CONSTRUCTION SPECIFICATION 26101-1003PS-R000-00001.

Figure 2.2-5
Typical Right-of-way: 36-inch, Wetland, Parallel Feature (also 42-inch for wetlands <500 feet)

DRAWN BY: PCS	CHK'D. BY: PCS
DATE: 6-16-17	APPRV. BY: PCS
DWG. NO. 16141-PL-TYP-0005	REV A

06-16-17 9:55 16141 2 MFZ

MAINLINE UPLAND CONSTRUCTION RIGHT-OF-WAY



1. DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
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3. THE TOPSOIL SHALL NOT BE COMPACTED.
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N O T E S / L E G E N D / M A T E R I A L S

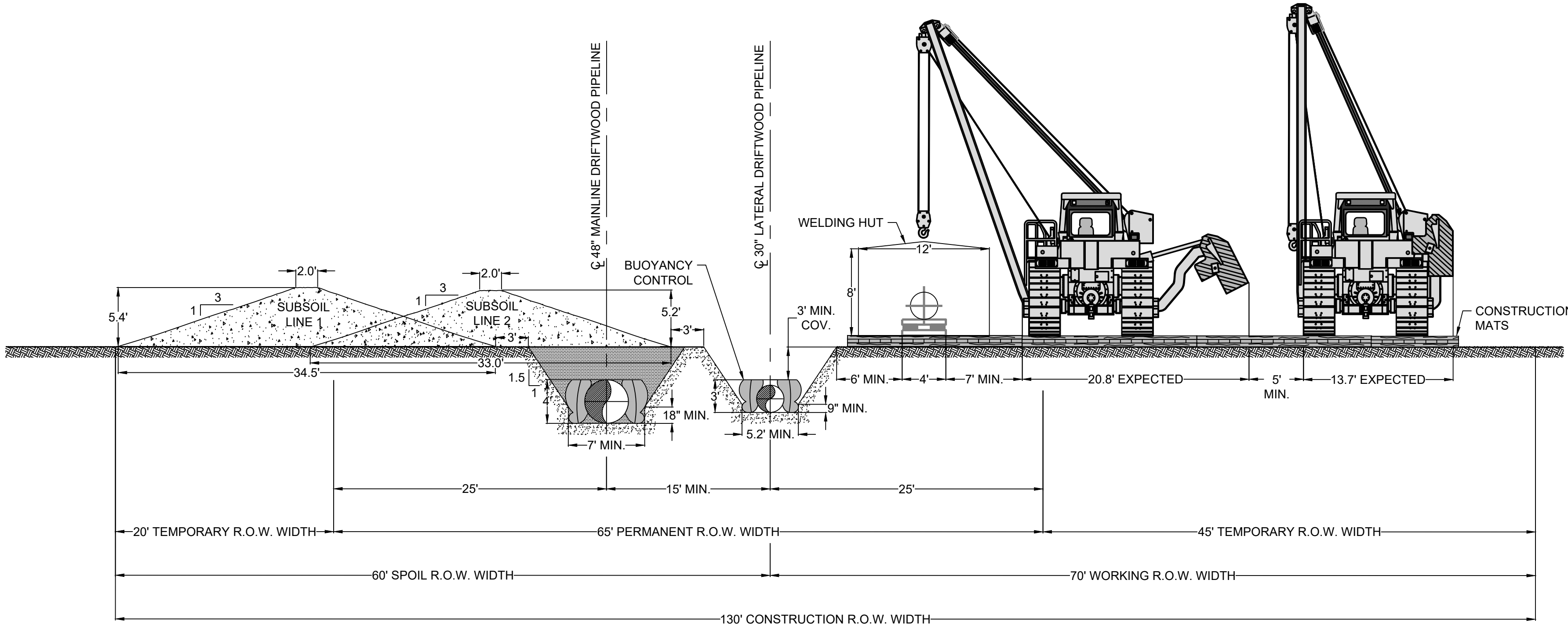
Figure 2.2-6
Typical Right-of-way: 48-inch & 30-inch, Upland, No Parallel Feature

REV.	DATE	DESCRIPTION	DES.	CHK.	ENG	APR.
002	06MAR17	RE-ISSUE FOR FERC	LJ	PL	SPS	MB / JT
001	03JAN17	RE-ISSUE FOR FERC	LJ	PL	SPS	MB / JT
000	14OCT16	ISSUE FOR FERC	LJ	PL	SPS	MB / JT

1"=10'

SIZE: ANSI_B | 26101-100-R5-0000-00014 | REV. 002

MAINLINE WETLAND CONSTRUCTION RIGHT-OF-WAY



1. DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
2. EXISTING PIPELINES AND/OR CABLES NEED TO BE PROTECTED ACCORDING TO OPERATOR STANDARDS.
3. THE TOPSOIL SHALL NOT BE COMPACTED.
4. THIS DRAWING SHALL BE USED IN CONJUNCTION WITH THE PIPELINE CONSTRUCTION SPECIFICATION 26101-100-3PS-R000-00001.

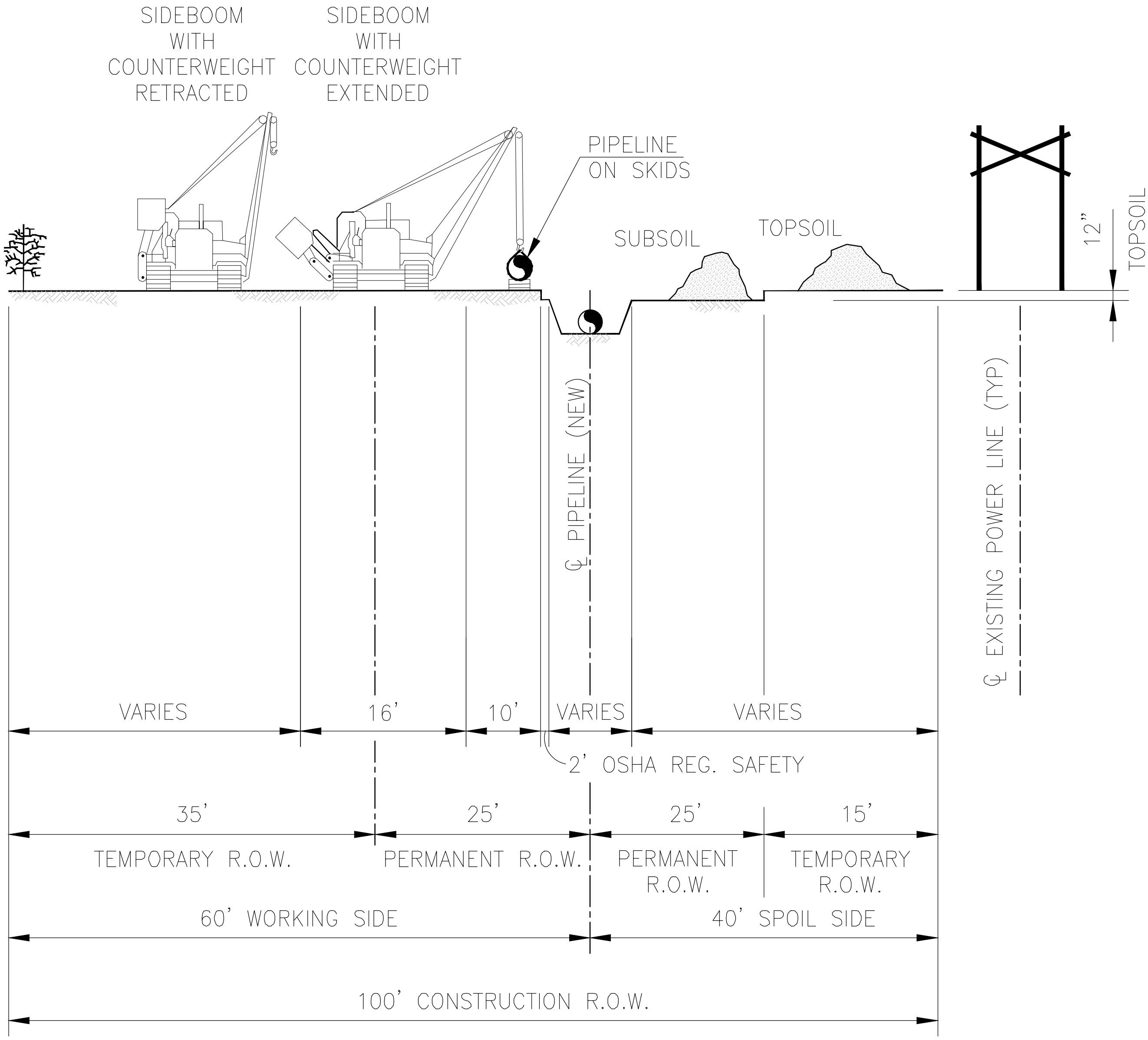
N O T E S / L E G E N D / M A T E R I A L S

REV.	DATE	DESCRIPTION	DES.	CHK.	ENG	APR.
002	06MAR17	RE-ISSUE FOR FERC	LJ	PL	SPS	MB / JT
001	03JAN17	RE-ISSUE FOR FERC	LJ	PL	SPS	MB / JT
000	14OCT16	ISSUE FOR FERC	LJ	PL	SPS	MB / JT

Figure 2.2-7
Typical Right-of-way: 48-inch & 30-inch, Wetland, No Parallel Feature

1"=10'

SIZE: ANSI_B 26101-100-R5-0000-00030 REV. 002



SPOIL SIDE (FT.)	WORKING SIDE (FT.)	CONSTRUCTION R.O.W. (FT)
40	60	100

* ISSUED FOR PERMITTING

NOTES:

1. DIMENSIONS ARE IN FEET UNLESS OTHERWISE NOTED.
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Figure 2.2-8
Typical Right-of-way: 36-inch, Upland, Parallel Feature

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DATE: 6-16-17	APPRV. BY: PCS
DWG. NO. 16141-PL-TYP-0003	REV A

06-16-17 9:49 16141 2 MFZ

The four pig launchers and receivers and 17 MLVs would be constructed within the boundaries of other facilities discussed above and would not have independent land requirements.

2.2.2.5 Access Roads

To the extent feasible, Driftwood would use existing public and private roads and the construction right-of-way as the primary means of accessing facilities during construction. In addition, Driftwood would improve or construct project-specific access roads, including 69 temporary roads that would be restored after construction unless otherwise specified by the property owner, and 28 permanent access roads which would remain during operation (see appendix A, table 2.2-3).

2.3 CONSTRUCTION SCHEDULE AND WORKFORCE

Subject to the receipt of an authorization from the Commission and all other applicable permits, authorizations, and approvals, Driftwood anticipates mobilizing for construction of the LNG Facility during the first quarter of 2019. The first liquefaction plant would be completed approximately five years after receiving the FERC Order. The remaining four liquefaction plants would be commissioned at intervals after completion of the first liquefaction plant, with full service anticipated after a total construction period of 86 months. DWPL anticipates construction of the Pipeline would begin approximately one year after receiving the FERC Order and proceed in three phases, continuing over about 30 months. Export of LNG could begin as soon as the first liquefaction plant and pipeline are completed.

2.3.1 LNG Facility

Commencing with mass earthworks, demolition, and dredging, the various construction phases and commissioning would occur over the majority of the following seven years, with LNG production and export operations occurring in the later portions of this period. Given this timeline, it is anticipated that the first LNG plant would be operating and the first cargo would be exported approximately five years after receiving the FERC Order. The remaining four plants would be constructed and commissioned in a phased manner after this first cargo date, with full service anticipated after a total construction period of 86 months.

Driftwood indicated prior to the draft EIS that construction activities at the LNG Facility site would primarily be conducted between 7:00 a.m. and 5:30 p.m. In a letter provided during the draft EIS comment period, Driftwood proposed to conduct construction 24 hours a day. This change is addressed further in Section 4.12.2.3 Construction Noise. Dredging would be conducted up to 24 hours a day. Pile driving with an impact driver would be conducted only between 7:00 a.m. and 7:00 p.m.

2.3.2 Pipeline

The Pipeline construction schedule has been established to ensure the ability to provide the required feed gas volumes needed to start up and operate the individual LNG plants that make up the LNG Facility. In this regard, as noted above, DWPL would construct the Pipeline in three phases to meet the LNG Facility's in-service dates. Engineering and detailed design of the Pipeline along with procurement of equipment and materials is expected to take at least two years from Project authorization. The facilities associated within each pipeline construction phase are depicted in figure 2.1-1.

DWPL proposes to construct the Pipeline in three phases to accommodate the commercial timeline of its potential customer(s) and to meet the LNG Facility's projected in-service dates. Each phase would have sufficient capacity to meet the requirements of the LNG Facility at the time of construction, i.e., phase

1 of the pipeline would have sufficient capacity to supply feed gas to up to three liquefaction plants, phase 2 would have sufficient capacity for up to four plants, and phase 3 would have sufficient capacity for up to five plants.

Compression has been designed to meet phase 3 requirements and would be installed in blocks to meet or exceed supply requirements, rather than installing only sufficient compression during phases 1 and 2 to meet phase-specific requirements. This approach eliminates the need for piecemeal development of incremental compression and results in excess compression during phases 1 and 2, which would provide redundancy and increase reliability of service.

Phase 1 of pipeline construction would take about 20 months to construct and commission, and would provide an estimated 2.27 Bcf/d (2,336,000 million British Thermal Units (BTU)/day based upon 1,029 BTU/scf heat rate) to the PDS. Phase 1 consists of about 50.8 miles of the 48-inch pipeline extending from the LNG Facility to an interconnect with Tennessee Gas Pipeline (TGP) (MS-07) near Kinder, Louisiana; 3.4 miles of 30-inch pipeline lateral between MP 36.5 (MS-05) and 39.9 (CS-01) of the 48-inch pipeline; CS-01 with three gas compressors of about 90,000 hp installed[8]; one delivery meter station (MS-01), and five receipt meter stations (MS-02 to MS-07);

Phase 2 of pipeline construction would take about 19 months to construct and commission, and would increase the Pipeline firm capacity to an expected total of 2.5 Bcf/d (2,573,000 million BTU/day) to the PDS. Phase 2 consists of the remaining 23.3 miles of 48-inch pipeline extending from an interconnect with TGP to an interconnect with ANR Pipeline up to MS-12 near Eunice, Louisiana; about 5.2 miles of the 42-inch pipeline extending from the ANR interconnect to an interconnect with Texas Eastern Transmission, LP (TETCO) near Egan, Louisiana (MS-12 to MS-13); CS-02 with one 20,500-hp gas compressor installed; and six additional receipt meter stations (MS-08 to MS-13).

Phase 3 of pipeline construction would take about 16 months and would complete the remainder of the Pipeline, bringing the nominal flow capacity to 3.8 Bcf/d (3,951,000 million BTU/day). Phase 3 consists of the remaining 5.4 miles of 42-inch pipeline extending from the interconnect with TETCO near Eunice, Louisiana, to DWPL's CS-03; about 11 miles of 36-inch pipeline extending from CS-03 to an interconnect with CGT (MS-14 to MS-15); additional 164,800 hp at CS-01, CS-02, and CS-03, with complete construction of CS-03; and 2 additional meter stations (MS-14 and MS-15).

Pipeline construction activities would be conducted between 7:00 a.m. and 7:00 p.m.; however, the horizontal directional drill (HDD) crossing method requires that pullback be conducted during one uninterrupted session, which may last 11 to 12 hours, depending on the length of the HDD, so nighttime work at some HDD crossings may be unavoidable. Driftwood would start HDD pullback early in the day to minimize nighttime work. In addition, some time-sensitive construction activities, such as hydrostatic testing, waterbody crossings, and tie-ins, could also require nighttime work. Noise impacts and mitigation for construction activities are detailed in section 4.12.2.2.

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[8] Three gas compressors would be installed at CS-01 but only two (60,000 hp total) are required for operations in Phase 1. The other 30,000 hp unit would be installed as a standby redundant unit to ensure consistent operations during startup in Phase 1 and is required in Phase 2.

2.3.3 Workforce

At its peak, Driftwood estimates construction of the Project would require about 6,430 workers (peak of 5,400 for the LNG Facility and 1,030 for the Pipeline, including 137 workers for construction of compressor stations). Driftwood also estimates about 30 percent of the Project's construction workforce would be hired locally – an estimated 1,929 workers (1,620 LNG Facility workers and 309 Pipeline workers). However, the percentage of local workforce would be dependent upon several factors at the time of construction, including the availability of local workers, the timing of need for different skilled trades, and the timing of construction for other proposed or ongoing projects in the study area. For purposes of this document, local workers are defined as those who reside 60 miles or less from the Project. The balance of workers (currently estimated at about 4,500 workers) would be sourced from outside the 60-mile commuter shed and would presumably relocate to the area for the duration of their employment by the Project.

2.4 ENVIRONMENTAL COMPLIANCE

The FERC may impose conditions on any Certificate or authorization it grants for the Project. These conditions include additional requirements and mitigation measures recommended in the EIS to minimize the environmental impact that would result from construction and operation of the Driftwood LNG Project (see sections 4 and 5 of this document). We will recommend that these additional requirements and mitigation measures (bold type in the text of the EIS) be included as specific conditions to any approving Certificate or authorization issued for the Project. We will also recommend to the Commission that DWLNG and DWPL be required to comply with the mitigation measures proposed as part of the Project unless specifically modified by other Certificate or authorization conditions. DWLNG and DWPL would be required to incorporate all environmental conditions and requirements of the FERC Certificate, authorization, and associated construction permits into the construction documents for the Project.

Driftwood would use Environmental Inspectors (EI) during construction to help with the environmental training process. The Project-specific environmental conditions would also be reviewed with prospective subcontractors during pre-bid meetings and would incorporate such conditions into construction bid documents. EIs would be used during the construction phase of the Project and would be responsible for monitoring compliance with the Driftwood Plan and *Wetland & Waterbody Construction & Mitigation Procedures* (Driftwood Procedures) (as outlined in paragraph II.B of the Driftwood Procedures), environmental conditions of FERC Order, and other Project-developed documentation, as well as federal, state, and local authorizations. EIs would have stop-work authority on activities where the potential to violate environmental conditions and mitigation measures could occur. In addition to monitoring compliance, the EIs would assist with report compliance on an as-stipulated basis. Use of EIs would include one EI per construction spread of the Pipeline construction and a minimum of one EI for LNG Facility construction. Specific responsibilities would include the following:

- overseeing the contractors' implementation of all environmental conditions described in applicable permits, authorizations, and approvals for the Project;
- communicating and coordinating with the Project Coordinator as needed;
- overseeing the installation and removal of erosion control measures;
- overseeing crossings of waterbodies, and wetlands, including any deviation from the Driftwood Procedures;

- overseeing the re-vegetation and restoration of right-of-way areas, including reseeding;
- notifying the Construction Manager of all needs for supplemental field-support personnel (biologists, archaeologists, paleontologists, etc.);
- coordinating with the cultural resources monitor on use of the *Unanticipated Discoveries Plan* (UDP), providing notification to the Construction Manager, and ensuring that the exclusion zone is installed and maintained if necessary;
- conducting onsite environmental training of construction personnel;
- completing Daily Environmental Inspection Reports, including updating photographic documentation, and submittal to the Environmental Project Coordinator;
- overseeing contractor spill response, including reports listing material(s) involved;
- overseeing the installation of all Project signs and environmental flagging;
- accompanying all agency personnel who visit the Project;
- attending pre-construction training and studying all Project documents when requested; and
- performing detailed reconnaissance of the right-of-way and access roads ahead of, during and after construction activities.

Prior to the start of pipeline construction activities, Driftwood's Environmental Project Coordinator and EIs would conduct environmental training for construction contractors. This training would provide a Project overview and would focus on personnel organization, communication and coordination, compliance requirements, construction and safety procedures, and other related Project issues and protocols. Site-based personnel would receive training that is specific to the site and to their respective job position or trade and the Driftwood Plan and Procedures. Craftsmen, staff, and subcontractors would participate in a site-specific induction that would be formally facilitated and cover essential topics relating to environmental training for approved workspaces, environmental constraints, and hazards, notification procedures and spill response. This forum would provide an avenue to introduce employees to FERC-specific procedures or requirements in unison with Driftwood-developed procedures with which Project personnel would be expected to comply.

FERC staff would conduct field and engineering 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.

2.5 CONSTRUCTION PROCEDURES

The Project would be constructed according to the Driftwood Plan, posted to the FERC Docket as pages 3-21 of Appendix 1D-1 Project Specific Plan and Procedures (FERC eLibrary accession number 20170331-5058), which incorporates the FERC *Upland Erosion Control, Revegetation and Maintenance Plan* (FERC Plan; FERC, 2013a) and the Driftwood Procedures, posted to the FERC Docket as pages 22-

48 of Appendix 1D-1 Project Specific Plan and Procedures (FERC eLibrary accession number 20170331-5058), which incorporates the FERC *Wetland and Waterbody Construction and Mitigation Procedures* (FERC Procedures; FERC, 2013b).

2.5.1 Alternative Measures to FERC's Plan and Procedures

Driftwood has proposed alternative measures to the FERC Plan and the FERC Procedures. These measures and equivalent protective measures are provided within the Driftwood Plan and Procedures and summarized as follows:

Section V.A.1 of our Plan states that cleanup operations should commence immediately following backfill operations. DWPL has proposed delaying cleanup operations where access to the right-of-way and/or direct access to the Pipeline is required to conduct hydrostatic testing, pigging to dry, caliper pig anomaly, cathodic protection installation, fiber-optic installation and testing, parallel or lateral pipeline installation, and/or tie- in connections. During the interim period, environmental and safety mitigation measures would be maintained and inspected. Where right-of-way access is required, timber mats would remain in place. Erosion and sediment control measures would remain in place. These alternative measures would avoid the need to disturb and restore the right-of-way for the exempted activities. See section 4.2.4.2 for our discussion of this proposed alternative measure and recommendation.

Section I.B.1 of our Procedures states that the term "waterbody" includes any natural and artificial stream, river, or drainage with perceptible flow at the time of crossing. DWPL has proposed that man-made drainage features, such as agricultural ditches and canals in fields and pastures and roadside drainage ditches not be treated as "waterbodies," as defined in this section. Because these waters are not typically considered Waters of the U.S. and do not fall under jurisdiction of the CWA and because these waters are typically used by landowners on an as-needed basis to facilitate agriculture and drainage practices, we find that not treating man-made drainage features as "waterbodies" as defined in this section is reasonable and adequately justified.

Section I.B.2 of our Procedures states that the term "wetland" includes any area that is not in actively cultivated or rotated cropland and that satisfies the requirements of the current federal methodology for identifying and delineating wetlands. DWPL has requested that cultivated tree farms not be treated as "wetlands," as defined in this section. Because the agricultural practices associated with tree farms in this region modify hydrology and wetland status depending on the stage of the timber and because cultivated tree farms represent low-quality wetland habitat even during the saturated hydrology stage, we find that not treating cultivated tree farms as "wetlands" as defined in this section is reasonable and adequately justified, provided that DWPL complies with the conditions of its COE permit, including the implementation of compensatory mitigation.

Section II.A.2 of our Procedures states that the construction right-of-way should be limited to 75 feet or less in wetlands. DWPL has requested that a standard construction width of 110 feet within wetlands be authorized, as shown in project-specific alignment sheets to support the safe and efficient installation of large-diameter pipeline. DWPL has stated that the extra width is necessary to support the installation of large-diameter pipe, which requires sufficient space to safely maneuver construction equipment. Because of the need to maintain slope stability of the large trench required for the large-diameter pipeline and to maintain excavated spoil within the right-of-way, we find this alternative measure to be acceptable for 42-inch-diameter pipeline constructed across wetlands greater than 500 feet long, and for construction of 48-inch-diameter pipeline. Because 36-inch pipeline and 42-inch-diameter pipeline constructed in wetlands less than 500 feet long requires a smaller trench and a smaller amount of excavated spoil, we find that a 75-foot right-of-way should be adequate.

Section IV.A of our Procedures states that all equipment must be parked overnight and/or fueled at least 100 feet from a waterbody or in an upland area at least 100 feet from a wetland boundary and that hazardous materials, such as fuels, must not be stored within 100 feet of a wetland, waterbody, or designated municipal watershed area, unless the location is designated for such use by an appropriate governmental authority.

DWPL has requested that fuel trucks required to transport fuel to and load fuel into heavy construction equipment be authorized to remain onsite in an area implementing secondary containment, spill prevention materials, EI inspection procedures, and operator training. The fuel trucks and bulk-fuel storage would not remain overnight within 100 feet of waterbodies or wetlands. Because this alternative measure would avoid the risk of unanticipated leaks and/or spills associated with the long traverses of wetlands needed by the required access roads, we find this alternative measure to be acceptable.

DWLNG has requested that large equipment and equipment working from barges be allowed to refuel in place, rather than attempting to move it away for refueling or storage. Fuel tanks would be provided with secondary containment, and refueling would be in accordance with the Project-specific construction SPCC Plan. Because this alternative measure would avoid the risk of unanticipated leaks and/or spills associated with frequent on- and off-loading of heavy equipment from work barges, we find this alternative measure to be acceptable.

Section V.B.2.b of our Procedures states that all extra work areas must be located at least 50 feet away from water's edge, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land. During initial review of the pipeline workspace, staff identified several workspaces within 50 feet of water's edge that were subsequently relocated to upland locations with sufficient setback; however, because of the abundance of wetlands and waterbodies in the region, upland locations with sufficient setback were not universally available. DWPL has requested that ATWS that must be located with a less than 50-foot setback from the water's edge be allowed and has provided site-specific justification of each ATWS in table 2.2-2 in appendix A. Best management practices (BMPs) would be used at each ATWS, including silt fencing, mulching, rock armoring, and drainage conveyances. In general, this alternative measure would reduce overall impacts on wetlands by reducing the amount of equipment required at each site, reducing the length of residence time of that equipment, and reducing the distance traveled and the associated risk of unanticipated leaks and/or spills. For the reasons provided in table 2.2-2 in appendix A, we find that the proposed locations for this workspace are sufficiently justified.

In addition to the Driftwood Plan and Procedures, Driftwood would develop and implement a Project-specific Construction Environmental Control Plan prior to construction. This plan would be developed following the Driftwood Plan and Procedures so that all environmental and other compliance requirements are achieved during construction of the Pipeline and during reclamation activities. Additionally, copies of other Project-specific construction management plans, such as the *HDD Contingency and Fluid Monitoring Plan* (HDD Plan), *ESCP*, *Construction SPCC Plan*, and *Fugitive Dust Management Plan* are also provided in the Construction Management Plans (FERC eLibrary accession number 20170331-5058). Driftwood would ensure that all Project personnel are trained and understand these requirements prior to initiating work on the Project.

We received a comment on the draft EIS requesting that a Pipeline alignment be considered that fully conformed to the FERC Plan and Procedures. FERC's Plan and Procedures are designed to avoid and minimize impacts on wetlands, waterbodies, and other natural resources in typical habitats throughout the United States. Alternative measures are frequently required to adapt the Plan and Procedures to specific habitats. The southern Louisiana setting contains abundant wetland habitat, which makes identification of a route for a 96-mile, large-diameter pipeline that avoids the need for alternative measures unlikely. Please see section 3.6.1 for additional details on route alternatives.

2.5.2 LNG Facility

2.5.2.1 Site Preparation

The LNG Facility site is a combination of historically undeveloped land and developed land of recent industrial use or brownfield components from a previous pipe-spool fabricating facility. Existing buildings and other structures in the brownfield area would be demolished and repurposed on site for temporary construction needs, such as underlayment, fill, or similar uses. If these components cannot be used on site, DWLNG would evaluate recycling options for useful materials like steel. Vegetation in the previously undeveloped areas would be cleared and grubbed.

2.5.2.2 Drainage System

Drainage would be constructed and erosion and sediment controls installed according to the site plans and the ESCP. Process areas and areas below the pipe racks containing LNG would be paved to allow collection and diversion of any LNG spills to the LNG spill-containment sump. Non-process areas would be suitably finished (e.g., paving, gravel, and open grass), based on equipment and area use.

2.5.2.3 Pioneer Docks

Three separate Pioneer Dock locations are also proposed by DWLNG. Pioneer Docks are considered to be temporary in nature as they would be demobilized from the property once their useful operation has concluded. The Pioneer Docks would be comprised of a spud barge with an approximate size of 120 feet by 35 feet by 8 feet aligned parallel and as close to the shoreline as possible. Mooring pile(s) would be installed off of each end of the spud barge to provide mooring for securing the cargo barge while it is being off-loaded. The first Pioneer Dock would be placed immediately south of the MOF but north of the Bollinger Shipyard Facility property line. The second and third Pioneer Dock locations would be on the southern end of the property currently controlled by the Port Authority of Lake Charles off the Intracoastal Waterway (ICW). Minor dredging would be required to establish required depth for barges adjacent to these docks. The Pioneer Docks would be used to offload bulk aggregate and imported fill to support concrete operations and general earthworks cut-and-fill activities.

2.5.2.4 Dredging of the Marine Facilities and MOF

The marine berth would be placed in a dredged slip, positioned with adequate recess from the Calcasieu Ship Channel and designed to accommodate the safe berthing and un-berthing of three LNG carriers up to 216,000 m^3 each. The marine berth would be designed to a water depth of 46 feet below NAVD88, with an additional 2 feet of advance maintenance dredging resulting in a water depth of 48 feet below NAVD88, plus approximately 2 feet of over-dredge accommodation.

The MOF would be located in a dredged slip with direct access from the Calcasieu Ship Channel. The MOF would be designed to a water depth of up to 18 feet below NAVD88, with an additional 2 feet of advance maintenance dredging giving a total depth of 20 feet below NAVD88 at the MOF area plus approximately 2 feet of over-dredge accommodation.

Dredging activities would take place in phases. First, construction of two of the three Pioneer Docks (above) would require a combined total of 30,000 m^3 (40,000 yd^3) of mechanical dredging to establish required depth for barges adjacent to these docks. This material would be dewatered and managed onsite.

Then, the MOF would be excavated "in the dry" from land out to near the water's edge leaving a temporary barrier in place. This land-based excavation would involve excavation of the first level of good-quality soils, generally above the saturated zone, down to a depth of -12 feet NAVD88. About 15,000 m^3 (20,000 yd^3) would be excavated from the MOF. In their comments on the draft EIS, Driftwood has requested a change from cutterhead suction dredging to the use of mechanical dredging; we have determined that this change in dredging method would not affect the environmental impact of the Project and have incorporated this change in the final EIS. Once the final depth has been reached, mechanical dredging would be used to remove the temporary barrier and complete the final dredging of the MOF, removing 115,000 m^3 (150,000 yd^3) of additional material for a total combined excavation and dredging from the MOF of 130,000 m^3 (170,000 yd^3). This material would be dewatered and managed onsite.

Concurrently, the marine berths would first be excavated "in the dry" from land using conventional excavation equipment to remove materials down to -12 feet NAVD88 within 75 to 100 feet of the water's edge, leaving an earthen barrier between the land-based excavation and the water's edge. Ground water collected and pumped during construction (dewatering) would be discharged to surface locations. Driftwood would employ best management practices to reduce erosion and sedimentation due to dewatering as noted in their ESCP, and volumes of water and pumping rates would not exceed limits for dewatering required by LDEQ. Additional discussion regarding dewatering is found in Section 4.3.2.1. The land-based excavation of the marine berth is expected to remove about 1.1 million m^3 (1.5 million yd^3) of earthen material, which would be used, along with the material from land-based excavations from the MOF and dredging of the Pioneer Docks, within the LNG Facility site for site grading and to construct the earthen berm. Once the marine berth land-based excavation is completed, the cutterhead suction dredge would be used to remove the temporary barrier and complete the final dredging of the marine berth, removing an estimated 5.2 million m^3 (6.8 million yd^3) of dredge material, which would be managed offsite as discussed below.

2.5.2.5 Construction of the Earthen Berm

Construction of the earthen berm for storm surge protection and the marine facilities would commence early in the overall construction sequence. About 1.1 million m^3 (1.5 million yd^3) of unsaturated materials would be generated from the land-based excavation of the marine berth and the MOF areas. This material would be trucked from the excavated area and redistributed on site to construct the earthen berm and raise site elevations. Close coordination between the berm construction and broader LNG Facility works would help prevent each work area from becoming overly congested and restricting access and egress. An additional approximately 2.0 million yd^3 of fill would be required for raising the site elevation and constructing the perimeter earthen berm. It is anticipated that this fill would be imported, primarily using 1,500-ton capacity barges that would be offloaded at the Pioneer Docks.

2.5.2.6 Management of Dredged Material

With the exception of the material from the Pioneer Docks and the MOF, Driftwood has elected to contribute the remaining 5.2 million m^3 (6.8 million yd^3) of dredge material to offsite areas designated for Beneficial Use of Dredged Material (BUDM), in accordance with Louisiana state law (Louisiana Administrative Code [LAC] 43:724) and consistent with the State of Louisiana, Master Plan for Coastal Protection and Restoration and the goals of the Chenier Plain Coastal Protection and Restoration Authority.

Driftwood would contribute to up to 10 BUDM sites that have been designated and established along the ICW, about 1.8 to 8.5 miles southwest of the LNG Facility. The material would be used to build and restore degraded coastal wetlands. According to Driftwood's preliminary calculations, about 56 percent of the marsh within the BUDM areas has been converted to open-water areas, and the material they propose to contribute has the potential to create/restore about 4,400 acres of saltmarsh.

Dredged material from the cutterhead-suction dredging of the Marine Berth would be pumped in a slurry form from the dredging location to BUDM areas through a pipeline. The slurry pipeline would be laid temporarily on top of existing upland and marsh in a fashion that would minimize temporary impacts. The BUDM areas farthest from the LNG Facility would be reached by floating the slurry pipeline in the ICW, anchored behind the existing rock embankment along the north side of the ICW to eliminate impacts on vessel traffic.

The dredged material would be pumped in slurry form into shallow, open-water areas within the BUDM areas to an initial elevation of 3.5±0.5 feet NAVD88. Ultimately, the BUDM areas are expected to continue settling to reach an elevation of 1.8±0.5 feet NAVD88 by year 5, at which time the top of marsh elevation is estimated to be at mean high water. Dikes would be constructed with in-situ material to contain dredge material and would be designed to an initial build height of 4.5±0.5 feet. The containment dike height would be determined based on procedures defined in COE Manual EM 1110-2-5027, Confined Dredged Material Disposal, as well as experience on similar projects in coastal Louisiana.

Sediment and turbidity within each BUDM area would be managed by using multiple proven techniques common to marsh-creation projects. Dewatering locations would be constructed to allow a controlled discharge of water and drying/settlement of the dredged material. Decant structures for each BUDM area would be placed adjacent to existing emergent vegetation, which would serve as natural filters and trap fine particles that exit the site. Prior to placement of dredged materials, silt curtains and/or hay bales would be placed in front of each decant or weir structure to reduce the amount of sediment exiting the BUDM areas.

Vegetative plantings would be conducted along newly constructed containment dikes to reduce wave-induced turbidity. Post-construction vegetative planting would occur within the mitigation area to reduce runoff by trapping sediment. Additional vegetative plantings would be conducted in the remaining BUDM areas on the interior of each decant structure at the time of construction to reduce the chance of increasing turbidity to adjacent waters. These plantings would help trap fine particles before they exit the site while the BUDM areas are revegetating by natural recruitment.

Because the BUDM sites have been assessed and established (including permitting) under an existing program, and the Driftwood LNG Project's action is limited to contribution to that existing program, the environmental analysis presented in this final EIS does not analyze the development of the BUDM sites; the extent of the analysis herein concludes with the generation of the dredge material.

Characterization of environmental impacts and approvals for construction of the BUDM sites fall under the purview of the COE, NMFS-Habitat Conservation Division, and LDNR Office of Coastal Management (OCM), and are separate from this final EIS. In coordination with these agencies, Driftwood has developed a BUDM Plan, which was submitted to the COE with the Section 10/404 permit application in March 2017.

2.5.2.7 Shoreline Protection

The sides of the marine berth would be contoured to a stable slope (about 3:1) and properly protected from scour and erosion using a combination of concrete riprap materials.

The MOF bulkheads would be constructed using a combi-wall system, that is intermediate sheet piles and king piles, with a total bulkhead length for both berths of about 1,020 feet. An additional 160 feet of retaining sheet pile wall would be used for non-bulkhead areas. In addition to the bulkhead, two crane pads and one relieving platform would be constructed using a combined total of 76 pre-stressed 14-inch concrete piles. An additional 16 steel 48-inch pipe piles would be used to construct three separate mooring dolphins for the MOF. Finished grade elevation around the MOF would be at 8 feet above NAVD88, and would be designed to allow offloading of the required materials and equipment.

2.5.2.8 Construction of Jetty Platforms and Breasting and Mooring Structures

Jetty platforms and breasting and mooring structures within the marine facilities would be constructed on piles and composed of concrete and structural steel. A combination of sheet pile and steel pipe piles, roughly 122 feet in length, would be installed to support these structures. These structures would be sized and detailed to satisfy all safety and operational requirements for the LNG loading. Pile driving would be performed once excavation and dredging has been completed and would be performed in the water.

2.5.2.9 LNG Facility Foundations and Pile Driving

The foundations for equipment, buildings, and pipe racks would be installed on piles. Precast concrete piles 14 and 18-inch square by 100 feet long would be used to support LNG Facility infrastructure. Lightly loaded structures and equipment would be either soil supported or supported on timber piles. Piles would be installed in a manner to efficiently complete piling operations on a schedule that would best support the subsequent construction activities. For this final EIS, we have assumed that piles would be driven by up to 12 diesel-driven impact hammers, which would generate high-intensity noise and in the air and high-intensity overpressure in the water. Driftwood estimates that 48,000 land-based piles and 420 water-based piles would be required. Steel sheet bulkhead would be driven by vibratory hammer and hydraulic pile-driving methods. After pile installation is complete, pile caps would be installed at the top of each pile. These would consist of form work, rebar installation, and concrete pours. Structural assemblies may be prefabricated off site and erected upon arrival.

2.5.2.10 Pipe Racks and Piping

Horizontal pipe support racks would be installed after the pile caps. Pipe spool fabrication would primarily be off site. A portion of the straight-run pipe would be field-fabricated prior to placement on the pipe racks. Pipe would also be painted to the maximum extent at the shops, after shop welds have been tested according to the applicable codes.

2.5.2.11 Materials and Equipment Delivery

During construction of the LNG Facility, barges and support vessels would deliver construction materials and large equipment to the MOF and Pioneer Docks. Other material and equipment would be transported to the site by truck.

Pioneer Docks would be established at the LNG Facility early in the construction process for use in offloading barged shipments of construction materials. One pioneer dock would be located to the north of the Marine Facility berth near the two concrete batch plants and would receive deliveries of aggregate, sand, and cement to supply concrete production, along with granular materials such as road base and crushed rock. Driftwood estimates that beginning in the second quarter of the construction period and continuing for approximately one year, about two barges per day would make deliveries at this dock. For approximately four years following that period, fewer deliveries would occur; between one to five barges per week.

Two pioneer docks would be located south of the Marine Facility and would receive barged deliveries of soils for construction of the perimeter earthen berm and raising site elevation. Deliveries at these docks would generally be in the form of 6-pack barges (i.e., each visit involves six barges). Driftwood estimates that during the second quarter of the construction period, about three 6-barge deliveries would occur each week. For approximately one and one-half years following that period, about six 6-barge deliveries would occur each week. For approximately four years following that period, about one 6-barge delivery would occur each week.

The MOF would be used to allow large equipment to be delivered to site by barge to reduce potential traffic congestion on roads near the site. The MOF would be completed by the first quarter of the construction period and would be capable of receiving barges and ships delivering equipment; bulk construction materials, such as precast concrete piles, steel, pipe, and pipe spools; and pre-assembled components. Where practicable, large equipment would be delivered to the site in pre-assembled packages for final hook-up and testing. Equipment would be designed, fabricated, and tested by qualified specialist suppliers, at their respective facilities, and shipped to site after the necessary inspections have taken place and the equipment is released. Larger equipment, including the cold boxes, would arrive on vessels; be offloaded at the MOF on multi-wheel, self-propelled modular transporters; and be transported to their foundations.

Until the MOF becomes available, materials would be delivered to the LNG Facility site’s existing barge slip. Driftwood estimates that for approximately 9 months following the second quarter of the construction period, the existing barge slip would receive about two barge deliveries per week. When the MOF becomes available, it is anticipated to receive an average of 2 to 2.5 barge deliveries per week, declining to one barge delivery every other week.

2.5.2.12 Temporary Construction Facilities

Construction facilities would be strategically placed within the 718-acre property (figure 2.2-1). Construction grounds for laydown areas and storage for equipment and plant components would be minimally improved to allow for safe transport of the materials using heavy machinery, trucks, forklifts, or cranes as required. Fences, gates, and appropriate security checkpoints would be installed where necessary to secure the storage laydown areas.

Temporary construction offices and/or trailers would be constructed on site to provide necessary offices for administrative, construction, and engineering staff. Warehousing would be provided to secure and protect stored materials that may be adversely affected by exposure to weather, rain, sun, or temperature extremes. A dedicated area would be established for the maintenance of machinery and vehicles. Lubricating oils, hydraulic oil, and other hydrocarbons would be properly stored to protect the environment from accidental spills.

In addition to the onsite construction areas, DWLNG would use offsite pre-assembly and laydown areas. The Project would use two previously established industrial fabrication facilities, an approximately 80-acre site at the Chennault Airport and an approximately 28-acre site on property immediately adjacent to the LNG Facility north of Burton Shipyard Road, for pre-assembly of project components. Minor temporary upgrades and modifications, such as clearing, grading and soil stabilization would be required. Additionally, portions of the park-and-ride locations may be used for additional offsite pre-assembly and laydown areas.

2.5.2.13 Liquefaction Plants

Installation of the equipment would proceed at the same time as the installation of piperack piping. Construction of other necessary facilities and buildings, as well as foundations and major utility equipment, would commence upon initial construction of the liquefaction units. Emphasis would be placed on coordinating the arrival of the major equipment with the completion and curing of the respective foundations so that the equipment can be positioned on its foundation upon arrival to avoid double-handling and the need for intermediate onsite storage.

The control and maintenance buildings would be constructed simultaneously with the liquefaction facilities.

2.5.2.14 LNG Storage Tanks

The three aboveground LNG storage tanks would be constructed sequentially in dedicated areas within the LNG Facility site. Construction would be coordinated to ensure that sufficient LNG storage capacity would be available as LNG plants 1 through 5 were brought into service. Tanks would be hydrostatically tested and placed into service upon completion.

2.5.2.15 Utilities

During construction, DWLNG would use the existing water and electric utility connection infrastructure on the LNG Facility site established by the former tenant to service construction activities. DWLNG would tie into the municipal water system to draw the approximately 250 gallons per minute (gpm) of water that would be required at peak for potable, utility, concrete, and piping hydrotest water requirements. Municipal water from the Calcasieu Parish Water Supply District No. 9, a source that derives its water via groundwater withdrawal, would be supplied to the LNG Facility via an existing 10-inch-diameter water line within the site boundary. During peak construction, approximately 360,000 gallons per day of municipal supply would be required for potable, utility, concrete, and piping hydrostatic test water requirements. Additionally, DWLNG would use water from the Calcasieu River as a source of hydrotest water for testing the LNG storage tanks. Onsite tankage would be provided to buffer the peak water requirements. Hydrostatic testing of LNG Facility piping would require a total of about 500,000 gallons of this water. Power required for construction activities would be coordinated with the power supplier and installed (as a non-jurisdictional facility) to meet the Project's power requirements to various locations on the site.

During construction, water would be used for dust suppression, soil compaction, general washing, and concrete production. Temporary tankage would be established to allow stockpiling of water during times of low use/need. Water for dust suppression would be obtained from impounded stormwater, drawn from the Calcasieu River, or sourced from the municipality. Water for other uses would be obtained from excavation dewatering, extraction from the Calcasieu River, and/or purchased from the local municipality using the existing utility connection infrastructure on the site. During LNG Facility operations, about 260,000 gallons per day of municipal water would be used for potable services (e.g., lavatories, kitchens, and emergency showers and eyewash stations), utility uses (unit washing), and to fill the firewater storage tanks.

2.5.2.16 Hydrostatic Testing

Prior to commencement of operation, the Project would require hydrostatic testing of the plant piping and the LNG storage tanks. Testing of the piping would require about 500,000 gallons of water, and water would be held within the piping for up to 72 hours. Source water for the hydrostatic testing would be provided by Calcasieu Parish Water District No. 9. Hydrostatic test water volumes and sources are summarized in table 2.5-1. No chemical additives would be used in the water during hydrostatic testing. Upon completion of testing, the hydrostatic test water would be discharged on-site according to the Driftwood Procedures. Mitigation measures would be implemented to prevent erosion and scour according to the LDEQ LPDES General Permit for Discharges of Hydrostatic Test Water.

Upon completion, each of the three LNG storage tanks would be hydrostatically tested, using about 38.6 million gallons of water for each LNG storage tank for a total volume of about 116 million gallons. Testing would be carried out at separate times for each tank, as the phased construction and in-service schedule would not support cascading water from one tank to another for reuse. Hydrostatic test water for each LNG tank would be withdrawn from the Calcasieu River over a 21-day period. Multiple floating suction lines would be used to draw water for hydrostatic testing from the Calcasieu River. These suction lines would be removed upon completion of the activity. Water would be held over a 24-hour period and then drained back to the Calcasieu River over a 13-day period. If necessary, a short-lived biocide, such as sodium or calcium hypochlorite, may be added to the water to control biological growth during testing. If such biocides are used, sodium bisulfite would be added to the test water prior to discharge to neutralize residual chlorine to minimize impacts on biological flora in the receiving water. All water would be tested and treated, if necessary, and discharged to the Calcasieu River in a controlled manner and according to the LDEQ LPDES General Permit for Discharges of Hydrostatic Test Water.

In addition to hydrostatic testing, LNG tanks may be power-washed to remove residual salt and silt off the tank walls. As the hydrostatic test water is being discharged from each tank, a crew would be stationed inside the tank to power-wash the tanks according to vendor specifications. The freshwater rinse would be supplied by the Calcasieu Water District No. 9 and would be accomplished from a number of small boats. Water would be discharged upon completion according to the LDEQ LPDES General Permit for Discharges of Hydrostatic Test Water.

2.5.2.17 Traffic Controls

Four independently operated park-and-ride facilities would be available near the LNG Facility to provide parking and bussing for site-based construction personnel. Figure 2.2-2 provides the locations for those facilities. Bussing from these facilities is intended to reduce the vehicle volume that would interface with the local community on a daily basis to the LNG Facility. During peak hours, typically around shift start (7:00 a.m.) and shift end (5:30 p.m.), material deliveries to the Project site would be managed so as not to compound local traffic conditions as reported in the Traffic Management Plan (FERC eLibrary accession number 20170331-5058). This may include DWLNG-stipulated delivery curfews to manage vehicles on the road.

Roadway Traffic

Highway 27, which extends south from Sulphur, Louisiana, is the nearest major roadway that would provide access to the area. Burton Shipyard Road, which intersects with Highway 27, would serve as primary access into the LNG Facility site. Secondary access would be via Global Drive. Driftwood commissioned a traffic impact study to determine the optimal access road design, traffic access patterns, and to aid in the design of any additional mitigation measures needed. Based on Driftwood's Traffic Impact Study (FERC eLibrary accession number 20170621-5139), Driftwood has committed to coordinating the following construction projects as mitigation for current and projected traffic issues near the LNG Facility:

- Improvements to Burton Shipyard Road, including a right-hand turn lane to the north onto Highway 27 and a left-hand turn lane on Highway 27 for traffic turning onto Burton Shipyard Road.
- Connecting Olsen Road directly to Highway 27 to allow local traffic to avoid Burton Shipyard Road.

DWLNG is engaged in ongoing discussions with Calcasieu Parish Police Jury and LADOTD officials with respect to plans for mitigation measures to be implemented to minimize traffic impacts, including improvements to Highway 27.

Marine Traffic

Much of the large equipment would be delivered to the site via water-based methods (i.e., barge and tug) to the Pioneer Docks and the MOF. Marine delivery would further reduce potential traffic congestion on roads near the LNG Facility.

Site Security

Security patrols would be performed to see that the established fence lines, laydown yards, and work areas are only accessed by authorized personnel. Visitors to the site would receive an abbreviated induction and would be assigned an escort for the duration of their stay. An indicative location map of the anticipated temporary facilities is included as figure 2.2-1.

2.5.2.18 Commencement of Operations

The Project schedule would be driven by the mechanical completion and pre-commissioning requirements.

The system completion and turnover packages would be scoped by startup personnel and populated during construction and pre-commissioning as test records are completed. A turnover coordinator would supervise the systems completion and turnover packages, which may include the following documentation:

- marked-up drawings to show the limit of the system and the location of blinds;
- line list by system with pressure testing documentation;

- list of equipment including motors with data sheets and inspection reports;
- marked-up single-line diagrams with inspection/test reports for electrical equipment;
- cable reports;
- instrument index with data sheets and calibration sheets;
- loop diagrams;
- applicable vendor documentation/drawings;
- turnover exception lists; and
- detailed punch list(s), if any.

As the piping installation, hydrostatic testing, pneumatic testing, and equipment erection work is concluded, the density of craft personnel and construction equipment within each of the areas would be reduced. The balance of the painting and insulation work would then be completed, starting with the pipe racks and then the process and utility areas.

2.5.2.19 Site Restoration

For each construction area where equipment and piping have been installed, final road paving, site grading, landscaping, and site cleanup would commence. The temporary construction facilities would be demobilized when they are no longer needed.

2.5.3 Pipelines

2.5.3.1 Mainline Pipeline

DWPL would conduct construction activities according to applicable federal and state regulations and guidelines, as well as the specific requirements of applicable permits. Prior to initiating construction-related activities, DWPL would secure right-of-way easements or other required authorizations from landowners whose properties would be crossed by the Pipeline route. Owners, tenants, private land lessees, and lessees and managers of public lands along the right-of-way would be notified in advance of construction activities that could affect their property, business, and/or operations.

DWPL's construction contractor would construct the Pipeline along the construction right-of-way using sequential pipeline construction techniques, including survey, staking, and fence crossing; clearing and grading; ditching; pipe stringing, bending, and welding; lowering-in and backfilling; hydrostatic testing; cleanup and restoration; and commissioning. Conventional overland installation of the pipeline is essentially a moving assembly line with a construction spread (construction crew and equipment) proceeding along the construction right-of-way in a continuous operation. The majority of the Pipeline construction process would be accomplished using conventional dry open-cut methods, which typically include the steps described in the following paragraphs. The proposed methods for accomplishing Pipeline installation across wetlands and waterbodies, as well as other specialized construction procedures, are also described in the following paragraphs describing special construction procedures.

Right-of-Way Survey

Prior to the start of construction, land surveys would be conducted and the Pipeline centerline and the boundaries of the construction workspace would be marked with stakes. Access roads would be clearly marked using temporary signs or flags. Existing utility lines, other sensitive resources, and areas to be avoided during construction as identified in landowner easement agreements or by federal/state/local agencies, would be located and marked to prevent accidental damage during Pipeline construction. As noted, prior to construction, DWPL's contractors would contact the "Call Before You Dig" or "One-Call" system to verify and mark all utilities along the Pipeline workspaces to minimize the potential for damage to other buried facilities in the area.

Clearing and Grading Operations

After completion of the surveys and staking, large obstacles, such as trees, rocks, brush, and logs, would be removed from the right-of-way and ATWS areas. Timber and other vegetative debris may be chipped into mulch for use as erosion control or otherwise disposed according to applicable local regulations and landowner requirements, which may include burning when allowed by authorities and the landowner.

The entire width of the construction work area, including the construction right-of-way and ATWS, may be rough graded as necessary to allow for the safe passage of equipment and to prepare the work surface for pipeline installation activities. Typically, the grading of the construction work areas would be completed with bulldozers and excavators. Where needed for erosion control, BMPs would be used as needed along the construction right-of-way and would be properly maintained throughout construction. BMPs would remain in place until permanent erosion controls are installed or restoration is completed.

Stringing

Pipe would typically be transported by truck from the contractor or pipe yards to the right-of-way. Sections (joints) of straight steel pipe, generally either 40, 60, or 80 feet long, would be placed in a single, continuous line (termed stringing) within the construction right-of-way. Certain areas including all crossing areas, areas where bends are required, width-restricted areas, and others may require multiple joints of pipe to be strung together to create drag sections and crossing sections. It is anticipated that most of the pipeline stringing would take place within the existing construction right-of-way.

Bending

Bending of pipe joints can be done both at the manufacturer (commonly referred as hot bend) or on the right-of-way (commonly referred as field bend). The bending technique used is dependent on the pipe diameter, pipe thickness, and bend angle. Hot bends are typically complex, large-angle bends or numerous bends of the same kind. The bends can be manufactured to meet the known or expected angle requirements, or they can be manufactured with higher fabrication tolerances that would allow them to be segmented in the field by the contractor to the degree needed at each location. Field bends are typically bent on the right-of-way to allow the pipeline to follow the natural grade and direction changes of the right-of-way. Bending would be accomplished using track-mounted hydraulic bending machines. Hot induction bends would be used along the pipeline where cold field bending at horizontal and vertical directional changes it is not practical.

Hot bends would also be considered for the above / below ground transitions at the pigging station inlets and outlets.

Welding

The pipe joints would typically be aligned, welded together into a long segment, and placed on temporary supports (known as “skids”) at the edge of the ditch. Welders would use multiple passes to complete a full penetration weld. DWPL would only use experienced welders who are qualified according to applicable American Welding Society, American Society of Mechanical Engineers (ASME), API standards and pass a project specific welding test. A front-end welding crew would perform the first step, which would be to prepare the end bevels, align the pipe for welding and complete at least the first two passes in the multi-pass welding process. Back-end welders would perform the second step, which would be to complete each weld started by the front-end welders. The pipe would be welded into long strings to minimize the number of welds that have to be made in the ditch (tie-in welds). Gaps in the welding process (or pipe strings) may be left at waterbody/wetland crossings, road crossings, and other locations where access across the construction work area needs to be maintained. Automatic and manual welding methods would be used.

Nondestructive Weld Inspection

Following welding, each weld would be inspected to assess whether the structural integrity is consistent with the applicable standard. Radiographs or ultrasonic images would be taken and processed on site for real-time results; and those welds that do not meet the requirements would be marked for repair or replacement.

Ditch Excavation

Following completion of welding, ditch excavation would be completed using backhoe excavators. The standard pipe depth of cover would be a minimum of 36 inches. Ditches would be excavated to a width between 4.5 feet to 5.5 feet along the right-of-way and would have a 1.5:1 or 3:1 slope. See figures 2.2.3 through 2.2.8 for details illustrating the typical construction right-of-way. Where the Pipeline crosses roads, railroads, highways, ditches, creeks, canals, rivers, etc., cover in excess of normal depth may be required and would be accordance with stated crossing conditions, government and regulating authority’s requirements, and prudent pipeline design approaches.

Excavated materials would be stockpiled along the right-of-way on the side of the ditch away from the construction traffic and pipe set-up areas. The Pipeline would be buried below the ground surface to a depth that would meet or exceed the DOT standards presented in 49 CFR 192.327. The ditch would be excavated to a sufficient depth to allow a minimum of 36 inches of cover between the top of the pipe and the final land surface after backfilling. DWPL would comply with applicable regulations at railroad crossings and railroad drainages. On slopes, ditch breakers (i.e., barriers to subsurface water flow placed in the ditch) would typically be used to create segments within the open ditch to reduce erosion and allow access across the ditch. Ditch breakers would typically consist of unexcavated ditch segments or excavated ditches temporarily filled with sandbags or polyurethane foam placed across the ditch.

Coating

After welding is completed, a coating crew would coat the area around the weld (also known as field joint coating). The entire coated Pipeline would be visually inspected for faults, scratches, or other defects and then electronically inspected (a process known as “jeeping”) for faults or areas where the coating is thinner than the coating thickness specification. If damage to the coating is discovered, the coating would be repaired before the pipe is lowered into the ditch.

Lowering-in

Prior to lowering-in the Pipeline, the work area, including the travel lane and ditch, would be visually inspected to verify that the pipe and ditch configurations are compatible, all debris or foreign material has been removed, and no significant water remains in the ditch. All debris and foreign materials would be removed from the work area. If significant water, either from groundwater seepage or precipitation, is present, the ditch would typically be dewatered. During ditch dewatering, water would typically be pumped from the ditch into a filter bag, straw bale structure, or equivalent in a vegetated upland area to remove sediment. The rate of flow from the pump would be regulated, and energy dissipation devices would be used as necessary to prevent erosion from runoff and to prevent the flow of heavily silt-laden water directly into adjacent waterbodies. Dewatering would be conducted according to applicable federal, state, and the Driftwood Procedures. After inspection, when removal of debris and foreign material and dewatering is complete, the pipeline would be lowered into the ditch by appropriately spaced sideboom tractors working in unison to avoid buckling of the pipe.

Backfilling

After the Pipeline is lowered into the ditch and adequately protected, buoyancy control devices would be installed as required. Saddle bags and/or anchors would be used on the pipeline to prevent the pipeline from floating out of the ground. Previously excavated subsoil would then be placed on and around the pipe in the ditch using bladed equipment or excavators. The areas directly over the ditch would be slightly crowned to accommodate soil settlement.

Cleaning of the Pipeline

Following the completion of distinct sections of tie-ins, each pipeline section would be internally cleaned with specially designed “pigs.” A manifold would be installed on one end of a long pipeline section and the pigs would be propelled by compressed air through the pipeline and into an open pig catcher. The pigs would remove dirt, water, or debris that was inadvertently collected within the Pipeline during the construction process. The procedure is repeated for each pipeline section prior to hydrostatic testing.

Hydrostatic Testing

Once installation and backfilling are completed and before the Pipeline begins operation, the pipeline would be hydrostatically pressure tested according to DOT safety standards (49 CFR 192) to verify its integrity and ability to withstand the MAOP. For the Pipeline, the maximum nominal pipe diameter is 48 inches and the MAOP is 1440 psig. Pipe sections to be installed by HDD methods would be tested prior to installation as a separate hydrostatic test once the section is welded, inspected, and the welds are coated. The HDD section would be tested again separately or as part of a mainline test section. The construction contractor would test the pipe in segments. DWPL would obtain all hydrostatic test water from nearby surface water sources (table 2.5-1), and it would be discharged according to the Driftwood Plan and Procedures and the LDEQ General Permit for discharges of hydrostatic test water. All discharges would be controlled to prevent erosion at the discharge location. Hydrostatic test details (e.g., source waters, volumes, and discharge locations) are listed in table 2.5-1.

Table 2.5-1

Pipeline Hydrostatic Test Water Volumes and Sources

Phase	Fill Section No.	Test Section No.	MP	Length (miles)	Fill Volume (ft^3)	Water Source/ Discharge
1	1	1A	0 to 5.4	5.4	340,000	West Fork Calcasieu River
		1B	5.4 to 23.9	18.5	1,160,000	West Fork Calcasieu River
1	2	2A	23.9 to 31.4	7.4	466,000	West Fork Calcasieu River
		2B	31.4 to 39.9	8.5 (mainline)	536,000	West Fork Calcasieu River
			36.5 to 39.9	3.46 (lateral)	85,000	West Fork Calcasieu River
1	3	3	39.9 to 53.2	13.23 (1.9 miles of 2B is overlapped)	828,000	West Fork Calcasieu River
			39.9 to 51.3	11.3	708,000	Calcasieu River
2	4	4	51.3 to 68.0	16.8	1,049,000	Bayou Nezpique
2	5	5	68.0 to 74.2	6.2	386,000	Bayou Nezpique
			74.2 to 79.4	5.2	251,000	Bayou Nezpique
3	6	6	79.4 to 84.9	5.4	261,000	Bayou des Cannes
			84.9 to 88.34	3.5	124,000	Bayou des Cannes
3	7	7	88.34 to 95.9	7.5	265,000	Bayou des Cannes

Caliper Pigging of the Pipeline

Following the completion of the tie-ins after hydrostatic testing, the Pipeline would be internally inspected using a caliper pig specifically designed to detect and provide a location of anomalies like ovality or dents in the installed Pipeline. Identified defects not according to applicable codes and specifications would be located, exposed, and repaired or replaced if necessary. Any replacement would be made with hydrostatically tested pipe of the same wall thickness.

Restoration and Revegetation

The right-of-way would be cleared of equipment, matting, and construction materials. Temporary structures would be removed. Trash and debris would be removed and disposed according to applicable federal, state, and local regulations. The right-of-way, ATWS, and other disturbed areas would typically be finish-graded as closely as possible to pre-construction contours and to conform to the adjacent off-right-of-way areas except for areas directly over the ditch location which would be slightly crowned, except in waterbodies and wetlands, to accommodate soil settlement. Any excess excavated materials or materials deemed unsuitable for backfill would typically be evenly spread over the right-of-way in uplands or disposed according to applicable regulations and landowner requirements. Compacted subsoil areas would then be mechanically de-compacted as needed. As necessary, permanent erosion control measures, such as diversion terraces and slope breakers, would be installed during this phase. Where topsoil segregation is conducted, topsoil would then be spread evenly across the right-of-way and erosion control devices would be installed in support of revegetation.

As specified in the Driftwood Plan, disturbed upland areas would be seeded, with written recommendations for seed mixes, rates, and dates as obtained from the local soil conservation authority or as requested by the landowner or land management agency, and according to permits and the Driftwood Plan.

Disturbed pavement and other road surfaces along access roads would be restored, unless otherwise specified by the property owner and approved by applicable regulatory agencies. Any private or public property damaged during construction, such as fences, gates, and driveways, would be restored, consistent with individual landowner agreements. Pipeline markers and/or warning signs would be installed along the Pipeline centerline at specified intervals to identify the pipeline location, specifying DWPL as the operator of the pipeline, and would provide telephone numbers for emergencies and inquiries.

Access Roads

The design of Project-constructed temporary access roads would aid in their complete removal following construction, for example, using geotextile membranes in soft ground to minimize migration of foundation material. Roads would be designed to provide and allow sufficient drainage during use and would be built to minimize soil erosion.

Existing access roads used temporarily for construction would be left in place and be restored as closely as possible to pre-construction conditions. If needed, grading, gravelling, installation of erosion controls, and seeding would be used to restore and promote revegetation of the access roads. Permanent access roads would be constructed, if not already available, to support regular operation and maintenance activities (e.g., regular inspections, right-of-way maintenance, and operations).

Cathodic Protection System

In addition to the external coating system, the pipeline would be provided with impressed current cathodic protection for external corrosion control, according to the requirements in 49 CFR 192 Subpart I and other applicable codes and standards.

The mainline would be electrically isolated from the compressor stations and meter stations. Any buried natural gas piping in the compressor stations and meter stations would be protected autonomously from the mainline.

The pipeline route includes areas that are near existing pipelines. The cathodic protection design would consider the nearby existing pipelines to avoid stray DC interference situations. The pipeline route also includes areas that are near overhead electrical transmission lines. An AC interference study would be performed to evaluate whether AC mitigation is required. The AC interference and study mitigation design would also include measures to evaluate and address the risk of AC corrosion.

Fiber Optic Cable

A Fiber Optic Cable (FOC) would be installed with the Pipeline. Driftwood has clarified in their comments on the draft EIS that the FOC may be installed in the same ditch as the Pipeline, which allows flexibility to install outside of the Pipeline ditch. We have determined that this flexibility in construction methods would not affect the environmental impact of the Project, if the FOC is installed concurrently with the Pipeline and within the Pipeline permanent easement. This cable would be enclosed in a 1.5-inch High Density Polyethylene conduit. The conduct and register boxes would be carefully placed above the pipe and backfilled. The FOC would be blown into the conduit between register boxes and terminated as required. The FOC would run along the entire length of the Pipeline and be the communication link between all aboveground facilities.

Special Construction Procedures

Residential Land

Residential structures within 50 feet of construction work areas were identified during field surveys. Special care would be taken in residential areas to minimize neighborhood and traffic disruption and to control noise and dust to the extent practicable.

Construction procedures specific to residential areas within 25 feet of construction areas require a Residential Site Specific Plan for each location, as further discussed under site-specific plans in this section. In general, the following measures would be taken in residential areas:

- notify local residents according to servitude and other landowner agreements;
- preserve mature trees and landscaping to the extent practicable;
- fence the boundary to the construction work area for a distance of 100 feet on either side of the residence so to ensure construction equipment, materials, and spoil remain in the construction right-of-way;
- use topsoil segregation procedures, as required, according to the Driftwood Plan and Procedures;
- complete all construction activities as quickly as reasonably practicable for safe construction of a pipeline;
- complete cleanup (including grading) and installation of permanent erosion control measures immediately after the ditch is backfilled, weather conditions permitting;
- restore lawns and landscaping immediately following final clean-up or as specified in landowner agreements, weather conditions permitting;
- if weather conditions prevent immediate restoration of these areas, maintain and monitor temporary erosion controls until restoration is completed; and
- DWPL would enact measures to provide access during construction in residential areas in case of an emergency.

Agricultural Land

In accordance with the Driftwood Plan, topsoil would be segregated at a minimum from the area above the ditch plus spoil side in cultivated or rotated fields, managed pastures, hayfields, and other areas at the landowner's request, unless the landowner specifically approves otherwise. Where topsoil is segregated, it would be stockpiled along the construction right-of-way. The topsoil would remain segregated to prevent mixing with the subsoil during construction activities. After the Pipeline has been lowered into the ditch, the subsoil would be used for backfilling and the segregated topsoil would then be spread across the graded right-of-way. In active cropland areas, the depth of cover above the pipeline would be at least 36 inches. Subsoil in all cultivated areas would be decompacted after backfilling and prior to replacing topsoil, if needed. If decompaction is necessary after topsoil has been replaced, the contractor would use a tiller (or similar equipment) to loosen compacted topsoil areas in a manner and at a depth that prevents mixing topsoil and subsoil.

Waterbody Crossings

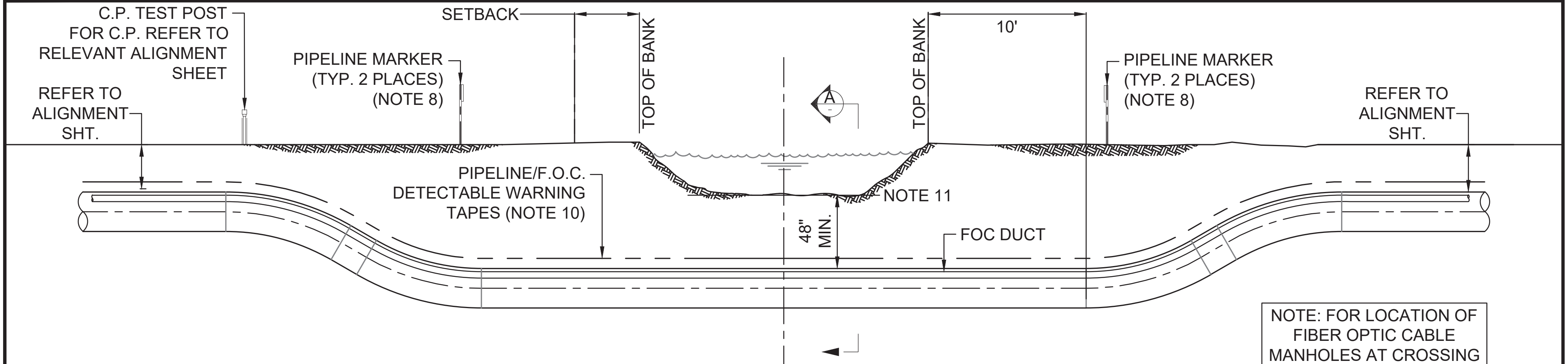
Waterbody crossings would be constructed according to the Driftwood Procedures (appendix C). With exception to the 15 waterbodies that would be crossed by HDD methods and two waterbodies that would be crossed by conventional bore (see Section 4.3.3 of this document), all other waterbodies would be crossed using the standard upland construction techniques, provided there is no perceptible flow at the time of crossing and the EI verifies that water is unlikely to flow between the initial disturbance and final stabilization of the feature. If flow is present in the waterbody, all crossing activities would follow the guidelines for open cut-crossing methods for minor, intermediate, and major waterbodies (figure 2.5-1).

The open-cut method involves excavation of the pipeline ditch across the waterbody, installation of a segment of pipeline, and backfilling of the ditch. Ditch plugs may be necessary to prevent stream water from entering the adjacent pipe ditch. Depending upon the width of the crossing and the reach of the excavating equipment, excavation and backfilling of the ditch would generally be accomplished using backhoes or other excavation equipment operating from one or both banks of the waterbody. If necessary for reach, the equipment may operate within the waterbody. Equipment in the waterbody would be limited to that needed to complete the work in the crossing. All other construction equipment would cross the waterbody using equipment bridges or alternative routes. Mitigation measures such as timber matting, silt fencing, stacked hay bales, sand bags, compacted earthen berms, would reduce sedimentation and minimize impacts on the aquatic environment during construction. Construction activities would be scheduled as reasonably practicable so that the ditch is excavated prior to pipe-laying activities.

Except where reasonable alternative access is available, temporary construction-equipment crossings would be installed across waterbodies to gain access along the right-of-way during construction. ATWS may be needed adjacent to waterbodies to assemble and fabricate the pipe necessary to complete the crossings. In areas where the ATWS is required to be set back from the waterbody, vegetation would not be cleared between the ATWS and the waterbody. The pipe would be installed according to regulatory requirements to provide an adequate depth of cover over the pipeline in stream beds. Streambed and bank contours would be restored to near pre-construction conditions, and the banks would be stabilized as soon as possible following installation of the pipe.

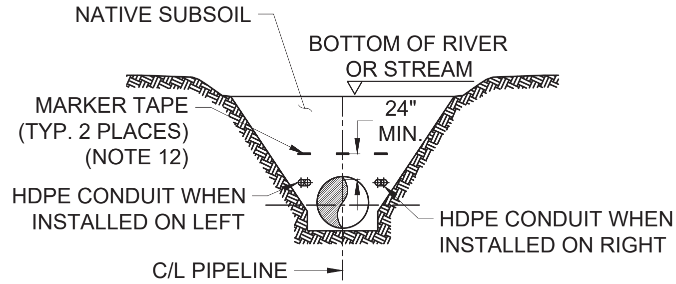
Horizontal Directional Drill

HDD is a construction method that allows the Pipeline to be installed between two points by drilling rather than ditching (figure 2.5-2). The length of Pipeline that can be installed by HDD depends on underlying soil conditions, pipe diameter, and available technology and equipment sizes. Soil conditions are determined based on geotechnical investigations performed prior to starting construction, and final depth of the pipeline would be determined based on the soils crossed. HDD involves drilling a pilot hole



TYPICAL RIVER CROSSING
(NOTE 9)

NOTE: FOR LOCATION OF FIBER OPTIC CABLE MANHOLES AT CROSSING REFER TO RELEVANT ALIGNMENT SHEET



SECTION A
N.T.S.
TYPICAL PIPELINE TRENCH
(NOTE 6)

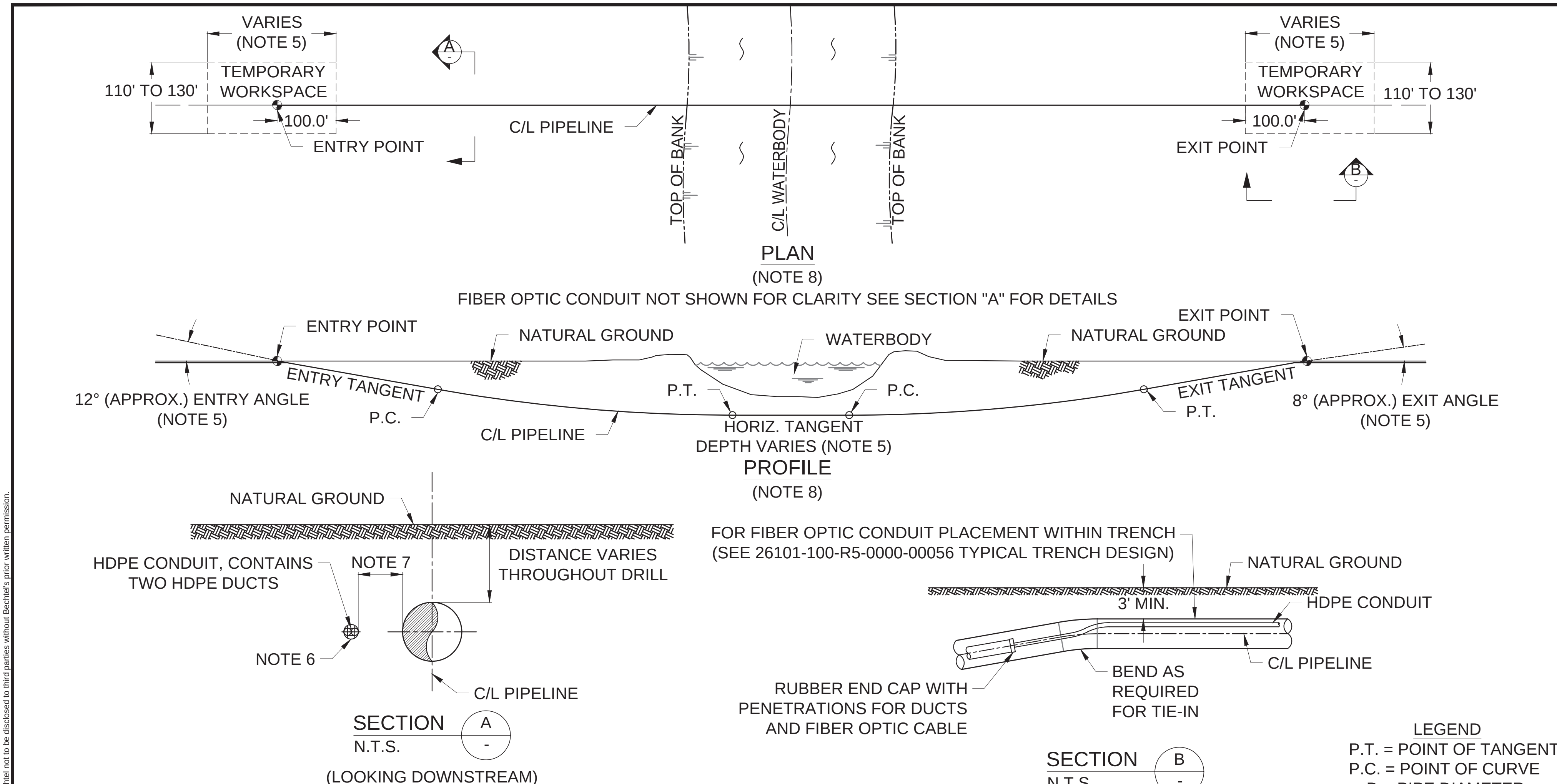
GENERAL NOTES :

1. ALL DIMENSIONS SHOWN ARE IN INCHES UNLESS OTHERWISE NOTED.
2. CONTRACTOR SHALL REPAIR BANKS AND INSTALL EROSION CONTROL WHERE REQUIRED. SEE REFERENCED DRAWINGS.
3. CONTRACTOR SHALL PREVENT SILT FORMATION DOWNSTREAM OF CROSSING DURING CONSTRUCTION.
4. CONTRACTOR SHALL MAINTAIN WATER FLOW IN ACCORDANCE WITH ANY PERMIT REQUIREMENTS.
5. CONTRACTOR SHALL VERIFY LOCATIONS AND DEPTH OF COVER FOR ALL UTILITIES PRIOR TO CONSTRUCTION.
6. FOR TRENCH DETAILS, SEE TYPICAL TRENCH DESIGN DRAWING REFERENCED.
7. THIS DRAWING SHALL BE USED IN CONJUNCTION WITH THE PIPELINE CONSTRUCTION SPECIFICATION 26101-100-3PS-R000-00001.
8. INSTALL PERMANENT MARKER ON EACH SIDE AFTER CONSTRUCTION.
9. SITE SPECIFIC DRAWINGS SHALL BE PREPARED FOR ALL CROSSINGS WHERE THERE IS INCREASED POTENTIAL FOR EROSION OR SCOUR.
10. DETECTABLE WARNING TAPES ARE NOT REQUIRED OVER THE CROSSING UNLESS THE RIVER OR STREAM IS DRY WHEN THE CROSSING IS CONSTRUCTED.
11. MINIMUM COVER TO BE MEASURED FROM THE LOWEST TRUE CLEANED BOTTOM OF THE WATERCOURSE. THE LEVEL SHALL BE MAINTAINED HORIZONTALLY BETWEEN SETBACKS, MEASURED AT 90° TO THE WATERCOURSE.
12. MINIMUM TECHNICAL REQUIREMENTS INCLUDING BURIAL DEPTH, SETBACK AND THE NEED FOR CIVIL PROTECTION WORKS SHALL BE VALIDATED BY A SUITABLY EXPERIENCED ENGINEER ON A CASE BY CASE BASIS DURING DETAILED DESIGN.

Figure 2.5-1
Typical Open-Cut River Crossing

REV.	DATE	DESCRIPTION	DES.	CHK.	ENG	APR.
000	02MAR17	ISSUE FOR FEED	LJ	PL	MB / SPS	
A01	15FEB17	ISSUE FOR REVIEW	LJ	PL	MB / SS	

SCALE:	NOT TO SCALE			
SIZE:	ANSI A	BEC DWG No.:	26101-100-R5-0000-00073	REV. 000



GENERAL NOTES :
1. ALL DIMENSIONS SHOWN ARE IN FEET UNLESS OTHERWISE NOTED.
2. INSTALL SUITABLE TANKS OR SUMPS TO CONTAIN DRILL MUD.
3. DISPOSE OF DRILLING MUD IN ACCORDANCE WITH THE APPROPRIATE REGULATORY AUTHORITY REQUIREMENTS.
4. CONTRACTORS SHALL HAVE SUFFICIENT PUMPS, HAY BALES, ETC. ON SITE TO DEAL WITH POTENTIAL INADVERTENT MUD RELEASES.
5. THIS DRAWING SHALL BE USED IN CONJUNCTION WITH THE SITE SPECIFIC DRILL DRAWINGS AND THE PIPELINE CONSTRUCTION SPECIFICATION 26101-100-3PS-R000-00001.
6. X DIA. STEEL CONDUIT IN PARALLEL BORE TO PIPELINE TO CONTAIN DUAL HDPE CONDUITS. MIINIMUM COVER FOR CONDUITS IS THE SAME AS THE PIPELINE AT EACH POINT.
7. EXACT CONDUIT LOCATION RELATIVE TO PIPELINE IS TYPICALLY 20' BUT MAY VARY DUE TO CONSTRUCTION METHOD AND LOCAL CONDITIONS.
8. HDD ENTRY AND EXIT POINTS CAN BE ON EITHER SIDE OF WATERBODY. LOCATIONS DEPEND ON SITE CONDITIONS.
9. FOR FIBER OPTIC CABLE (F.O.C.) AND DUCT INSTALLATION DETAILS, SEE THE SPECIFICATION FOR HDPE CABLE DUCT AND INSTALLATION, DOC. NO. 26101-000-3PS-ERG0-00001.

Figure 2.5-2
Typical HDD Crossing

REV.	DATE	DESCRIPTION	DES.	CHK.	ENG	APR.
001	02MAR17	RE-ISSUE FOR FEED	LJ	PL	MB / SPS	
000	13FEB17	ISSUE FOR FERC	LJ	PL	MB / SPS	
A01	29NOV16	ISSUE FOR REVIEW	LJ	PL	MB / SS	

NOT TO SCALE

SIZE: ANSI A | 26101-100-R5-0000-00058 | REV. 001

along a prescribed path and then enlarging that hole using reaming tools to achieve a hole large enough to accommodate the pipe. The reaming tools are attached to the drill string and drawn back to the drilling rig, thus progressively enlarging the pilot hole with each pass. During this process, drilling fluid consisting of bentonite clay and water is maintained in drilling pits within the construction work area and is continuously pumped into the hole to remove cuttings and maintain the integrity of the hole between the HDD entry and exit points. Where possible, drilling fluid is cleaned of rock and debris and reused; spent and excess drilling fluids are transferred to tanker trucks for disposal at a pre-approved location.

Once the hole has been sufficiently enlarged, a prefabricated segment of pipe would be attached behind the reaming tool on the exit side of the crossing and pulled back through the drill hole to the drill rig, completing the crossing. Surface disturbance between the ends of a HDD crossing are limited to clearing of brush by hand for the placement of the surface coil used for downhole survey and depending on site conditions, clearing an approximate 10-foot-wide access to the water's edge for placement of a pump and hose for withdrawing water.

Site-specific Plans

The Driftwood Procedures require site-specific plans for each major waterbody crossing (i.e., natural waterbodies greater than 100 feet wide at the water's edge at the time of crossing) and each HDD crossing of waterbodies, wetlands, or other features (e.g., highway, residence). Site-specific plans are also required for residences within 25 feet of construction areas. Comments on these site-specific plans may be submitted to FERC as described in section 1.3.1. Site-specific plans are not required for waterbodies crossed using the open cut or conventional bore method.

A summary of these crossings is included in table 2.5-2.

Table 2.5-2

Site-specific Plans

Identifier	MP	Site-specific Plan - Figure Number(s) (Appendix D)	FERC eLibrary Accession Number	Geotechnical Investigation Status	Additional Description
HDD locations					
HDD A1	6.4-7.1	2.5-3	20171017-5114	Prior to Construction[a]	Avoidance of residential areas along Dave Dugas Road
HDD A2	8.5-9.2	2.5-4	20171017-5114	Prior to Construction[a]	Avoidance of diversion canal (two crossings)
HDD A3	10.1-10.6	2.5-5	20171017-5114	Prior to Construction[a]	Avoidance of wetlands, existing pipeline, and I-10
HDD 1	15.0-15.4	2.5-6	20171017-5114	Completed	Avoidance of Houston Canal
HDD 2	17.5-17.9	2.5-7	20171017-5114	Completed	Avoidance of Houston River and wetlands
HDD A4	23.6-24.3	2.5-8	20171017-5114	Completed	Avoidance of the West Fork Calcasieu River and wetlands and OCAG003
HDD 4	Mainline 37.4-38.0 Lateral 0.8-1.5	2.5-9 and 2.5-10	20171017-5114	Completed	Avoidance of the Calcasieu River and wetlands (two parallel HDDs; one for mainline and one for lateral pipeline)
HDD A5	55.3-55.8	2.5-11	20171017-5114	Prior to Construction[a]	Avoidance of Coulee Bayou (tributary of Bayou Serpent) and wetlands
HDD A6	55.8-56.6	2.5-12	20171017-5114	Prior to Construction[a]	Avoidance of Bayou Serpent and wetlands
HDD A7	67.2-67.7	2.5-13	20171017-5114	Prior to Construction[a]	Avoidance of Bayou Nezpique and wetlands

Table 2.5-2

Site-specific Plans

Identifier	MP	Site-specific Plan - Figure Number(s) (Appendix D)	FERC eLibrary Accession Number	Geotechnical Investigation Status	Additional Description
HDD 5	88.0-88.6	2.5-14	20171017-5114	Completed	Avoidance of Bayou Des Cannes
Waterbodies Crossed by Conventional Bore					
Unnamed	13.1	Not Required	NA	Not Required	Unnamed leg of Houston Canal
Unnamed	13.7	Not Required	NA	Not Required	Unnamed leg of Houston Canal
Major Waterbodies Crossed by Open Cut					
Pond OCAA003	1.1	2.5-15	20170822-5131	Not Required	Pond
Man-made pond OCEA004	7.9	Not Required	NA	Not Required	Man-made pond
Pond OJEY001	49.4	2.5-16	20170822-5131	Not Required	Pond
Residences Within 25 feet of Workspace[b]					
LA-CA-349.502	1.0	2.5-17	20170331-5058	Not Required	Residence and shed
LA-CA-339.000	1.9	2.5-18	20170331-5058	Not Required	Construction office
LA-CA-280.000	8.1	2.5-19	20170331-5058	Not Required	Shed/barn
LA-CA-235.500	12.0	2.5-20	20170331-5058	Not Required	Paintball field
LA-CA-010.555	27.5	2.5-21	20170331-5058	Not Required	Residence, barn, shed
LA-JE-055.512	49.4	2.5-22	20170331-5058	Not Required	Residence

[a] Driftwood has committed to performing geotechnical investigations prior to commencing construction via HDD.

[b] Driftwood has purchased the structures at MP 0.26 and MP 0.90; therefore site-specific plans are not required for these locations.

Wetland Construction Methods

Wetland construction would be conducted according to the Driftwood Procedures. Specific procedures for saturated and unsaturated wetland are described below. Where practicable, topsoil would be segregated over the ditch up to 12 inches in depth where hydrologic conditions permit this practice. Segregated topsoil would be placed in the ditch following subsoil backfilling.

Construction within unsaturated wetlands would be similar to the typical upland construction with additional measures to protect wetland resources. If normal construction equipment begins to rut or would result in mixing of wetland topsoil and subsoil, low-ground-pressure equipment would be used, or temporary board or timber equipment mats would be installed to allow passage of equipment with minimal disturbance of the surface and vegetation. Trees would be cut to grade, and stumps would only be removed from the ditchline and from the working side where necessary for safety.

Topsoil over the pipe ditch would be segregated from subsoil to the extent possible. A vegetated buffer zone may be left between the wetland and the upland construction areas, except for the pipe ditch and travel lane and as site-specific conditions warrant. Erosion control measures such as silt fences, interceptor dikes, and straw bale structures would be installed and maintained as necessary to minimize sedimentation into off-right-of-way areas. Ditch plugs would be installed where necessary to prevent the unintentional draining of water from the wetland.

Crossing of saturated wetlands would require the use of matting and low-ground-pressure equipment to minimize the amount of rutting that could occur. Topsoil segregation would not be practical in saturated wetlands. Equipment mats or timber mats would be used to aid in equipment movement through and work within the wetland. Otherwise, construction would be similar to that described above for unsaturated wetlands.

The push-pull construction method may be used in saturated wetland areas. The push-pull construction method involves digging the ditch, and then pushing or pulling the Pipeline, as sections are welded together from the entry point, along the ditch through the wetland. This technique requires standing water in the ditch.

Foreign Pipelines

Foreign pipeline crossings would be open cut and have a minimum clearance of 12 inches between the Pipeline and the foreign pipeline. Minimum clearances would be according to 49 CFR 192, as well as according to pipeline crossing agreements with the foreign pipeline operators.

Protection of Utilities

Along the Pipeline, there are a number above and below ground pipelines (for natural gas, oil, etc.) and utilities (including power, telecommunications, sewer, and water). Construction activities that cross or parallel other pipelines and utilities would be performed to the required safety standards, according to the applicable owner's or authority's permit or agreement, providing a safe environment for the public and Project workforce and to provide protection from damaging such infrastructure. The safety standards in these simultaneously operating areas are critically strict and involve a large amount of planning and preparation with the relevant pipeline or utility operator. Safe Work Process Procedures outline required tasks and method statements from which a risk assessment and an emergency response plan (ERP) are developed, outlining the potential risks, mitigation measures, and required controls. Driftwood would conduct continuous supervision, inspection and surveillance during the works, and use more precise excavation techniques (e.g., vacuum trucks, soil water-blasting, manual excavation) if needed.

Excavated material would be stored along the existing utility in a way that does not pose a risk to that service or infrastructure. When crossing an existing utility, it would be manually uncovered across the Project pipeline ditch width and secured all around with shoring. The maximum length of the uncovered pipeline or utility would not exceed 50 feet. If the existing utility is an underground cable, it would also be manually uncovered and supported along its length by overhanging beams across the uncovered length. For the crossing of irrigation channels, every effort would be taken during construction to ensure that the continuous operation of the irrigation channel is maintained. Any necessary interruptions would only occur with the approval and coordination of the affected irrigation system operator. The owner or utility may have personnel in attendance to inspect the works as they progress along or across the respective asset. The construction or crossing would be done according to approved plan with the owner or utility to ensure proper separation and cathodic protection is maintained and complete the backfill.

Road and Railroad Crossing Techniques

Methods Driftwood proposes to use for road crossings are available on FERC eLibrary (accession number 20170621-5139).

Open-Cut Method

Pipeline crossings of lightly traveled paved and unimproved rural dirt or gravel roads would typically be accomplished using the open-cut installation method. The trench for an open cut crossing is excavated with a backhoe or similar equipment, all backfill is compacted, and the road resurfaced. If open-cut road construction requires extensive construction time, provisions would be made for detours or other measures to permit traffic flow during construction.

Conventional Bore/Jack-and-bore Method

There are no open-cut crossings of railroad lines associated with the Pipeline. Railroad crossings and major roadway crossings would be crossed using conventional jack-and-bore methodology. These crossings are constructed independently by separate construction crews and later tied into the rest of the Pipeline. The jack-and-bore method involves the excavation of pits on either side of the transportation feature and the placement of a bore machine within one of the pits. This device would bore under the road and install the pipeline segment. Once the bore has reached the other pit, the pipeline segment would be tied in with the pipeline installed on the other side. With this method, the pipeline would pass under the railroad or roadway with little or no disturbance to traffic along the rail or roadway.

Protection of Road and Railway Crossings

Pipeline crossing of roads and railways would conform to the requirements established under 49 CFR 192 and the API Recommended Practice (RP) 1102 specification. Permits for these crossings would be obtained from the regulating authority, and would be constructed to a specific execution plan, detailing methods, procedures, engineering drawings and calculations, alignment sheets, scheduled timing of works, equipment, personnel, and safety control measures.

For the boring method, all road crossing excavations would be completed outside of the road crossing load bearing areas with the depth of cover in the bar ditches and the road surface according to the applicable authority's permit or agreement. For open-cut, two methods would be used: (1) only one-half of the road crossing would be excavated at a time with the same depth criteria as described above, a temporary bypass lane would be installed adjacent to the crossing and for its entire crossing length; and (2) the complete crossing would be open, traffic directed along a safe and reasonable detour. In both cases the pipeline would laid in either in two sections or one complete section through the open excavation.

Once the pipeline is installed, backfilling and the reinstatement of the crossed surfaces would be completed. The construction area would remain separated from traffic, and traffic controllers, warning signs, and road closure and detour methods would be used to alleviate congestion and provide a safe passing for vehicles. All active road crossings would be illuminated by night, and temporary traffic lights may be provided where necessary.

<u>Electric Transmission Line Crossing and Collocation Techniques</u>

Electrical Isolation from Construction

It is not uncommon for pipelines to parallel or cross existing utility rights-of-way, including electric transmissions rights-of-way. Construction activities which are adjacent to overhead electrical lines is a critical component to the Project safety program for its employees and the public. Such activities are only supervised and performed by experienced personnel, who are trained on the elements of associated risk and the requirements of all required safety precautions to be applied. Site-specific surveys would be performed prior to construction for data collection of the location and size of existing powerline structures within the construction corridor, including the tower footing locations and dimensions, and wire heights (lowest point between towers). From this, construction activities would be planned and executed accordingly to achieve the required safety measures from induced current or contact with paralleling high voltage transmission. This includes the incorporation of field survey data to offset the simultaneous operations of heavy construction equipment interfering or coming into contact with overhead high voltage transmission lines. For crossings beneath power lines, special restrictions (e.g., height of cranes or side booms) and safety measures (e.g., goal posts, warning signs,) would be defined and installed.

Pipeline Electrical Isolation

The Project would carry out measures to address the potential for electrical arcing or alternating current/direct current interference in locations where the pipeline or a compressor station is adjacent to a high voltage electric transmission line. The pipeline would be in a ditch with a minimum depth of cover of 36 inches. Where the pipeline is parallel to an electrical transmission line, the centerline of the pipeline shall be not less than 50 feet from the power line grounding.

Where the pipeline crosses an electrical transmission line, the pipeline shall be located at a specified minimum distance from the nearest tower or pole, depending on the electrical system power level. Table 2.5-3 shows the minimum distances for each crossing class (Overhead Crossing [OHX] 1 to OHX3).

Table 2.5-3

Minimum Distances to Electrical Lines or Poles for Pipeline Crossings

Electrical System	Crossing Class	Minimum Distance to Tower or Pole (feet)
> 110 kV	OHX1	100
72 kV - 110 kV	OHX2	65
35 kV - 72 kV	OHX2	65
< 35 kV	OHX3	15

The pipeline cathodic protection system would be designed to avoid interference with the transmission line. DWPL would work with the electric transmission owners and developers to ensure that installed systems are not affected. DWPL would follow common industry practice to mitigate AC induced voltages on the pipeline by installing adequate zinc ribbon conductors connected to regularly spaced anode beds to dissipate these voltages and protect the pipeline. Special design would be incorporated at these locations. Care would be taken to ensure that the pipe near and/or parallel to electric transmission powerlines is not magnetized during stringing, bending, and line-up that would adversely affect the welding process.

2.5.3.2 Lateral Pipeline

The 30-inch lateral pipeline would parallel the 48-inch mainline between MS-05 and CS-01. The entire width of the right-of-way would be marked, cleared, grubbed, and graded. Following right-of-way preparation, the mainline and lateral pipelines would be installed in two passes, maintaining an about 25-foot offset between pipelines. The entire right-of-way would then be restored. At the Calcasieu River crossing, the HDD installation of each pipeline would proceed independently, using the same construction disturbance area, with the HDD segment tied into the conventionally installed pipeline segment separately.

Aboveground Facilities

Typical Construction Method for Compressor Stations

Site Preparation and Earthworks

Prior to site disturbance, the boundaries of the approved site construction workspace would be appropriately marked. Temporary stormwater management systems (e.g., silt fences, hay bales) would be installed according to the Construction Environmental Control Plan.

Construction activities would commence with the establishment/rerouting of access roads, followed by clearing and grubbing of the sites. Rough grading of the site would follow. Temporary areas such as parking lot, areas for site trailers and laydown areas would be established and site facilities, such as security facilities, bathrooms, lunchroom, and rod and tool rooms would be installed. A warehouse would be built at an early stage for use by the contractor during construction.

There would be no permanent underground stormwater drainage system; all drainage would be created via swales. Unsuitable soil/earthwork would be removed to an approved location. Imported clean structural fill would be used to bring the site up to the required elevation and to provide a suitable structural base for the Compressor Station.

Foundations

After fencing and rough grading of the site, concrete foundations for the compressors would be poured. Mud mats would be installed immediately after excavation to provide a working base.

Foundations for the warehouse and air cooler, substation, filter separators and compressor building foundations would be installed first, with foundations for auxiliary equipment and structures installed last. No piles would be required for foundation support.

Equipment

Large equipment (compressors/gas turbines, filter separators, air coolers and substation) would be installed after concrete foundations have reached their design strength. This would be followed by the installation of smaller equipment. Compressor building structural steel would be constructed after placement of the compressors to allow for crane lifting access.

Piping

The underground piping headers between the compressor building and the air handling units would be installed and backfilled immediately to minimize access issues. Large-bore piping would be installed next from the mainline to/from the filter separators, air coolers, and compressors. These would be installed and backfilled by conventional methods.

Aboveground piping would be installed generally from the compressors and air coolers to the headers for alignment issues.

Hydrostatic testing of the aboveground facility piping would commence after sufficient piping is installed and has passed nondestructive testing. Hydrotest water would be obtained from local municipal sources, and would require about 587,000 gallons at CS01, 361,000 gallons at CS02, and 303,000 gallons at CS03. Hydrostatic testing of aboveground facility piping would be concurrent with the pipeline. Pipeline hydrostatic testing is discussed further in section 2.5.3.1

Potable water

Potable water would be trucked to each compressor station site during construction. Operational water supplies would be either from local utilities or from a water well drilled at each site. Water sources would comply with required regulations and permits.

Electrical

The prefabricated and wired substation would be set on its elevated foundation. Cable trays would be installed under the substation and installed on elevated racks to the compressor building and air coolers. Minor cable runs to equipment would be via duct banks. This would be followed by the installation of other electrical equipment/devices. Cable would be pulled and terminated, after which testing/loop checks would be completed. Permanent yard lighting would be installed at an early stage to support short days and off-hour security. Local utility providers would supply electricity for both construction and operation.

Testing and turnover

After construction of the specific equipment and commodities, the commissioning team would commence testing. After successful commissioning of the systems, the team would work with the operator to turn-over the aboveground facility for operations.

Commissioning

As the various systems are completed, they would be tested and calibrated for proper operation. Above- and below-ground gas piping would be hydrostatically tested. Controls and safety devices such as the emergency shutdown (ESD) system, relief valves, gas and fire detection facilities, and other safety devices would be thoroughly checked and tested. During commissioning of the compressor stations, units would be operated on a trial basis following completion of the piping and mechanical work. Commissioning is considered a trial operation and would involve several short duration runs conducted over the course of several days. Start-up of the compressor units can commence once all testing has been completed.

Typical Construction Method for Other Aboveground Facilities

The other aboveground facilities, including meter stations, pig launchers and receivers, and mainline valves, would be constructed according to the same federal regulations and guidelines as the Pipeline facilities, and according to the specific requirements of applicable federal and state approvals. Aboveground facilities are sited to avoid cultural and natural resource impacts to the greatest extent practicable.

Clearing and Grading

Following surveying activities to define the boundaries of the construction work areas associated with the aboveground facilities, the sites would be cleared of any existing vegetation. Site grading would then be conducted to create a level surface for the safe movement of construction vehicles and to prepare the areas for construction. In accordance with the Driftwood Plan and Procedures, silt fencing, stacked hay bales, sand bags, compacted earth berms would be installed so to minimize sedimentation into offsite waterbodies, wetlands, roads, or other sensitive areas.

Foundations

Where foundations are required for the aboveground facilities, the ground would be excavated and improved as needed for the installation of building foundations and pipe supports. Forms and reinforcing bars would be installed in excavated areas, as necessary, and concrete would be placed to the appropriate levels for the equipment. Concrete would be randomly sampled and tested to verify compliance with specifications. All concrete would then be properly cured to the design strength.

Piping

Installation of piping systems would begin concurrently with the foundation work. Piping, valves, and fittings may be fabricated at the individual sites or may be fabricated off site at a contractor's fabrication shop and transported to the respective aboveground facility site for installation. Piping would require welded construction, except where the piping is connected to flanged or threaded components. Ditches would be dug for the underground portions of the piping, and the pipe would be welded, non-destructively inspected, coated for corrosion protection, placed in the ditch, and then backfilled.

A cathodic protection system may be installed to further protect the underground piping. Cathodic protection units installed along the Pipeline would be regularly monitored to maintain required pipe-to-soil potential. This would be conducted according to DOT regulations. The portions of piping that are aboveground would be installed on concrete or metal pipe supports and would be painted. Electrical conduit systems would also be installed.

Structures and Equipment

Once the structures and equipment are set on foundations, they would be connected to the piping and electrical systems. Electrical wiring would be installed to provide power and connect instrumentation to control systems.

2.5.3.4 Traffic

DWPL is conducting preliminary planning and design of site access and traffic for the Pipeline and its associated compressor stations and meter stations. To the extent practicable, DWPL would use public and existing roadways to reduce the requirement for construction of new access roads. It is anticipated that any impacts on traffic and roadways from construction of the Pipeline would be incremental to its existing volume and flow and of short duration due to the geographically-dispersed spread of construction and relatively quick linear movement of construction. Because construction would be phased and would occur over an approximately 96-mile span, work would move along the Pipeline route such that traffic impacts would be temporary in any particular area. Furthermore, DWPL or its contractors would obtain any necessary authorizations required for transportation of construction equipment and materials on public roads and highways. Roadway damage due to construction would be repaired as necessary.

2.6 OPERATION AND MAINTENANCE PROCEDURES

2.6.1 LNG Facility

The Project would be operated according to the DOT's Federal Safety Standards for LNG Facilities (49 CFR 193) and NFPA 59A. In addition, the marine facilities would be operated and maintained according to the USCG regulations for LNG Waterfront Facilities, 33 CFR 127.

DWLNG would employ the necessary operations staff (e.g., operations managers, operations engineers, console operators, field operators, safety, and security personnel) as required to operate the LNG Facility safely and efficiently. DWLNG anticipates up to 250 permanent workers would be required during operation of the LNG Facility which would be staffed 24-hours a day. It is DWLNG's intention to recruit qualified candidates from local and regional communities to fill the permanent Project operational positions. Where available and appropriate, DWLNG would partner with local educational institutions to create occupational technologies curricula to provide workforce development opportunities. DWLNG would conduct specific training for their personnel on the control aspects of working in a natural gas liquefaction facility and the necessary safety measures in the day-to-day operation of the Project. The operations personnel, along with some full-time maintenance personnel, would also support DWLNG in their pre-commissioning, commissioning, and startup activities. Final operation procedures would address safe startup, shutdown, cool down, purging, etc., as well as routine operation and monitoring.

Maintenance of the LNG Facility would be conducted according to 49 CFR 193, Subpart G. DWLNG would employ the necessary maintenance staff and craftsmen (e.g., mechanics, millwrights, electricians, instrument technicians, etc.) as required to properly maintain the LNG Facility. Full-time maintenance staff would conduct routine maintenance and minor overhauls. Overhauls and similar major maintenance would be handled by authorized factory service representatives and trained contract personnel. Scheduled maintenance would be performed on safety and environmental equipment, instrumentation, and other equipment. All scheduled and unscheduled maintenance would be part of a systematic approach to maintenance, using industry accepted practices for scheduling and tracking maintenance activities.

2.6.2 LNG Marine Traffic

DWLNG would enter a long-term Marine Service Agreement with an experienced Towing Operating Company for the design, construction, and operation of four tractor tugs with firefighting class-1 capability. The tractor tugs would be dedicated on a full-time basis to DWLNG shipping needs. They would be highly capable tugs for active and passive escort of the LNG carriers along the inland transit route and the carriers' turning maneuvers for berthing and un-berthing to/from the loading berths. The tugs would be specifically designed to ensure that they could maintain effective control of the LNG carriers up to Q-flex size at the upper environmental navigational conditions allowed by the Lake Charles Pilots Association and consented by USCG, namely 20 knots wind from any direction and 1.5 knots tidal current. DWLNG and the Lake Charles Pilots Association have conducted full-mission bridge simulated maneuvering trials and determined that the DWLNG tugs should have the same power and bollard pull performance characteristics as the tractor tugs proposed or in use in the Calcasieu Ship Channel by other LNG facilities. The specific tugs to be used for the LNG Facility would be the result of a technical specification tender, tugboat Owner/Operator selection, and LNG buyers' chartering process.

2.6.2.1 Regulatory Compliance

The tugs would be built to American Bureau of Shipping or equivalent Class +A1 Escort Tug with FiFi 1 notation requirements for full ocean service and would comply with all the applicable laws of the U.S. and rules listed below in force at the time of delivery, insofar as they may have jurisdiction:

- USCG Rules and Regulations 46 CFR Subchapter M, Rules for Towing Vessels;
- Federal Communications Commission;
- American Bureau of Shipping, where applicable, including Escort Rules (Rules for Building and Classing Offshore Support Vessels, Part 5, Chapter 13);
- USCG – Uninspected Towing Service, Coastwise;
- U.S. Public Health Service "Handbook on Sanitation of Vessel Construction, Publication No. 393";
- Institute of Electronics and Electronics Engineers 45 – "Recommended Practice for Electrical Installations on Shipboard Applications";

Tugs Residence

The tugs would reside at a berth location whereby they can be mobilized and positioned in the marine basin within 5 to 15 minutes from the initial activation time of an emergency event. The exact location of the tugs' residence would be decided between DWLNG and the selected Owner/Operator to meet the tugs' mobilization time to respond to an emergency in the Marine Facility.

The selected berthing for the tugs would be equipped with shore power "cold ironing" system, as well as with other utilities necessary to support the vessels and crew at berth.

2.6.2.2 LNG Carriers

LNG carrier construction consists of a combination of conventional and specialized materials and systems designed to safely load, carry, and offload LNG liquids stored at a temperature of –260 °F.

There are predominantly two types of deep-draft LNG carriers in the global fleet based on the cargo containment design type; (1) ships with spherical cargo tanks (or Moss type) and (2) ships with prismatic membrane cargo tanks. As of 2016, the carriers with the prismatic membrane tanks are dominating the global LNG fleet by about 7 to 1 ratio versus carriers with spherical cargo tanks.

The cargo volumetric capacity of both types of these ships in transatlantic or transpacific trade is between 125,000 m^3 to 260,000 m^3. The DWLNG Marine Facility would be designed to accommodate LNG carriers up to 216,000 m^3 cargo capacity.

Additionally, LNG carriers have mainly two basic categories of main engine power drive propulsion; (1) a steam turbine propulsion system and (2) the dual fuel diesel engine (DFDE) of medium or low revolution per minute direct mechanical or electric motor drive propulsion systems. The steam turbine propulsion system is predominant in most of the older generation carriers constructed up to year 2007, while the DFDE propulsion is predominant in the modern fleet.

Per the International Gas Union LNG World Report – 2016, and other industry sources, more than ninety percent of the new building orders for delivery to the Owners from 2017 to 2020 would be of the DFDE or electric motor drive propulsion, as they exhibit higher efficiency and lower fuel consumption than the steam turbine propelled vessels. In addition, the anticipated increase of liquefaction export capacity from U.S. Gulf by year 2022 would require significant shipping tonnage of the larger, more efficient (and therefore more economical to lease and operate) LNG carriers to handle the long-haul voyages to Asia and the Pacific Coast South American countries via the expanded Panama Canal.

The trend for larger capacity carriers can be seen in the above-mentioned sources where almost 100 percent of the new ships would be larger than 155,000 m^3 capacity and more than 80 percent of the new building order book represents LNG carriers between 170,000 m^3 and 180,000 m^3 cargo capacities. The latter group size represents the new Panamax class LNG carriers, as these ships are designed and constructed for maximum cargo capacity and dimensions to transit the expanded Panama Canal. The older-generation steam turbine propulsion carriers are anticipated to become less active in transpacific and transatlantic voyages from the U.S. export terminals. The older-generation steam turbine carriers have already undergone, or are planning to undergo, conversion to Floating Storage and Regasification Units. Based on the depletion trend of these types of carriers, only a small number (2-3 per year) would be expected at the Project.

<u>Ballast Water Discharge</u>

The USCG regulations (33 CFR 151, subpart D and 46 CFR 162.060 on "Standards for Living Organisms in Ships' Ballast Water Discharged in U.S. Waters; Final Rule" [77 Fed. Reg. 17254 (Mar. 23, 2012)] and Navigation and Vessel Inspection Circular (NVIC) 01-18, provide guidance to the maritime industry and USCG personnel relative to the implementation of ballast water management system (BWMS) requirements. In conformance with these governing regulations, which apply to all vessels that enter or operate within U.S. waters and are equipped with a ballast water system, LNG carriers are required to install and operate a BWMS that has been approved by the USCG under 40 CFR 162.060 and that meets the applicable ballast water discharge standards (BWDS) as noted in 33 CFR 151.2030.

The USCG requires that all vessels (and LNG carriers) equipped with ballast tanks and bound for ports or places in the U.S. (except for the Great Lakes), regardless of whether the vessel operated outside the Exclusive Economic Zone, submit the ships' ballast water management information to the USCG no later than six hours after arrival at the port or place of destination, or prior to departure from that port or place of destination, whichever is earlier. For ballast water carried onboard when the LNG carrier is at the loading berth, it can only be discharged if it meets the USCG BWDS and the vessel has a BWMS approved by the USCG.

Regulatory Compliance

The LNG carriers are designed, constructed, and operated according to the International Maritime Organization (IMO) International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk and to comply with the USCG requirements under 46 CFR 154 and other industry standards and guidelines such as the Society of International Gas Tanker and Terminal Operators and Oil Companies International Marine Forum.

In addition, all non-U.S. flag carriers are subject to Port State Control. The Port State imposes laws and regulations specific to their individual ports and areas of jurisdiction. In the case of vessels entering the U.S., the USCG executes the Port State authority and functions. All foreign-flag LNG carriers are subject to Port State Control examination by USCG in all aspects of safety and security. A non-U.S. flag LNG carrier, prior to entering a U.S. port for the first time, is subject to verification by the USCG Marine Safety Center as meeting the certification requirements in 46 CFR 154. Prior to the initial visit to the U.S. port, the vessel must submit, for the review of the Marine Safety Center, an application requesting a USCG Certificate of Compliance endorsement, accompanied by certain documentation including a copy of its IMO Certification of Fitness, a description of the vessel and specifications of its cargo containment system, and various drawings, schematic plans, and safety plans. Once the vessel confirms that the Marine Safety Center has completed its review, the vessel schedules the initial visit and undergoes the required Certificate of Compliance examination. The vessel's Certificate of Compliance must be renewed every two years.

Ballast Water

Ballast water would be carried onboard by LNG carriers making calls to the LNG Facility as these ships would likely arrive in a slack conditions, with cargo tanks containing the minimum volume of LNG required to maintain a cold, cryogenic condition. As such, ships making the transoceanic trips would take on ballast water from the surrounding waters at ports of origin to control or maintain trim, draught, stability of, or stresses to the vessel. This ballast water would be treated in a USCG-approved BWMS and discharged in the berth area as LNG was loaded onto the vessel. The volume of ballast water to be released per LNG vessel would range from about 26,000 to 57,000 m^3 (7 to 15 million gallons) for LNG carriers ranging in size from 125,000 to 216,000 m^3. Available BWMS and the impacts and mitigation associated with ballast water discharges are discussed further in section 2.6.2.2 of this final EIS.

Cooling Water Use

During arrival, loading, and departure from the berth, LNG carriers would draw water (cooling water) from the Calcasieu River to keep their main engines and auxiliary equipment cool and within prescribed operating temperatures. The tugboats are envisioned to be equipped with keel coolers thus eliminating the need for river cooling water intake and discharges during escort assist and maneuvering the LNG carriers for berthing and/or un-berthing at the loading berths.

The cooling water flow rate and volume of water required for cooling the machinery varies depending on the type of vessel propulsion and the mode of operation. Impacts associated with cooling water are discussed further in section 4.4.3 of this final EIS.

2.6.2.3 Maintenance Dredging

According to the COE, maintenance dredging of the Calcasieu Ship Channel occurs once or twice annually in the bar channel, every other year along miles 5 to 28 where the LNG Facility site would be located (alternating between the segment from mile 5 to mile 17 and the segment from mile 17 to mile 28), and every 5 to 8 years in the inland portion from mile 28 to 36 (COE, 2010b).

Driftwood estimates that the marine berths and MOF would require maintenance dredging of up to 435,000 m^3 (570,000 yd^3) of material about every three years; however, the volume and frequency of the required dredging would be assessed during the detailed design phase and would align with the COE maintenance dredging maintenance permit, which covers maintenance dredging for up to ten years, and the LDNR CUP, which covers maintenance dredging for up to five years and then must be renewed every two years. Dredged material from maintenance would either be placed in the BUDM area(s) used for initial dredging or in one of the Port's local managed dredge material placement areas (DMPA).

2.6.3 Pipeline and Aboveground Facilities

The Pipeline and aboveground facilities would be operated by appropriately trained and licensed DWPL personnel and contracted entities, according to applicable statutes and regulations, regulatory permit conditions and authorizations, engineering design specifications, recommended manufacturer maintenance practices, and Project operating policies and procedures. All pipeline, meter station, and compressor station facilities shall meet the requirements of 49 CFR 192; compressor stations and meter stations shall be designed to the applicable version of ASME B31.8, Gas Transmission and Distribution Piping Systems. All design would observe the U.S. statutory laws and regulations and would be based on the applicable U.S. codes and standards.

Industrial, Regulatory, and Project Specifications, Standards, and Guides exist to govern the engineering and design of Instrumentation and Control Systems for natural gas pipelines and associated facilities. All applicable codes and standards would be followed during the engineering, design, construction, commissioning, and start-up of the Pipeline and associated facilities.

DWPL anticipates that 41 permanent workers would be required to support Pipeline operations, including 11 workers for compressor stations. There would be qualified workers to operate and maintain the Pipeline and related facilities as well as support personnel in other offices. DWPL personnel and subcontracted entities would be qualified and properly trained for the tasks for which they are assigned. The DOT requires that pipeline companies develop and maintain a written qualifications program for individuals performing certain safety-related tasks, known as an Operator Qualification Program. The Operator Qualification Program would document formal training and on-the-job experience. The intent is to have a qualified workforce and reduce the possibility of incidents caused by human error.

DWPL would develop procedures to properly operate the Pipeline facilities according to governmental regulations, permit requirements and authorizations, manufacturer recommendations, and operating requirements for the Pipeline. These standards and procedures would enhance performance, reliability and safety of the Pipeline, and would address routine Pipeline operations. DWPL would participate in the local "One-Call" system for utility stake out and would perform outreach training and coordination activities with local emergency response entities regarding operations and response.

2.7 SAFETY AND SECURITY PROCEDURES

DWLNG would develop an ERP for the LNG Facility in cooperation with federal, state, and local agencies. It would include details of training requirements, as well as training exercises that must be performed periodically to confirm the functionality of the plan and to confirm individual roles and responsibilities. The LNG Facility ERP must include the following details:

- actions to be taken by individuals who have designated responsibilities in responding to emergency situations and terrorist or other external threats posed to the Project, which would also include communications with federal, state, and local regulatory agencies and authorities;
- protocols for safeguarding Project personnel and equipment;
- protocols for communicating an emergency situation to external organizations that would provide resources to help in an emergency;

- protocols for safeguarding the local community and the environment; and
- protocols for ordering evacuation of personnel.

DWPL would develop a Pipeline ERP in accordance with DOT Minimum Federal Safety Standards (as specified in 49 CFR 192). The ERP would be finalized in consultation with federal, state, and local agencies (including local fire departments) to verify that all required equipment, training, procedures and support are available to respond to a hazardous condition caused by the Pipeline. The proposed Pipeline ERP must contains details of

- the structure of the emergency response team, including roles, responsibilities and contact details;
- information on offsite emergency organizations, including nearby local fire departments;
- plans for information collection, analysis, and dissemination;
- list of available and qualified contractors;
- plans for mobilizing personnel, equipment, tools, and materials;
- the general responses to emergency situations that can occur along the Pipeline;
- notification requirements for onsite, internal officials, offsite, federal and other relevant agencies, and residents and recreational users;
- emergency evacuation routes, including evacuation zones, routes, and methods of egress;
- post-response and incident termination, including "All Clear notification", follow-up reporting and incident investigation;
- training and exercises; and
- documentation of consultations made with interested parties during the development of the ERP.

2.7.1 LNG Facility

The security requirements for the proposed LNG Facility are governed by 33 CFR 105, 33 CFR 127, and 49 CFR 193, Subpart J – Security. 33 CFR 105, as authorized by the MTSA, requires all terminal owners and operators to submit a Facility Security Assessment and a Facility Security Plan (FSP) to the USCG for review and approval before commencement of operations of the proposed project facilities. DWLNG 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.

As required by 49 CFR 193.2509, DWLNG 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. DOT regulations under 49 CFR 193.2905 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 certain 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. Additionally, in accordance with the EPAct 2005, FERC would also approve an ERP covering the terminal and ship transit prior to construction.

2.7.2 Pipeline

DWPL would design, construct, operate and maintain its facilities according to DOT regulations. Protective controls would be included in the Pipeline to inhibit system degradation and better ensure its safe and reliable operation.

2.7.2.1 Mainline and Lateral Pipeline

Periodic aerial reconnaissance and ground patrols would be conducted to visually inspect the Pipeline route from above or on the ground for issues such as vegetative encroachment, evidence of unauthorized activity, damage or exposed pipeline facilities, areas of environmental concern, and other concerns that could affect public safety.

Vegetation along the permanent right-of-way would be maintained to prevent growth from encroaching onto the permanent easement to ensure Pipeline integrity and right-of-way accessibility, according to the Driftwood 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, to help with periodic corrosion/leak surveys, 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.

2.7.2.2 Aboveground Facilities

In fenced and graveled aboveground facility locations where mowing and hand cutting is impractical, non-restricted use of herbicides may be used. These activities would be controlled by applicable governmental laws and regulations, permit conditions/authorizations, and land owner agreements.

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3.0 ALTERNATIVES

3.1 INTRODUCTION

In accordance with NEPA and FERC policy, we evaluated a range of alternatives to determine whether an alternative would be preferable to all or part of the proposed action. We also discuss alternatives that were eliminated from detailed analysis because they were not reasonable or practicable. Alternatives considered here include those identified by our staff, cooperating and other resource agencies, affected landowners, the public, and Driftwood. The range of alternatives evaluated include the No-Action Alternative, system alternatives, route alternatives, compressor station alternatives, and facility configuration alternatives. In addition, process, construction, and dredge material disposal alternatives were considered for the LNG Facility.

Evaluation Process

The evaluation criteria used for developing and reviewing alternatives were:

- ability to meet the Project's stated objective;
- technical and economic feasibility and practicality; and
- significant environmental advantage over the proposed action.

The alternatives were reviewed against the evaluation criteria in the sequence presented above. If the alternative would not meet the Project's objective, or is not feasible, we did not compare environmental information to determine if the third evaluation criterion was satisfied.

The first consideration for including an alternative in our analysis is whether or not it could satisfy the stated purpose of the project. An alternative that cannot achieve the purpose for the project cannot be considered as an acceptable replacement for the project. All of the alternatives considered here are able to meet the project purpose stated in section 1.1 of this final EIS.

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

Determining if an alternative provides a significant environmental advantage requires a comparison of the impacts on each resource as well as an analysis of impacts on resources that are not common to the alternatives being considered. The determination must then balance the overall impacts and all other relevant considerations. In comparing the impact between resources (factors), we also considered the degree of impact anticipated on each resource. Ultimately, an alternative that results in equal or minor advantages in terms of environmental impact would not compel us to shift the impacts from the current set of landowners to a new set of landowners.

We considered a range of alternatives in light of the Project's objectives, feasibility, and environmental consequences. Through environmental comparison and application of our professional judgment, each alternative is considered to a point where it becomes clear whether the alternative could or could not meet the three evaluation criteria. To ensure a consistent environmental comparison and to normalize the comparison factors, we generally used desktop sources of information (e.g., publicly available data, aerial imagery) and assumed the same right-of-way widths and general workspace requirements. We evaluated data collected in the field if surveys were completed for both the proposed site and route and its corresponding alternative site or route. Where appropriate, we also used site-specific information (e.g., detailed designs). Our environmental analysis and this evaluation considers quantitative data (e.g., counts, acreage, or mileage) and uses common comparative factors such as total length, amount of collocation, and land requirements.

The factors considered for an aboveground facility (the terminal and compressor stations) are different than those considered for a pipeline route because an aboveground facility is a fixed location rather than a linear facility and because, unlike a pipeline, an aboveground facility is visible during operations and, in most cases, generates noise and air emissions. In evaluating these locations, we consider, amount of available land, current land use, adjacent land use, location accessibility, engineering requirements, stakeholder comments (section 1.3), and impacts on the natural and human environments.

Our evaluation also considers impacts on both the natural and human environments. The natural environment includes water resources and wetlands, vegetation, wildlife and fisheries habitat, farmland soils, and geology. The human environment includes nearby landowners, residences, land uses and recreation, utilities, and industrial and commercial development near construction workspaces. In recognition of the competing interests and the different nature of impacts resulting from an alternative that sometimes exists (i.e., impacts on the natural environment versus impacts on the human environment), we also consider other factors that are relevant to a particular alternative or discount or eliminate factors that are not relevant or may have less weight or significance. In our alternatives analyses, we often have to weigh impacts on one kind of resource (e.g., habitat for a species) against another resource (e.g., residential construction).

3.2 PUBLIC COMMENTS/LANDOWNER REQUESTS

We received comments during scoping, and additional input during our review of the Application requesting directly or indirectly that we evaluate alternatives, including the following general types of alternatives:

- The use of existing pipelines as an alternative method of supplying feed gas to the LNG Facility for liquefaction and export.
- The use of alternative pipeline routes, including requests to realign the pipeline within a landowner's parcel or to avoid specific parcels.
- Reducing offset distance between the pipeline and existing adjacent pipelines to minimize the overall width of the maintained right-of-way.
- The use of alternative locations for pipeline aboveground facilities, such as meter stations or compressor stations.
- Alternate locations or configurations to minimize noise, vibration, and light from the LNG Facility or compressor stations with regard to nearby residents.
- Configurations or safeguards to ensure safe transit of LNG carriers.

In some cases, Driftwood revised the Project in response to landowner, stakeholder, agency, and staff comments, as well as their own assessments. Our analysis of alternatives in this section considers alternatives developed throughout Project refinement.

3.3 NO-ACTION ALTERNATIVE

The CEQ regulations for NEPA (40 CFR 1502.14) require that the alternative of no action be included in the analysis. The No-action Alternative considers the effects and actions that might result if the Project were not constructed.

Under the No-action Alternative, the environmental impacts, both positive and negative, described in this final EIS would not occur; however, the stated purpose of the Driftwood proposal would not be met.

In Order No. 3968 issued February 28, 2017, the DOE authorized the export of LNG from the Driftwood LNG Facility to Free Trade Agreement nations (DOE, 2017). Among other factors, the DOE considered the economic, energy security, and environmental impacts and determined that exports from the terminal would not be inconsistent with the public interest. It is reasonable to expect that if the Driftwood LNG Project is not constructed (the No-action Alternative), export of LNG from one or more other LNG export facilities could also be authorized by the DOE and eventually be constructed. Thus, although the environmental impacts associated with constructing and operating the Project would not occur under the No-action Alternative, equal or greater impacts could occur at other location(s) in the region as a result of another LNG export project seeking to meet the demand identified by Driftwood.

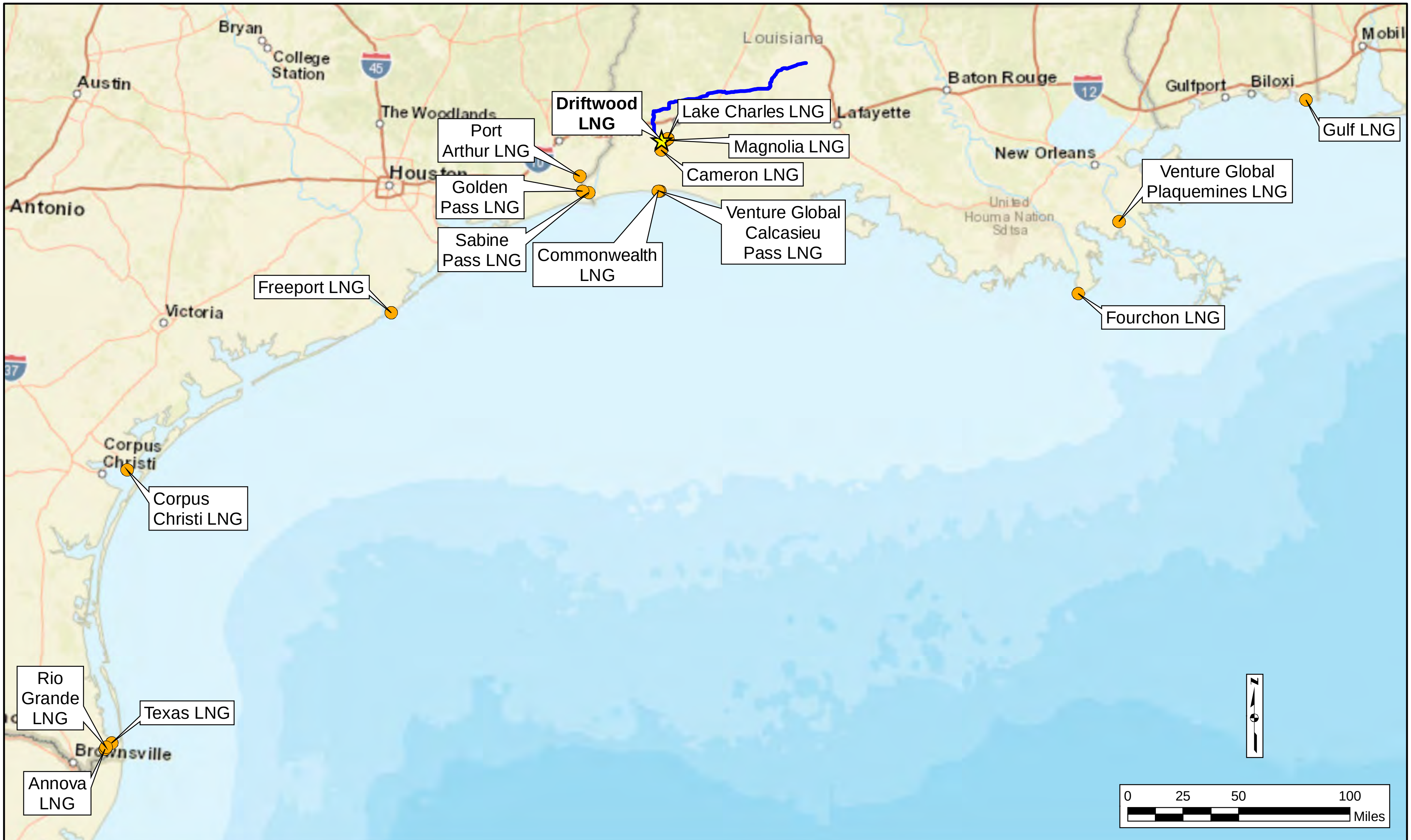
We conclude that the No-action Alternative does not meet the project objective and an alternative project to meet the market demand would not likely provide a significant environmental advantage over the proposed action. Therefore, we do not consider it further.

3.4 SYSTEM ALTERNATIVES

System alternatives to the Project would make use of other existing, approved but not yet constructed or operational, or proposed facilities to meet the stated purpose and need of the Project. Implementing a system alternative would make it unnecessary to construct all or part of the Project; however, modifications or additions to an existing or proposed LNG or transmission system/facility may be necessary.

3.4.1 LNG Facility System Alternatives

We reviewed existing, approved, proposed, and planned liquefaction projects within the Southeast/Gulf Coast region; locations of these facilities are shown in figure 3.4-1 and are summarized in table 3.4-1. Our analysis is predicated on the assumption that each project, if approved, has an equal chance of being constructed and would therefore be available as a potential alternative. However, market forces will ultimately decide which and how many of these facilities are built. Each of the liquefaction projects is authorized or has applied to DOE to export to FTA countries. The Natural Gas Act, as amended, has deemed FTA exports to be in the public interest; therefore, we will not speculate or conclude that excess capacity is available to accommodate this Project's purpose and need. Consequently, the export capacity at any other existing or proposed LNG facility would likely require an expansion to accommodate the necessary additional liquefaction and export facilities similar to the proposed facilities.



Map Location

Legend

- Driftwood Pipeline Route
- Driftwood LNG Facility Site
- Other LNG Facility Site

Figure 3.4-1: LNG System Alternatives

Driftwood Project

NOTES:
Map Projection: NAD 1983 NSRS2007 StatePlane Louisiana South FIPS 1702 Ft US
Image Source: Esri online World Imagery Service.

\\apaenvfile01\gis\1-PROJECTS\Driftwood\Fig 3.4-1 Driftwood_Facilities_20180102.mxd

Table 3.4-1

System Alternatives Summary of Proposed LNG Export Projects

Project Name (FERC Docket No. [a])	Owner Location	Total Capacity (MTPA)	Status	Target In-service Date
Approved LNG Export Terminals				
Cheniere/Sabine Pass LNG Terminal (CP11-72 and CP14-12)	Sabine Pass Liquefaction, LLC/ Sabine Pass Liquefaction Expansion, LLC/ Sabine Pass, LNG, L.P.	20.0	Plants 1-3: Operating Plant: 4 completed October 2018	2015
Sabine Pass Expansion (CP13-552 and CP13-553)	Sabine, LA	10.0	Plant 5 under construction; Plant 6 approved	2019
Cameron LNG Terminal (CP13-25)	Cameron LNG, LLC Hackberry, LA	15.0	Under construction	2019
Cameron LNG Expansion (CP15-560)		10.0	Not under construction	2019
Freeport LNG Dev/Freeport LNG Expansion/FLNG Liquefaction Terminal (CP12-29, CP12-509, and CP15-518)	Freeport LNG Development, L.P/ FLNG Liquefaction, LLC/ FLNG Liquefaction 2,LLC/ FLNG Liquefaction 3, LLC/ FLNG Liquefaction 4, LLC Freeport, TX	15.3	Under construction	2018-2019
Freeport LNG Expansion (PF15-25 and CP17-470)		5.1	Environmental Assessment issued on 11/2/2018	2023
Corpus Christi LNG Import Terminal (CP12-507)	Cheniere—Corpus Christi LNG / Corpus Christi Liquefaction, LLC Corpus Christi, TX	15.0	Under construction	2021
Corpus Christi LNG Stage 3 Project (CP18-512 and CP18-513)		10.0	Application filed 6/8/2018	2021
Lake Charles LNG Terminal (CP14-120)	Lake Charles LNG Company, LLC / Lake Charles LNG Export Company, LLC / Trunkline Gas Company, LLC Lake Charles, LA	16.45	Not under construction	2019-2020
Magnolia LNG Terminal (CP14-347)	Magnolia Pipeline Company, LLC / Magnolia LNG, LLC Lake Charles, LA	8.0	Not under construction	2019
Golden Pass LNG Terminal (CP14-517 and 518)	Golden Pass Products, LLC / Golden Pass Pipeline, LLC Sabine Pass, TX	15.6	Not under construction	2019-2020
Proposed LNG Export Terminals				
Gulf LNG Terminal (CP15-521)	Gulf LNG Liquefaction Company, LLC (L.L.C.) / Gulf LNG Energy, LLC Pascagoula, MS	10.0	Draft EIS issued on 11/15/2018	2024
Calcasieu Pass Project (CP15-550 and 551)	Venture Global Calcasieu Pass, LLC Cameron Parish, LA	10.0	Final EIS issued on 10/22/2018	2022
Texas LNG Brownsville (CP16-116)	Texas LNG Brownsville, LLC Brownsville, TX	4.0	Draft EIS issued on 10/26/2018	2023
Rio Grande LNG Terminal (CP16-454)	Rio Grande LNG, LLC / Rio Bravo Pipeline Company LLC Brownsville, TX	27.0	Draft EIS issued on 10/12/2018	2023
Annova LNG Project (CP16-480)	Annova LNG, LLC Brownsville, TX	7.0	Draft EIS issued on 12/14/2018	2024
Port Arthur LNG Project (CP17-20)	Port Arthur LNG, LLC / PALNG Common Facilities Co., LLC Port Arthur, TX	13.5	Draft EIS issued on 9/28/2018	2024

Table 3.4-1

System Alternatives Summary of Proposed LNG Export Projects

Project Name (FERC Docket No. [a])	Owner Location	Total Capacity (MTPA)	Status	Target In-service Date
Venture Global Plaquemines LNG (CP17-66)	Venture Global Plaquemines LNG LLC Plaquemines Parish, LA	20.0	Draft EIS issued on 11/13/2018	2022 (Phase 1)
Planned LNG Export Terminals				
Commonwealth LNG Project (PF17-8)	Commonwealth LNG, LLC / Commonwealth Projects, LLC Cameron Parish, LA	8.4	Pre-filing approved on 08/15/2017	2024
Fourchon LNG Export Facility (PF17-9)	Fourchon LNG, LLC Lafourche Parish, LA	5.0	Pre-filing approved on 08/21/2017	2021 (Phase 1)
Galveston Bay LNG (PF18-7)	NextDecade LNG, LLC Galveston County, TX	16.5	Pre-filing approved on 10/10/2018	2027

[a] To access the public record for this proceeding, go to FERC's Internet website (http://www.ferc.gov), click on "Documents and Filings" and select the "eLibrary" feature. Click on "General Search" from the eLibrary menu and enter the docket number.

To assess whether an LNG facility system alternative was technically and economically feasible, we based the minimum site requirements on Driftwood's stated criteria site selection, which include 350 acres of developable land and 1,200 feet of waterfront access.

We analyzed aerial photographs and filed facility maps to determine whether expansion of the alternative liquefaction projects to accommodate the necessary addition liquefaction and export facilities would be technically feasible and practicable. We determined that the following terminal sites could not be readily expanded to accommodate the Driftwood facilities:

- Sabine Pass LNG Terminal (Cheniere/Sabine Pass LNG). There are no contiguous 350-acre areas available for additional development apparent within the existing site.
- Freeport LNG Terminal (Freeport LNG). Expansion of this system by 350 acres would encroach into residential property and/or across the primary road on this island into Port of Freeport property.
- Corpus Christi Liquefaction Project and Expansion (Cheniere-Corpus Christi LNG). Expansion of the LNG berthing facilities does not appear feasible, because Corpus Christi LNG's shoreline is fully developed and constrained by developed industrial properties on both sides.
- Lake Charles LNG Terminal (Lake Charles LNG). The LNG Facility site is constrained by the existing LNG import terminal to the south and existing industrial facilities to the west, and expansion of the LNG berthing facilities does not appear feasible in the limited area of the existing turning basin.

- Magnolia LNG Project Terminal (Magnolia LNG LLC). Minimal undeveloped area is available within the LNG Facility site, and additional area for further development is constrained by the adjacent turning basin and industrial properties.
- Golden Pass LNG Terminal (Golden Pass Products, LLC). Expansion of the facilities within the existing site would not be technically or economically feasible because the site is fully developed.
- Gulf LNG Terminal (Gulf LNG). Expansion of liquefaction facilities would not be feasible within the existing site, which is bounded by the Bayou Casotte Ship Channel, Mississippi Sound, and a COE dredge spoil management area.
- Texas LNG Project (Texas LNG). Waterfront access is limited, and the additional LNG carrier berths required to export the additional capacity would not be feasible.
- Rio Grande Project (Rio Grande LNG LLC). The remaining acreage (about 230 acres) on this site would not be sufficient to develop Driftwood's facilities.
- Port Arthur LNG Project (Port Arthur LNG). Expansion of the facilities within the site or expansion of the site to accommodate additional facilities would not be technically feasible.
- Venture Global Plaquemines LNG (Venture Global Plaquemines LNG LLC). The proposed facilities would occupy the majority of the site, and further expansion of the facilities within the site would not be technically feasible.
- Commonwealth LNG Project (Commonwealth LNG LLC). Expansion of the facilities within Commonwealth's site to accommodate additional capacity would not be technically feasible.
- Fourchon LNG Project (Fourchon LNG LLC). Expansion within Fourchon LNG's 140-acre site, constrained by Belle Pass on the east and south sides and neighboring landowners and extensive saline marsh to the north and west sides, to accommodate the Driftwood LNG Project's capacity would not be technically feasible and practical.
- Galveston Bay LNG (NextDecade LNG, LLC) Expansion of facilities within this 750-acre site is constrained by Galveston Bay and an active 200-acre dredge spoil placement area, to accommodate the Driftwood LNG Project's capacity would not be technically feasible.

Locations for siting terminals must be available for sale or lease. Section 3 of the NGA does not convey any authority of eminent domain. Consequently, a site that is not available is not a feasible alternative. For facilities with sufficient space for expansion to meet Project objectives, we further analyzed the surrounding habitats to make an estimate of the likely degree of environmental impact. LNG facility system alternatives that did not meet a criterion were eliminated from further analysis.

3.4.1.1 Approved LNG Export Terminals

Only one approved LNG Export Terminal in the Southeast/Gulf Coast region appeared to have sufficient developable area to make expansion of the liquefaction and export facilities potentially feasible and practicable, the Cameron LNG Terminal and Expansion.

Cameron LNG Terminal (Sempra-Cameron LNG)

The Cameron LNG Terminal is on the Calcasieu Ship Channel, near Hackberry, Louisiana, about four miles south of the Driftwood LNG Facility site. Cameron LNG has received authorization and begun construction of two additional liquefaction plants within the original three-plant facility; this expansion appears to fill the remaining contiguous areas within the current site. Additional area for further development at the Cameron LNG Terminal site is constrained by the adjacent Calcasieu Ship Channel to the east, Highway 27 to the west, and privately held land to the north. Cameron LNG owns land west of Highway 27, which might be made available for expansion; however, expansion into these areas would require permanent fill of estuarine wetlands and open-water habitat, estimated at nearly 100 percent of the area per National Wetland Inventory (NWI) analysis. Based on the known wetlands within the site, we conclude that the impacts of siting facilities to accommodate the Driftwood LNG Project's capacity adjacent to the Cameron LNG Terminal would be greater than those associated with the site proposed by Driftwood. Therefore, the Cameron LNG system alternative does not offer a significant environmental advantage over the proposed action, and this system alternative was not evaluated further.

3.4.1.2 Proposed LNG Export Projects

There are currently two proposed LNG liquefaction and export terminals in the Southeast/Gulf Coast region that appeared to have sufficient developable area to make expansion of the liquefaction and export facilities potentially feasible and practicable: the Calcasieu Pass LNG Project; and the Annova LNG Project.

Calcasieu Pass LNG Project (Venture Global)

Venture Global has requested authorization to construct and operate a liquefaction and LNG export facility on the east side of the Calcasieu Ship Channel near the Gulf of Mexico, about 20 miles south of the Driftwood LNG Facility site, in Cameron Parish, Louisiana. The proposed site is over 800 acres with about a mile of waterfront access, and expansion of the facilities to accommodate the Driftwood LNG Project's capacity may be feasible within the site.

The proposed facilities would require permanent loss of over 140 acres of wetlands. The site configuration proposed by Venture Global avoids wetlands and minimizes impacts to the extent practicable. The degree of additional impact required to expand the site to meet Driftwood's authorized export volume is speculative. Based on the known resources present within the site, we conclude that the impacts of siting facilities to accommodate the Driftwood LNG Project's capacity on Venture Global's proposed site would be equal or greater than those associated with the site proposed by Driftwood. Therefore, the Venture Global LNG system alternative does not offer a significant environmental advantage over the proposed action and was not evaluated further.

Annova LNG Project (Annova LNG)

Annova LNG is planning an LNG liquefaction and export terminal on a 731-acre site on the Brownsville Ship Channel in Cameron County, Texas, about 373 miles southwest of the Driftwood LNG Facility. The permanent facilities, including the dredged LNG berth, would permanently affect over 285 acres of the site. The remaining contiguous acreage is distributed in a relatively narrow ring around the proposed facility, which would not be sufficient to accommodate the 350-acre rectangular area needed for the additional liquefaction facilities required to meet the Driftwood LNG Project's capacity and the additional LNG berths to export the LNG. The area within the remaining contiguous acreage is nearly 100-

percent estuarine wetlands, and development of the site to accommodate additional facilities would require permanent fill of the wetlands. Further, the site is constrained by the Brownsville Ship Channel to the north and nearly 100-percent estuarine wetlands and waterbodies to the east, west, and south, based on NWI analysis. If the adjacent lands surrounding it were available for sale or lease, expansion of the site to accommodate additional facilities would require permanent fill of the wetlands and waterbodies. Assuming that 350 acres of land would be required and based on the known resources surrounding the site, we conclude that the impacts of siting additional facilities to accommodate the Driftwood LNG Project's capacity at the Annova LNG Site would be equal or greater than those at the site proposed by Driftwood. Therefore, the Annova LNG system alternative does not offer a significant environmental advantage over the proposed action and was not evaluated further.

3.4.1.3 LNG System Alternatives Conclusions

Based on our analysis of aerial photographs and facility maps, few existing, authorized, proposed, or planned LNG facilities can be expanded to accommodate Driftwood's minimum facility requirements of 350 acres of developable land and 1,200 feet of waterfront access. Further analysis of the anticipated environmental impacts of expansion of the facilities that appear to have the necessary area for expansion did not identify an alternative site that would offer a significant environmental advantage over the proposed action. LNG system alternatives were not analyzed further.

3.4.2 Pipeline System Alternatives

As stated previously, an existing system, as-is or modified, may be considered as an alternative.

To serve as a pipeline system alternative, the alternative would need sufficient capacity for natural gas and have sufficient connections to providers to ensure a steady supply of natural gas to meet the demands at the LNG Facility, as well as provide an environmental advantage, either through reduced disturbance or avoidance of significant environmental features, relative to the proposed Pipeline.

Because the Pipeline would carry a larger volume than many of the existing systems, connections to multiple gas sources (pipelines) and use of multiple existing pipelines would be necessary to ship sufficient volumes of feed gas to meet the 4.0 Bcf/d demand of the LNG Facility. There are two pipeline systems near the LNG Facility that we evaluated as potential system alternatives to the Pipeline: the Creole Trail Pipeline and Kinder Morgan Louisiana Pipeline.

The Creole Trail Pipeline is within 2 miles of the LNG Facility and currently is permitted to carry 1.5 Bcf/d. The Creole Trail Pipeline is expanding to increase the carrying capacity to up to 3.0 Bcf/d.[9] The full volume of the pipeline is committed to supply natural gas to the Sabine Pass LNG Terminal and therefore has

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[9] Docket No. CP12-251

no additional capacity to provide gas to the LNG Facility. Even if the full capacity of the Creole Trail Pipeline were available for DWPL's use, it is still insufficient to meet the Project's objectives by itself.

The existing Kinder Morgan Louisiana Pipeline operates within 1,000 feet of the LNG Facility and currently carries 3.2 Bcf/d. Modifications are currently proposed to the system that would increase the capacity to about 3.8 Bcf/d.[10] Currently, Kinder Morgan has agreements to provide 1.2 Bcf/d to Magnolia LNG, 0.6 Bcf/d to Sabine Pass Plant 5, and 0.6 Bcf/d to Sabine Pass Plant 6. The FERC Notice of Application states the expansion would provide an additional 0.6 Bcf/d to the Sabine Pass Liquefaction Facility, currently under expansion as discussed in Section 3.4.1. The remainder of the expanded capacity, 0.8 Bcf/d would not provide sufficient volume to the LNG Facility to meet the stated purpose.

Because sufficient capacity could not be met using existing pipelines, these system alternatives are not technically feasible alternatives to the proposed action. Therefore these pipeline system alternatives were not evaluated further.

3.5 LNG FACILITY ALTERNATIVES

3.5.1 LNG Facility Site Alternatives

To minimize the potential environmental impacts from the proposed action, we evaluated potential alternative sites for the LNG Facility within the Gulf Coast region that meet the following minimum Project site criteria: (1) deep channel access (> 40 foot depth), (2) sufficient size (> 350 acres) and waterfront access (> 1,200 feet) to construct and operate the LNG Facility, including ensuring adequate suitable buffer area from nearby facilities.

A comment on the draft EIS recommended an analysis of an additional site approximately 1.5 miles north of the proposed site location in the undeveloped upland tract on the north side of the industrial canal serving the Lake Charles LNG Terminal. This alternative site was assessed in the draft EIS as Alternative Site 6, as shown in figure 3.5-1 and discussed below.

Upon completing this initial review, we further evaluated a number of alternative locations predominantly in Texas, Louisiana, and Mississippi, identified in figures 3.5-1 through 3.5-3 and summarized in table 3.5-1, as potential sites for the LNG Facility based on whether the location would result in a significant reduction in environmental impacts relative to Driftwood's proposed site.

Table 3.5-1

Comparison of LNG Facility Site Alternatives

Attribute (units)	Preferred Site	Alt Site #1 (Industrial Canal)	Alt Site #2 (Singing River Island)	Alt Site #3 (Sabine Pass)	Alt Site #4 (Pelican Island)	Alt Site #5	Alt Site #6
Area of Site (acres)	718	439.7	378.0	485.4	883.1	352.1	568.0
Safe Marine Maneuverability	Yes	Constricted	Constricted	Yes	Yes	Unknown	Unknown

[10] Docket no CP17-22

Table 3.5-1

Comparison of LNG Facility Site Alternatives

Attribute (units)	Preferred Site	Alt Site #1 (Industrial Canal)	Alt Site #2 (Singing River Island)	Alt Site #3 (Sabine Pass)	Alt Site #4 (Pelican Island)	Alt Site #5	Alt Site #6
Subject to High Currents	No	No	Yes	No	Yes	No	No
Wetlands (acres) [a]	553.2	376.2	124.2	318.0	263.0	234.4	250.0
Open water (acres) [a, b]	<0.1	8.1	2.5	9.9	550.8	18.2	28.1
Proximity to DMPA and/or BU areas	BU	DMPA	DMPA	BU	DMPA	Yes	Yes
Proximity to Natural Gas Pipelines	Yes	Yes	Yes	Yes	No	Yes	Yes
Facility Site Access	LA Hwy 27 10 road miles from I-10	No existing roads	Single bridge access	Single road access	Single bridge access	LA Hwy 27 15 road miles from I-10	No existing access road. 10 road miles from I-210
Previous Disturbance/ Development	Industrial	DMPA, 2 pipeline crossings	Industrial, DMPA	2 pipeline crossings	DMPA	Partial industrial	Pipeline crossings, clearing
Proximity to Infrastructure (water, power)	Yes	No local water / power connection	Yes	Yes	Yes	Yes	Yes
Additional Pipeline Requirements; challenges	Base case	1 mile Crossing of Calcasieu Ship Channel	Undetermined	40+ miles	Undetermined	2 miles	4 miles Crossing of Calcasieu Ship Channel

[a] Based on NWI (USFWS, 2018a); analysis performed using publicly available information only, and does not directly correlate to wetland acreages that include aerial interpolation or field data.

[b] Includes freshwater and estuarine and marine deepwater

3.5.1.1 Alternative Sites

Alternative Site 1 (Industrial Canal)

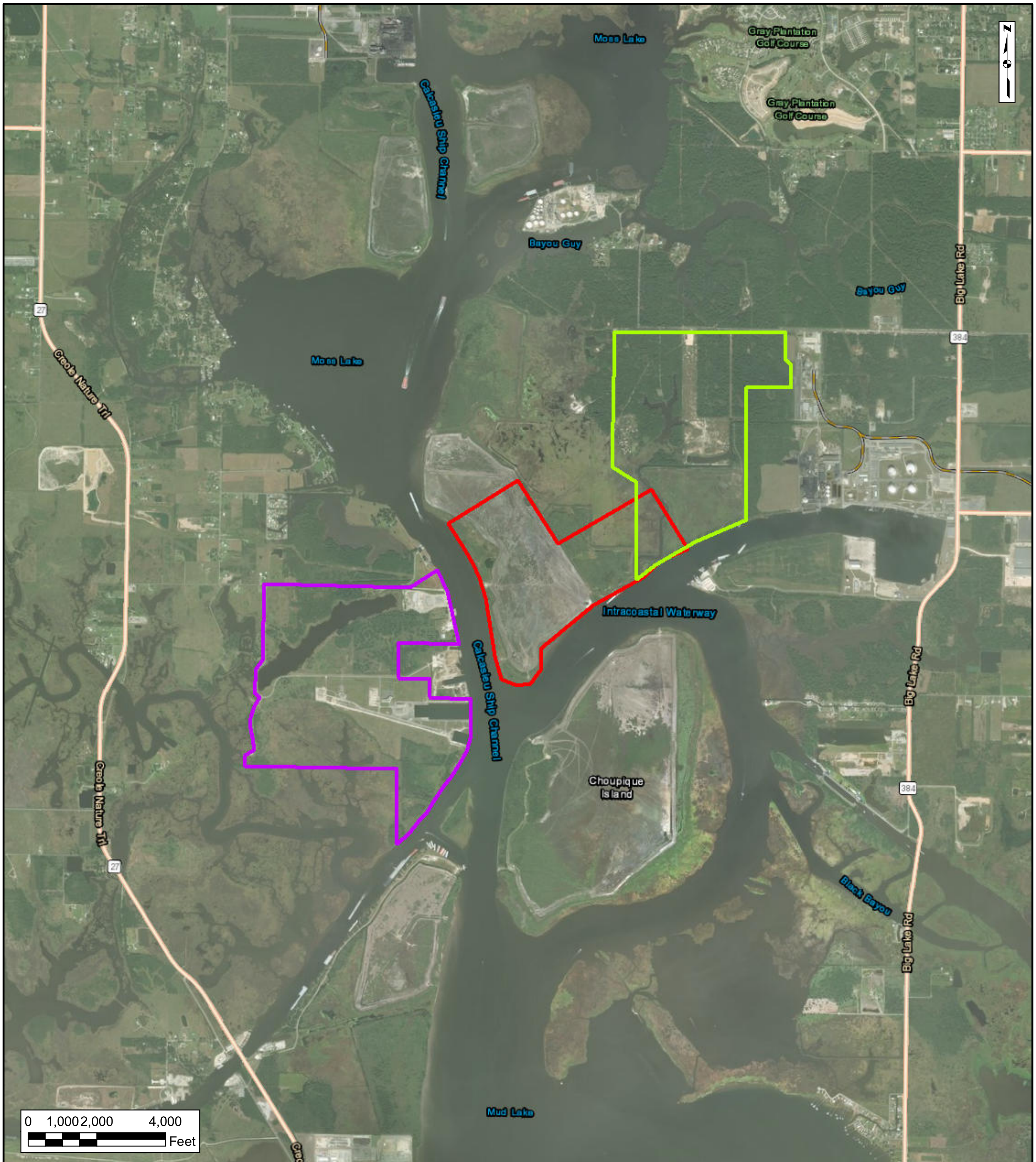
Alternative Site 1 (figure 3.5-1) is a COE-managed DMPA south of Lake Charles, Louisiana, about 0.5 mile east of the proposed site on the east side of the Calcasieu Ship Channel. Development of this site appears feasible, but the environmental impacts of constructing and operating the LNG Facility at Alternative Site 1 would be similar to those at the proposed site, and extending the pipeline to the site would require crossing of the Calcasieu Ship Channel. Therefore, selection of Alternative Site 1 would not provide a significant environmental advantage to Driftwood's proposed site, and we did not evaluate it further.

Alternative Site 2 (Singing River Island)

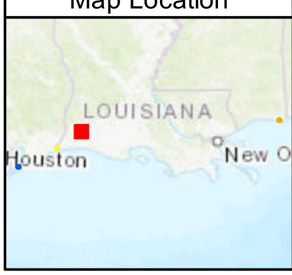
Alternative Site 2 (figure 3.5-2) is a former DMPA on Singing River Island, at the mouth of the Pascagoula River, about 2 miles southwest of Pascagoula in Jackson County, Mississippi. Access by road is via a single bridge (the USS Vicksburg Way), which would need to be evaluated for supporting heavy haul loads and structural integrity. It was considered because it met the minimum acreage requirement for operations (although temporary construction areas were not identified), existing deepwater access, and availability for lease. However, the U.S. Navy and USCG would continue to occupy a portion of the island, constraining the available space during construction and affecting Driftwood's ability to secure and control third-party marine vessel ingress/egress. Because this alternative site was more than 200 miles from either end of the proposed Pipeline, it was assumed that other sources of natural gas would be accessed, and a different pipeline route would be required. The length of this alternative pipeline route was not determined. Because of the issues with security and the potential restrictions for LNG vessel access, as well as uncertainty regarding alternative natural gas sources and pipeline required to access it, selection of Alternative Site 2 would not provide a significant environmental advantage, and we did not evaluate it further.

Alternative Site 3 (Sabine Pass)

Alternative Site 3 (figure 3.5-2) is an undeveloped parcel on the south side of the Sabine Pass Channel, about 1 mile southeast of the Golden Pass LNG Terminal and about 9 miles south of Port Arthur, Texas. Alternative Site 3 provides adequate space for operation and is along a deepwater access channel currently used for LNG carriers. An estimated 10 fewer acres of NWI wetlands would be disturbed relative to the proposed site, but Alternative Site 3 is smaller than the proposed site. Therefore, its use would likely require additional workspace close by during construction, which could easily impact another 10 or more acres of wetlands. Construction of a new access road and utilities would result in additional construction in wetlands near Alternative Site 3, relative to upland construction at the proposed site. Assuming that natural gas was sourced from the same pipeline interconnections, this alternative would require over 40 miles of additional pipeline, much of it in wetlands. Based on this review, we determined Alternative Site 3 did not provide a significant environmental advantage to Driftwood's proposed site and did not evaluate it further.



Map Location



Legend

Proposed Site

Site Alternatives

(Boundaries Approximate)

Alternative Site 1

Alternative Site 6

Figure 3.5-1: Alternative Facility Site Details
Driftwood Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

NOTES:
Map Projection: NAD 1983 StatePlane Louisiana South FIPS 1702 Feet
Image Source: Esri online World Imagery Service.

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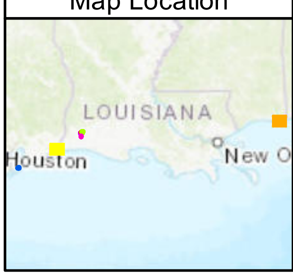
Map Location



Legend

Site Alternatives

(Boundaries Approximate)

Alternative Site 2

Alternative Site 3

Figure 3.5-2: Alternative Facility Site Details
Driftwood Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

NOTES:
Map Projection: NAD 1983 StatePlane Louisiana South FIPS 1702 Feet
Image Source: Esri online World Imagery Service.

\\apaenvfile01\gis\1-PROJECTS\Driftwood\Fig 3.5-1b Driftwood_LNG_Alts_20180605.mxd

Alternative Site 4 (Pelican Island)

Alternative Site 4 (figure 3.5-3) is an existing DMPA on the northern portion of Pelican Island, in Galveston Bay (Galveston County, Texas), about 2.5 miles north of Galveston and about 6 miles south of Texas City. The entire site is shown as wetland by NWI, resulting in over twice the disturbance to this resource, relative to the proposed site. Because this alternative site was more than 100 miles from either end of the proposed Pipeline, it was assumed that other sources of natural gas would be accessed, and a different pipeline route would be required. The length of this alternative pipeline route was not determined. Therefore, we have determined locating the LNG Facility at Alternative Site 4 does not provide a significant environmental advantage to Driftwood's proposed site, and it was not evaluated further.

Alternative Site 5

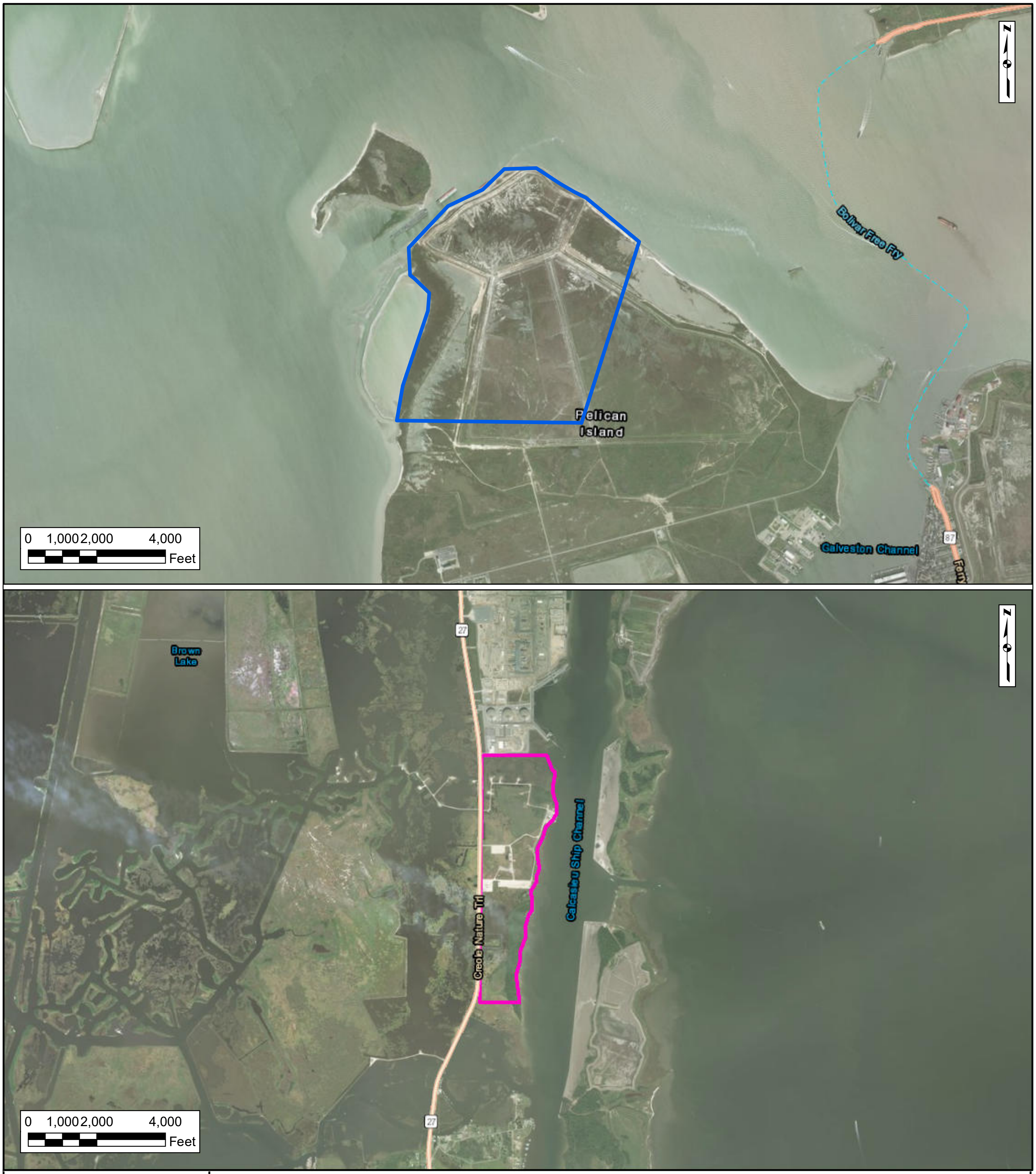
Alternative Site 5 (figure 3.5-3) is an undeveloped parcel on the west side of the Calcasieu Ship Channel, adjacent to the south end of the existing Cameron LNG Terminal. Development of this site would affect more acres of wetlands than the proposed site, and Alternative Site 5 is smaller than the proposed site, and additional construction workspace, which would likely affect additional wetlands, would likely be required. In addition the wetlands on Alternative Site 5 are primarily high-quality wetlands, whereas the wetlands on the proposed site are of low quality. Assuming that Driftwood would use the same pipeline route currently proposed, extended to reach Alternative Site 5, it would require about 4 miles of additional pipeline. Based on our review of the alternative site, we determined that this site did not provide a significant environmental advantage to Driftwood's proposed site and did not evaluate it further.

Alternative Site 6

Alternative Site 6 (figure 3.5-1) is an undeveloped parcel located west of the Alcoa facility on the Industrial Canal. It has no road access. Although development of this site would affect about 50 acres fewer wetlands than the proposed site, the wetlands in the northern portion of the site appear to have the pimple mounds characteristic of remnant coastal prairie habitat, an LDWF vegetation community of special concern, and the need for an access road through wetlands would also add to the wetland impact. Assuming that Driftwood would use the same pipeline route currently proposed, extended to reach Alternative Site 6, it would require about 2 miles of additional pipeline, including a crossing of the Calcasieu Ship Channel. We determined that this site did not provide a significant environmental advantage to Driftwood's proposed site and did not evaluate it further.

3.5.2 LNG Facility Configuration Alternatives

Six different configurations for the LNG Facility (figures 3.5-4 through 3.5-9) were considered for the potential to reduce environmental impacts on nearby residences. Concerns raised during scoping included noise, visual resources, and surface water runoff. The footprint required for liquefaction and Marine Facilities was similar for all configuration alternatives, and surface-water runoff is generally proportional to the amount of impervious surface, which was also similar for all alternative configurations. It would be managed according to local floodplain requirements at the parish level. It did not appear to be a differentiator between



Map Location

Legend

Site Alternatives

(Boundaries Approximate)

Alternative Site 4

Alternative Site 5

Figure 3.5-3: Alternative Facility Site Details
Driftwood Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

NOTES:
Map Projection: NAD 1983 StatePlane Louisiana South FIPS 1702 Feet
Image Source: Esri online World Imagery Service.

\\apaenvfile01\gis\1-PROJECTS\Driftwood\Fig 3.5-1c Driftwood_LNG_Alts_20180605.mxd configurations. Therefore the comparison of alternative configurations focused on the potential for alternative locations within the site to minimize noise and visual impacts on nearby residences.

Noise and visual resources: The liquefaction plants produce constant noise during operation. Configurations B, C, and D place the liquefaction plants north of DWLNG's proposed location (configuration A), reducing the distance to the nearest noise sensitive areas (NSAs) (the Driftwood Community), which reduces the associated noise attenuation and increases the potential for noise at the Driftwood Community. These configuration alternatives were not environmentally preferable to alternative A.

Process flares produce intermittent noise and visual impacts. Configurations B and E place the process flares on the north side of the liquefaction units within the LNG Facility site, reducing the distance to the nearest NSAs, causing a greater impact on these resources at the Driftwood Community; they did not confer an environmental advantage over the proposed configuration (alternative A) for these resources.

Configurations A and F both place the liquefaction plants in about the same location and both place the process flares south of the liquefaction units. The noise and visual impacts of these two configurations are expected to be similar with no environmental advantage conferred by either configuration.

Based on our review of the alternatives for site plan configurations, configurations B, C, D, and E appeared to have greater potential impact than the preferred alternative (configuration A) for noise and visual impacts at the nearby Driftwood Community, and configuration F did not appear to confer an environmental advantage over the proposed configuration. Therefore, alternative configurations B through F were not evaluated further.

Legend

Facility Boundary

0 500 1,000 2,000

Feet

NOTES:
Aerial Imagery: ESRI World Imagery
Reproduced under license in ArcGIS 10.4

Figure 3.5-4: Alternative Facility Layout A Configuration Driftwood Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

Legend

Facility Boundary

0 500 1,000 2,000 Feet

NOTES:
Aerial Imagery: ESRI World Imagery
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Figure **3.5-5**: Alternative Facility Layout B Configuration Driftwood Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

NOTES:
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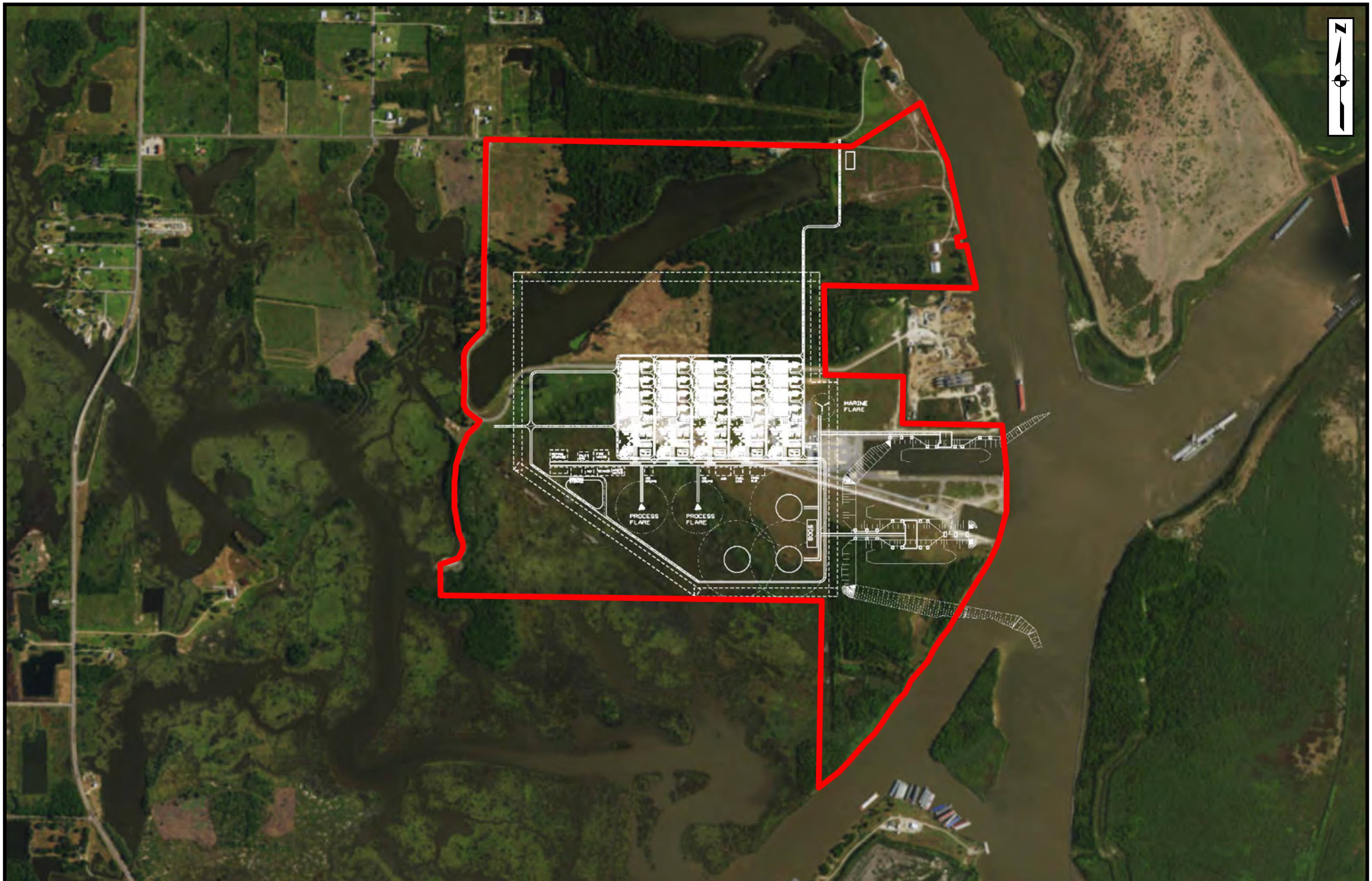
Figure **3.5-6**: Alternative Facility Layout
C Configuration Driftwood Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana



Legend

Facility Boundary

0 500 1,000 2,000 Feet

NOTES:
Aerial Imagery: ESRI World Imagery
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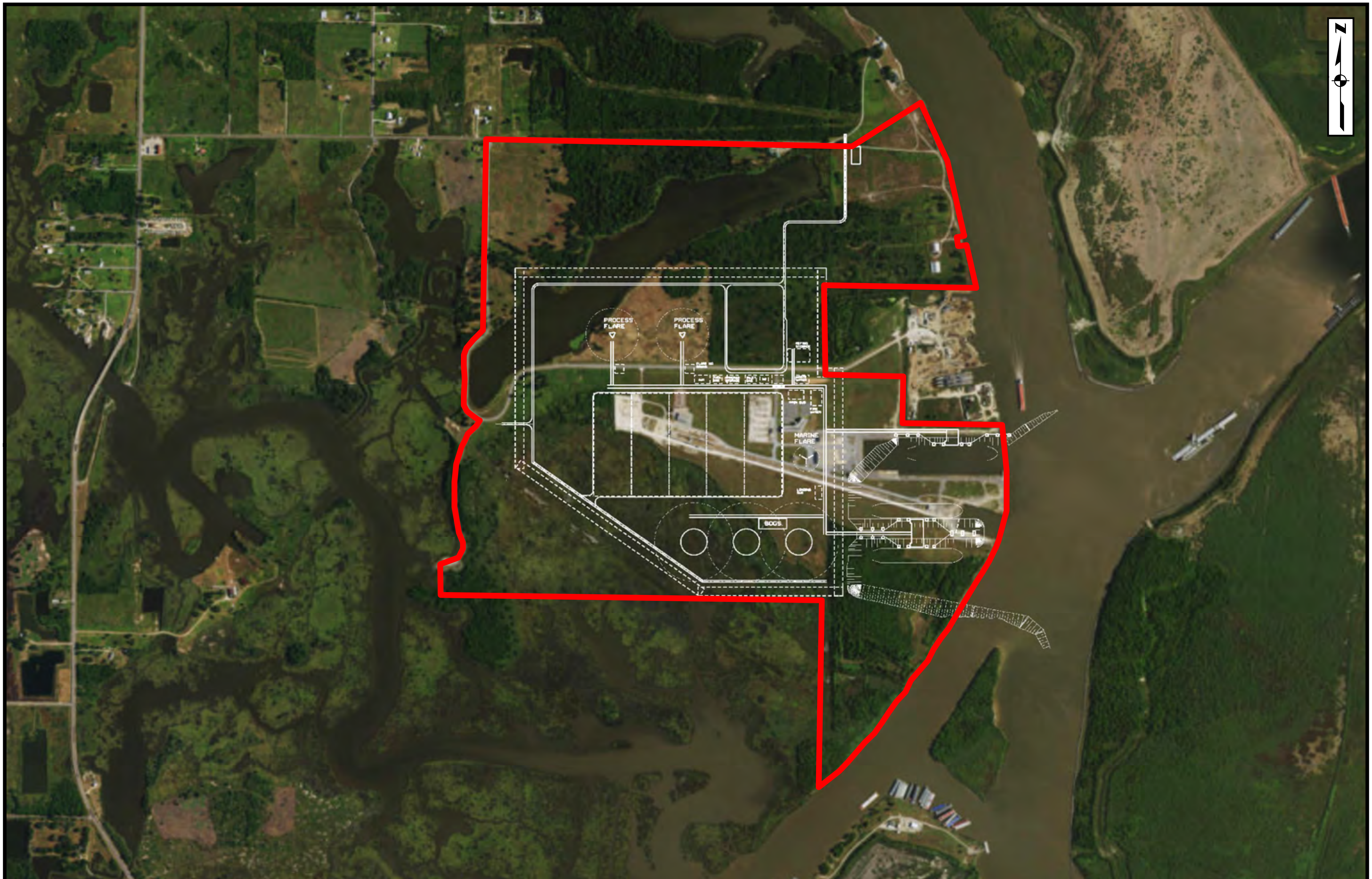
Figure 3.5-7: Alternative Facility Layout D Configuration Driftwood Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana



Legend

Facility Boundary

0 500 1,000 2,000

Feet

NOTES:

Aerial Imagery: ESRI World Imagery

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Figure 3.5-8: Alternative Facility Layout E Configuration Driftwood Project

Driftwood LNG LLC and Driftwood Pipeline LLC

Calcasieu Parish, Louisiana

Legend

Facility Boundary

0 500 1,000 2,000 Feet

NOTES:
Aerial Imagery: ESRI World Imagery
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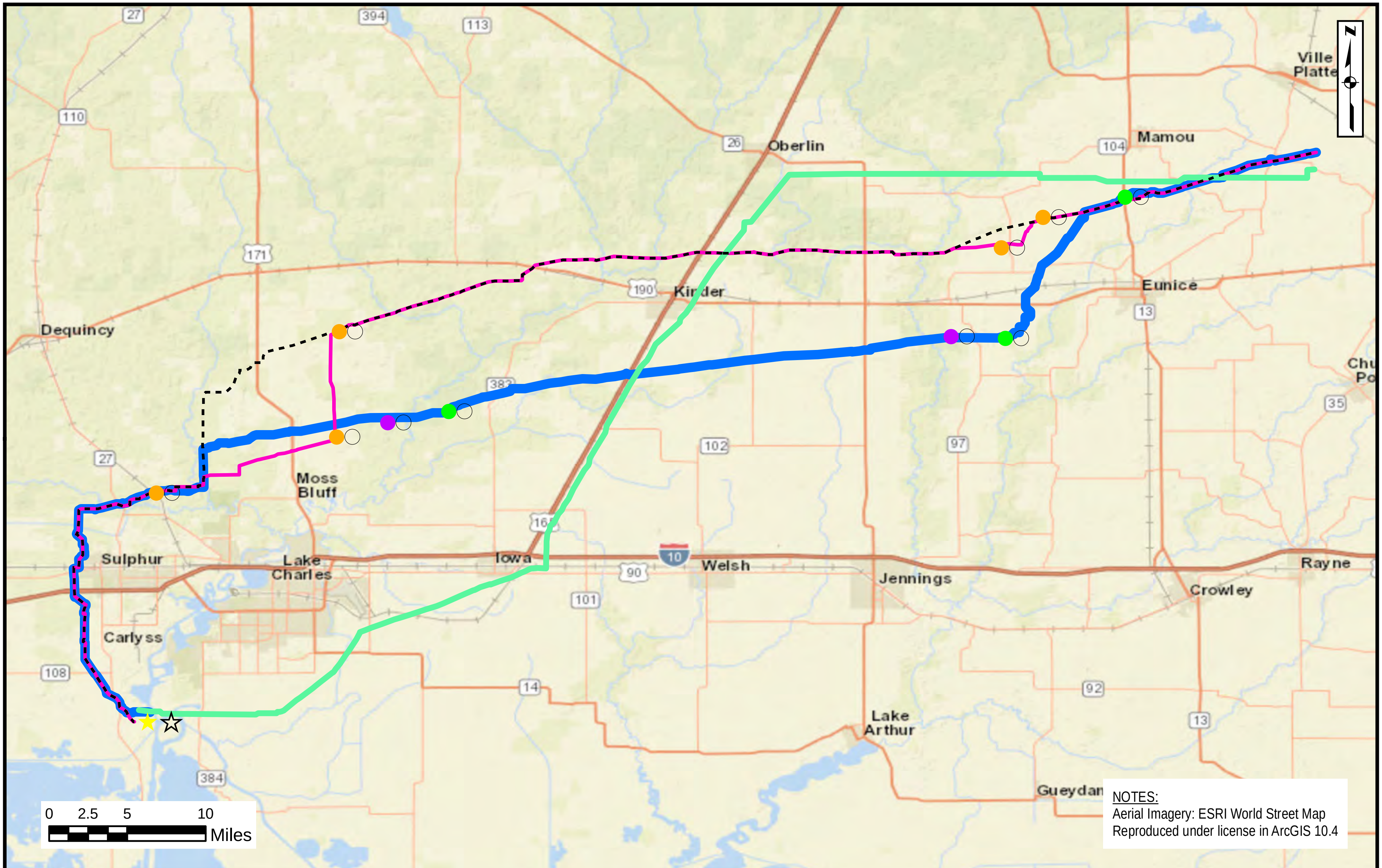
Figure **3.5-9**: Alternative Facility Layout F Configuration Driftwood Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

3.6 PIPELINE ROUTE ALTERNATIVES

3.6.1 Major Route Alternatives

We reviewed three major route alternatives to the proposed Pipeline route (figure 3.6-1) for the potential to significantly reduce the environmental impacts of the Pipeline. These major route alternatives begin at the LNG Facility near the city of Carlyss and end at an interconnect with CGT about 4.5 miles south of Ville Platte, Louisiana. The analysis was based on comparable information (e.g., NWI for wetlands and waterbodies including palustrine emergent [PEM], palustrine scrub-shrub [PSS], and palustrine forested [PFO], and U.S. Department of Agriculture (USDA) information for land use) for each alternative; therefore impacts for the proposed route differs from analyses in other sections of this document that incorporate survey data. The results of this evaluation for Major Route Alternatives 1 through 3 are summarized in table 3.6-1 and are discussed in the following sections.



Legend

Driftwood LNG Site

Currently Proposed Compressor Stations

Alternative Compressor Station Sites on Proposed Route

Alternative Compressor Station Sites on Major Route Alternatives; GILLIS COMPRESSOR

Proposed Pipeline Route

Alternative Route 1

Alternative Route 2

Alternative Route 3

Figure **3.6-1**: Pipeline Major Route Alternatives Driftwood Project
Driftwood LNG LLC and Driftwood Pipeline LLC Calcasieu Parish, Louisiana

Table 3.6-1

Comparison of Major Route Alternatives

Features	Unit	Driftwood's Proposed Route	Alt. 1	Alt. 2	Alt. 3
ROW Requirements and Road Crossings					
Total length[a]	miles	101.8	114.1	98.2	98.6
Length of collocation for the Mainline	miles (percent)	68 (70)	41 (48)	75 (77)	82 (86)
Length of collocation for lateral pipelines	miles (percent)	4.4 (76)	27.3 (94)	0.3 (23)	1.7 (47)
Residences and structures within 50 feet of construction work area [a]	number	9	24	27	11
Land Use [b]					
Agricultural lands crossed	miles	42.6 [c]	52.5	26.5	24.5
Forested lands crossed	miles	6.0	2.8	9.1	8.4
Wetlands Crossed [d]					
PFO	miles	6.5	4.0	8.5	8.3
PSS	miles	0.2	0.4	0.2	0.2
PEM	miles	0.7	0.7	0.5	1.0
Open Water [e]	miles	0.3	1.7	0.3	0.3
Waterbodies Crossed					
Perennial and Intermittent [a]	number	104	158	138	137
Major waterbody crossings (>100 feet) [a]	number	3	31	13	14
Trails					
Creole Nature Trail All-American Road crossings[a,f]	number	1	4	1	1

[a] Total miles of impact or number of occurrences including mainline pipeline, lateral pipelines, compressor stations, and meter stations.

[b] Based on USDA, National Agricultural Statistics Service (2017) Cropland Data Layer.

[c] Includes 2 miles of tree plantation.

[d] NWI. The NWI database is considered the primary source of wetland information used for environmental comparison of the routes. Wetland information provided by the USDA database is derived using different methodology, and does not directly compare with NWI information. USDA information is included for consistency with remaining Land Use categories.

[e] Includes freshwater pond, riverine, marine deepwater, marine wetland, and estuarine classifications.

[f] The Pipeline would pass under the Creole Nature Trail All-American Road (Highway 27).

Major Route Alternative 1

Major Route Alternative 1 was considered because it requires a shorter total length of pipeline (mainline and lateral pipelines).

Although Major Route Alternative 1 is about 11 miles shorter than the proposed route, this alternative would require 23.3 more miles of lateral pipeline than the proposed route; therefore, the total pipeline length is greater. Much of the additional lateral pipeline or "suction lateral" pipeline would be required to connect to hydraulically favorable CS locations. Longer suction laterals would also require a higher amount of compression, and thus larger engines, at CSs. This is because pressure in each pipeline system is highest immediately "downstream" of the CS (in the direction of flow) and lowest immediately "upstream" of the CS (away from flow). For gas from the foreign pipeline to move into the Driftwood pipeline, pressure in the Driftwood pipeline must be lower than that in the foreign pipeline. The greater the difference in pressure, the more efficiently the gas is transferred, which can reduce the amount of compression required. If the CS is "upstream" of a meter station that interconnects with a foreign pipeline, the pressure in the Driftwood system would be similar to or higher than pressure in the foreign pipeline, which would mean very little or no gas would be pulled into Driftwood's pipeline. To ensure a good flow from the foreign pipeline into the Driftwood Pipeline, the CS should be "downstream" of the meter station, that is, between the LNG Facility and the interconnection. Ideally, the CS should be as close as possible downstream of the interconnection so that the lowest-pressure area in the Driftwood Pipeline would be at the interconnection with the foreign pipeline. In practice, siting a single CS immediately downstream of a cluster of interconnections (several interconnections in proximity to each other) allows a single CS to serve several interconnections, further reducing the amount of compression needed. Siting a CS upstream of an interconnection to accommodate physical constraints, such as existing infrastructure and development or sensitive environmental features, would require construction of a "suction lateral" to connect the CS to the Pipeline downstream of the foreign pipeline interconnection. If no suction lateral were constructed, natural gas would not be pulled out of the foreign pipeline and injected into the Driftwood Pipeline. Suction laterals result in construction and operational disturbance, and also increase the compression requirements of the CS, which requires additional/larger engines with associated noise and air impacts during operation.

Topography associated with pipeline routes and compressor station locations also factors in the amount of compression needed at compressor stations. Much like walking or bicycling, additional energy is required to move gas up and down multiple hills or under waterbodies, even if the slope is slight. Additionally, the lower the pressure has fallen within a pipeline by the time it reaches a compressor station, the harder the compressors need to push to bring the gas up to pressure, much like starting from a stopped position on a bicycle.

Over twice the number of homes and structures would be within 50 feet of construction than for Driftwood's proposed route. Fewer total miles of wetlands would be crossed than for Driftwood's proposed route, attributable to a less forested wetlands crossed, although the more open water would be crossed. A larger number of waterbodies would be crossed by Major Route Alternative 1, including a tenfold increase in the number of major waterbodies (>100 feet wide) crossed. Due to the additional lateral lengths and topography from waterbody crossings, an additional 22,800 hp of compression would be required. Because air emissions generally increase with increases in hp, the anticipated air emissions for Major Route Alternative 1 would be greater than Driftwood's proposed route. In addition, Major Route Alternative 1 would cross the All-American Road Creole Nature Trail All-American Road three more times than the proposed route. Therefore, Major Route Alternative 1 would not provide a significant environmental advantage to the proposed route, and we did not evaluate it further.

Major Route Alternative 2

Major Route Alternative 2 was considered because it requires a shorter length of lateral pipelines.

Major Route Alternative 2 is comparable in total length to Driftwood's proposed route and would be collocated with existing utilities for 7 more miles more of mainline pipeline and about 1 less mile of lateral pipeline. Major Route Alternative 3 would be within 50 feet of 27 homes or structures, compared to 9 on Driftwood's proposed route. More forested and open lands would be disturbed, some of which would be converted to non-forested right-of-way for long-term maintenance. More forested wetland would be crossed than Driftwood's proposed route, and 34 more waterbodies would be crossed, including 10 more major waterbodies (>100 feet wide). Driftwood provided hydraulic modeling indicating that an additional 4,200 hp would be required for Major Route Alternative 2 than for the proposed route. Because air emissions generally increase with increases in hp, the anticipated air emissions for Major Route Alternative 2 would be greater than Driftwood's proposed route. Major Route Alternative 2 would not provide a significant environmental advantage to the proposed route, and we did not evaluate it further.

Major Route Alternative 3

Route Alternative 3 was considered because it includes greater collocation with existing linear facilities.

Major Route Alternative 3 is comparable in length to Driftwood's proposed route, and environmental impacts from the mainline would be minimized due to an additional 14 miles of collocation. The number of homes and structures would be within 50 feet of construction is similar to Driftwood's proposed route. More forested wetlands would crossed than for Driftwood's proposed route, and 134 additional waterbodies would be crossed, including 11 more major waterbodies (>100 feet wide). Driftwood's hydraulic modeling indicated that an additional 88,000 hp would be required for Major Route Alternative 3 than for the proposed route. Because air emissions generally increase with increases in hp, the anticipated air emissions for Major Route Alternative 3 would be greater than Driftwood's proposed route. Although disturbance associated with Major Route Alternative 3 would be similar the proposed route, this alternative does not provide a significant environmental advantage to the proposed route, and we did not evaluate it further.

3.6.2 Minor Route Variations

Minor route variations include realignments to minimize localized resource impacts or accommodate landowner requests. Only those resources that would have impacts that are significantly different from the proposed Pipeline alignment are discussed. The analyses were based on comparable information (e.g., NWI for wetlands and waterbodies, USDA information for land use) for each alternative.

A comment on the draft EIS recommended avoidance of the Pipeline crossing of Bayou Serpent. Bayou Serpent would be crossed using the HDD method, which is described in Section 2.5.3.1. This construction method minimizes impacts between the entry and exit points by boring underneath the surface feature. The site-specific construction plans for HDDs 5 and 6, which avoid disturbance to Bayou Serpent are shown on figures 2.5-11 and 2.5-12.

3.6.2.1 Burton Shipyard Road Route Variation

We reviewed one alternative pipeline route variation between approximate MPs 0.0 and 1.4, which would locate the Pipeline to the north of Burton Shipyard Road (FERC eLibrary accession number 20180305-5158), which would reduce the potential for delays due to construction-traffic congestion during construction of the Pipeline within the LNG Facility site between approximate MP 0.0 and 0.9 (figure 3.6-2). The results are summarized in table 3.6-2, and discussed in more detail below.

Table 3.6-2

Comparison of Burton Shipyard Road Route Variation

Features	Unit	Proposed Route	Burton Shipyard Road Route Variation
Length	miles	1.4	1.4[a]
Length of Collocation (pipeline and road)	miles	1.0	1.4
Residences within 50 feet of construction ROW [b]	number	1	2
Number of parcels	number	9[c]	10
Land Use [b, d]			
Forested Lands	acres	0.2	3.1
Open Water		0.2	0.7
Wetlands			
PEM/PSS	acres	5.2	9.3
PFO	acres	0[a]	1.9
Total Land Disturbance	**acres**	**9.1**	**18.5**
Waterbodies crossed	number	4	10

[a] Approximately 0.9 mile of pipeline would be constructed within the area disturbed for the LNG Facility.

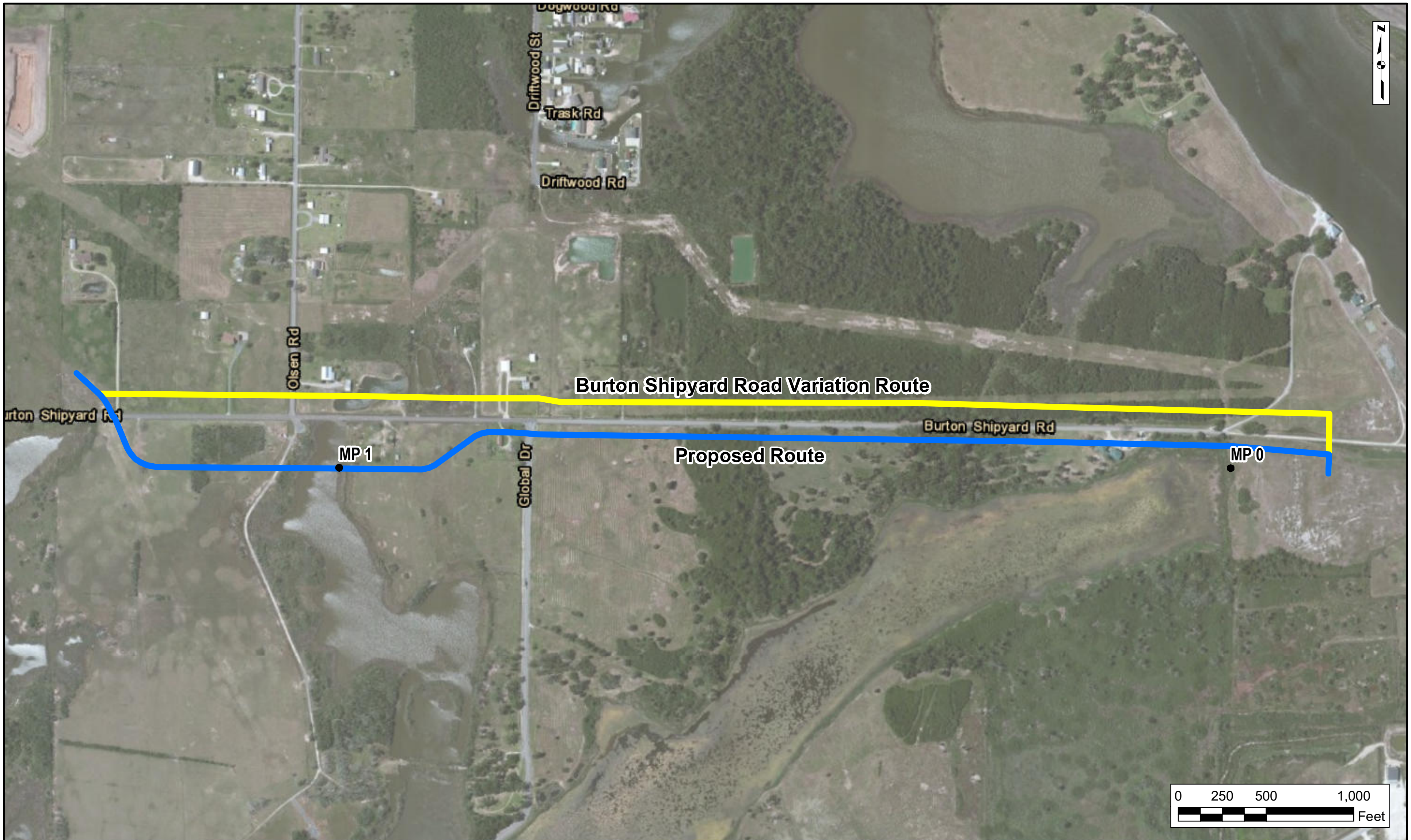
[b] Assumes a standard construction width for 48-inch-diameter pipeline of 130 feet in uplands and 110 feet in wetlands, abutting the existing rights-of-way where collocated, and otherwise centered on the pipeline. Excludes area within the LNG Facility boundary that would be disturbed during construction/operation.

[c] Includes three parcels under contract for the LNG Facility.

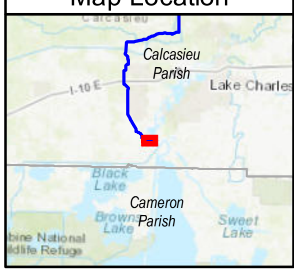
[d] National Land Cover Database (NLCD)

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

Construction workspace and operational right-of-way for the proposed alignment between MP 0.0 and MP 0.9 would be within the disturbed area for the LNG Facility and therefore is not included in this analysis. Construction workspace and operational right-of-way for the Burton Shipyard Road Route Variation would disturb approximately 9.4 additional acres of land than the proposed route, including 6.0 additional acres of wetlands, 1.9 acres of which are palustrine forested (PFO) wetlands. The Burton Shipyard Road Route Variation also would affect 2.9 additional acres of forested uplands than the proposed route. Although the amount of vegetation and wildlife habitat affected would be greater for the Burton Shipyard Road Route Variation than for the proposed route, these areas are within an existing developed area. The Burton Shipyard Road Route Variation would cross more waterbodies resulting in more temporary impact on surface waters during construction than for the proposed route.



Map Location



Legend

- • Milepost
- Burton Shipyard Road Variation Route (yellow line)
- Proposed Route (blue line)

Figure 3.6-2: Burton Shipyard Road Variation
Driftwood Project
Calcasieu Parish, Louisiana

NOTES:
Map Projection: NAD 1983 StatePlane Louisiana South FIPS 1702 Feet
Image Source: Esri online World Imagery Service.

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The Burton Shipyard Road Route Variation would affect one more landowner than the proposed route, based on the number of parcels of land, and construction would be within 50 feet of one more residence than the proposed route. The Burton Shipyard Road Route Variation would cross two additional roads, including Olsen Road, which provides access to the Driftwood Community, and would result in additional traffic impacts for that community during construction.

Based on our analysis, we have determined the Burton Shipyard Road Route Variation does not provide a significant environmental advantage, and therefore it was not analyzed further.

3.6.2.2 MP 12.9 Route Variation

We reviewed the MP 12.9 route variation to reduce impacts on forested wetlands. This variation would avoid two conventional-bore crossings of the Houston River Canal at approximate MPs 13.05 and 13.75 by instead paralleling the east side of the Canal (figure 3.6-3). The proposed route variation would be installed using HDD methods to further reduce disturbance on the forested wetlands on the east side of the Canal. A comparison of the proposed route and the MP 12.9 Route Variation provided by Driftwood (FERC eLibrary accession number 20180305-5158), constructed using HDD, is summarized in table 3.6-3.

Table 3.6-3

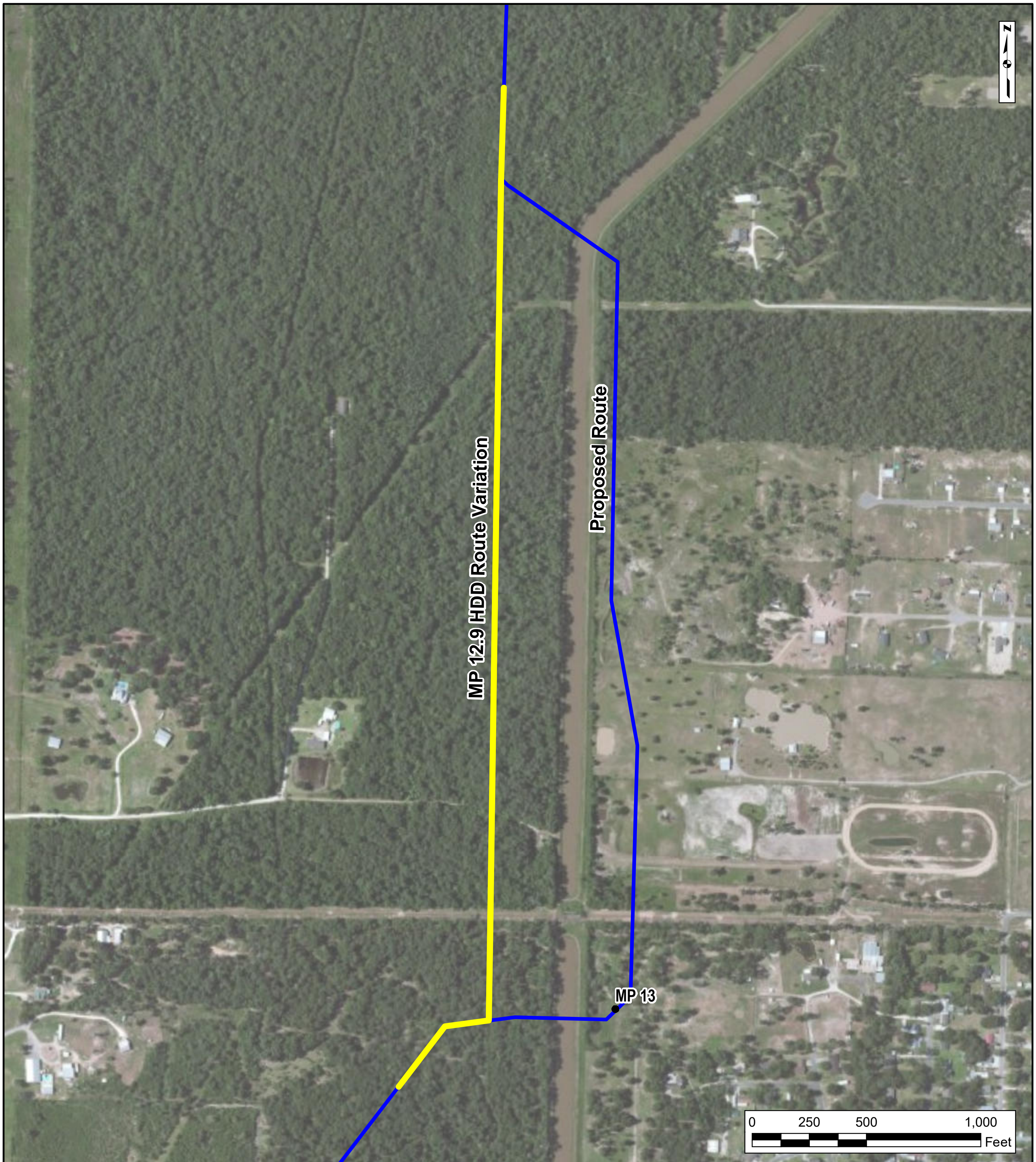
Comparison of the MP 12.9 Route Variation

Features	Unit	Proposed Route	MP 12.9 Route Variation
Length	miles	1.0	0.9
Length of Collocation	miles (percent)	0.5 (51%)	0 (0%)
Number of parcels	number	11	5
NSAs within 0.2 mile of HDD or bore entry/exit	number	17	3
Land Use [a, b]			
Forested Lands	acres	0.9 [a]	0 [a, b]
Open Lands	acres	3.7 [a]	0 [a, b]
Developed Lands	acres	4.8 [a]	0 [a, b]
Wetlands			
PEM/PSS	acres	1.2	0
PFO	acres	12.2[a]	6.2[a]
Total Land Disturbance	**acres**	**22.8**	**6.2**
Waterbody Crossings		4	1

[a] Assumes a standard construction width for 48-inch-diameter pipeline of 130 feet in uplands and 110 feet in wetlands, abutting the existing rights-of-way where collocated, and otherwise centered on the pipeline.

[b] NLCD

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



Map Location

Legend

- Milepost
- Proposed Route
- MP 12.9 Route Variation

Figure 3.6-3: MP 12.9 HDD Variation
Driftwood Project
Calcasieu Parish, Louisiana

NOTES:
Map Projection: NAD 1983 StatePlane Louisiana South FIPS 1702 Feet
Image Source: Esri online World Imagery Service.

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Overall disturbance associated with the MP 12.9 Route Variation would be approximately 16.6 acres less than the proposed route. The proposed route would affect open space and developed lands as well as wetlands (both PEM/ PSS and PFO), while the MP 12.9 Route Variation would be exclusively located in PFO wetlands. Because the MP 12.9 Route Variation would be constructed using HDD methods, it would result in disturbance of approximately 7.2 fewer acres of wetlands.

The proposed route would require four waterbody crossings, two of which would be by conventional bore and so would not affect the waterbody. The MP 12.9 Route Variation would cross only one waterbody, which it would cross by HDD.

The proposed pipeline route crosses six parcels more than the MP 12.9 Route Variation. Because the MP 12.9 Route Variation would require tree clearing in a forested area, it would result in a slightly greater impact on visual resources viewed from Kim Road.

Construction noise associated with conventional boring of the Canal would affect 17 NSAs within 0.2 mile of entry/exit points of the proposed pipeline route, compared to only three NSAs within 0.2 mile of HDD entry/exit points affected by the MP 12.9 Route Variation.

Cultural resources have not been evaluated for the MP 12.9 Route Variation. One previously recorded site of unknown eligibility is located on the proposed route, and a different previously recorded site of unknown eligibility is located on the MP 12.9 Route Variation. The site on the MP 12.9 Route Variation would be avoided through construction by HDD.

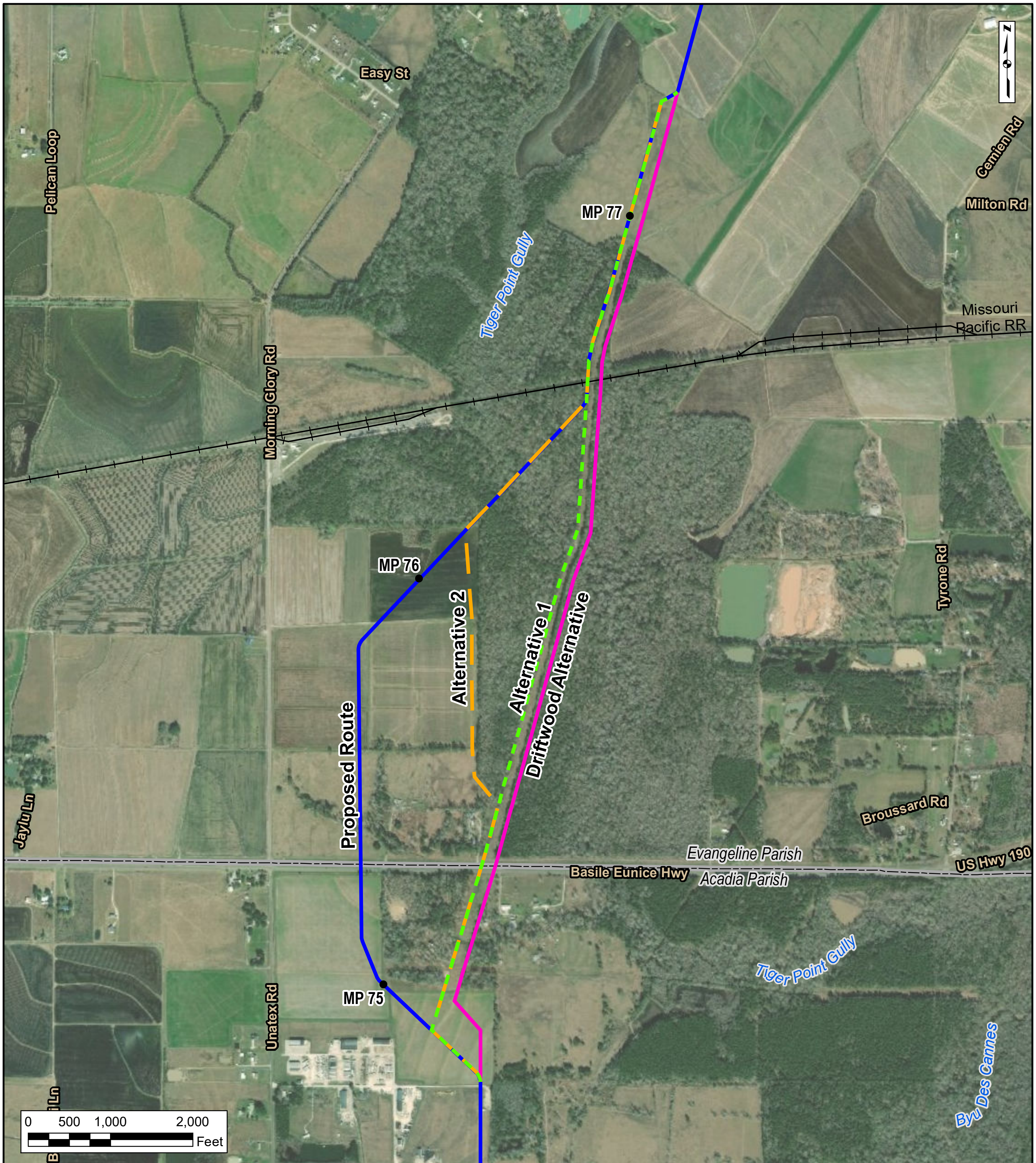
Based on our analysis, we have determined that the MP 12.9 Route Variation would affect fewer landowners, result in less overall disturbance, and less disturbance to wetlands, but would have a greater potential to affect visual resources from Kim Road. Overall, we conclude the MP 12.9 Route Variation offers a significant environmental advantage and should be incorporated into the proposed route. Therefore, **we recommend:**

> **<u>Prior to construction</u>, DWPL should adopt the MP 12.9 Route Variation into the Pipeline route. DWPL should file with the Secretary of the Commission (Secretary), for review and written approval by the Director of the Office of Energy Projects (OEP), revised alignment sheets that show its modified route and workspaces in the area, an HDD site-specific plan, and the results of geotechnical investigations (or indicate timing of when this would be provided).**

3.6.2.3 Aucoin Reroute

The Aucoin Reroute was considered in response to a landowner-who requested a variation of the 42-inch pipeline route crossing their lands at approximately MP 75.4. The landowner stated that Driftwood's proposed route bisected his property and that existing pipeline rights-of-way were available for a collocated route that either followed the property's boundary or avoided the property altogether. We reviewed alternative routes prepared by Driftwood (FERC eLibrary accession number 20171106-5328), as well as two additional options in this area to minimize bisecting the property.

Driftwood's Alternative results in a slightly (0.2 mile) shorter alignment with more collocation with existing rights-of-way and avoids bisecting the landowner's property. Although Driftwood's alternative would result in less impact to forested wetlands, construction disturbance would be within 50 feet of two residences and one outbuilding. The same number of parcels would be affected by each route, although one parcel would be different on each route. Therefore, Driftwood's Alternative would be less preferable than the proposed route, and we did not consider it further.



Map Location

Legend

- Milepost
- Proposed Pipeline Route
- Alternative 1
- Alternative 2
- Driftwood Alternative

Figure 3.6-4: Aucoin Reroute Variations
Driftwood Project
Evangeline & Acadia Parishes, Louisiana

NOTES:
Map Projection: NAD 1983 StatePlane Louisiana South FIPS 1702 Feet
Image Source: Esri online World Imagery Service.

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In addition to Driftwood's alternative, we developed and analyzed two alternate routes. Minor Route Alternatives 1 and 2 for the Aucoin Reroute would be 0.1 mile shorter would and provide greater collocation, and avoid bisecting the landowner's property. The alternatives would result in similar impact to forested wetlands, and result in slightly more disturbance to forested lands. In addition, one residence would be within 50 feet of the construction disturbance of each of these alternative routes. The same number of parcels would be affected by each of these routes compared to the proposed route. Existing structures are adjacent to the alternate routes, and additional workspace needed to cross the Basile Eunice Highway would result in workspace within 50 feet of a residence. Therefore, although the overall reduction in disturbance is generally preferable, we have determined these alternative routes do not provide a significant environmental advantage, and therefore they are not analyzed further.

These alternatives are shown in (figure 3.6-4). A summary of these alternative routes is included as table 3.6-4.

Table 3.6-4

Driftwood Alternative for Aucoin Reroute

Features	Unit	Proposed Route	Driftwood's Alternative	Minor Route Alternative 1	Minor Route Alternative 2
Length	miles	2.6	2.4	2.4	2.5
Length of Collocation	miles (percent)	1.2 (47%)	2.4 (100%)	2.2 (93%)	2.4 (94%)
Residences within 50 feet of construction ROW [a]	number	0	2	1	1
Land Use [b, d]					
Developed Lands	miles	0.1	0.1	0.1	0.1
Agricultural Lands (*Cultivated Crops, Hay/Pasture*)	miles	1.8	1.0	0.8	1.3
Forested Lands (*Deciduous Forest, Evergreen Forest, Mixed Forest*)	miles	0.1	0.2	0.4	0.2
Open Lands (*Herbaceous, Shrub/Scrub*)	miles	0	0.1	<0.1	<0.1
Wetlands (*Emergent Herbaceous Wetlands, Woody Wetlands*)	miles	0.6	1.0	1.1	0.9
Wetlands crossed [c, d]					
PEM	miles	0.0	0.0	0.0	0.0
PSS	miles	0.0	0.0	0.0	0.0
PFO	miles	0.4	0.2	0.5	0.4

[a] Assumes a standard construction width for 48-inch-diameter pipeline of 130 feet in uplands and 110 feet in wetlands, abutting the existing rights-of-way where collocated, and otherwise centered on the pipeline.

[b] NLCD

[c] NWI

[d] The NWI database is considered the primary source of wetland information used for environmental comparison of the routes. Wetland information provided by the NLCD database is derived using different methodology, and does not directly compare with NWI information. NLCD information is included for consistency with remaining Land Use categories.

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

3.6.2.4 Port Arthur Pipeline Variation

The proposed Port Arthur Pipeline Louisiana Connector Project (FERC Docket No. CP18-7-000) would overlap with portions of the Driftwood Pipeline corridor between approximate DWPL MP 5.6 and 16.2 in Calcasieu Parish. Generally, space restrictions have the potential to occur where both proposed pipeline alignments are adjacent to an existing utility right-of-way. Our review of the available mapping indicates that in most locations, both the Driftwood Pipeline and the Port Arthur Pipeline would have sufficient space to construct adjacent to each other. Minor adjustments to one or both alignments could be required to minimize overall environmental impact and ensure final alignments are immediately adjacent to one another. Where the existing utility is a Port Arthur affiliate, Port Arthur could construct within 25 feet of the existing pipeline rather than 50 feet, which could reduce the overall permanent right-of-way width for three pipelines to 125 feet rather than 150 feet. Driftwood's schedule for the Pipeline estimates construction approximately 2 years after receiving their Certificate, after construction begins on the LNG Facility. Port Arthur's schedule estimates construction beginning within the same year as receiving their certificate to proceed. Because the timing of each project's possible approval by the Commission is not determined at this time, both applicants have provided route variations to accommodate the other pipeline.

Driftwood filed a realignment, the "Port Arthur Pipeline Variation," identifying approximately 7.0 miles within the general area where they could make adjustments to the alignment of the Driftwood Pipeline to accommodate the Port Arthur Pipeline adjacent to the existing utility (FERC eLibrary accession number 20180305-5158). The Port Arthur Pipeline Variation would require route variations at five locations with a total length of about 7.0 miles (table 3.6-5).

Table 3.6-5

Collocation of Port Arthur Pipeline Variation with Port Arthur Affiliates [a]

Segments that DWPL adjusted for the Port Arthur Pipeline Variation			Segments adjacent to Port Arthur affiliate utility		
MP start	MP stop	Length (miles)	MP start	MP stop	Length (miles)
5.6 [b]	6.7 [b]	1.1	5.6 [b]	6.7 [b]	1.1
7.2	7.4	0.2	7.2	7.4	0.2
8.2	8.5	0.4	8.2	8.5	0.4 [b]
8.6	12.7	4.1	8.6	9.0	0.4
			10.0	11.3	1.3
15.0	16.2	1.2	--	--	--
	Total adjustments	7.0		Total adjacent to Port Arthur affiliate	3.3

a mileposts and miles have been rounded for presentation purposes.
b MP 6.4 to 7.1 installed using HDD construction method.

Within these locations, the Driftwood Pipeline would be immediately adjacent to a Port Arthur affiliate for approximately 3.3 miles. The Port Arthur Pipeline Variation would shift the centerline and workspaces for the Driftwood Pipeline an additional 50 feet away from the existing utility right-of-way to accommodate construction and operation of the Port Arthur Pipeline immediately adjacent to the existing utility right-of-way (figure 3.6-5). Where Port Arthur could construct immediately adjacent to an affiliate pipeline, reducing the distance between the affiliate utility and their pipeline could move approximately 3.4 acres of temporary and permanent disturbance onto existing utility right-of-way.

A comparison of Driftwood's proposed route and the Port Arthur Pipeline Variation is summarized in table 3.6-6 and discussed in more detail below.

Table 3.6-6

Comparison of the Port Arthur Pipeline Variation

Features	Unit	Proposed Route	Port Arthur Pipeline Variation Route
Length	miles	10.7	10.7
Length of Collocation	miles (percent)	5.5 (51.8)	5.5 (51.7)
Residences within 50 feet of construction ROW [a]	number	4	4
Number of parcels [a]	number	43	44
Roads Crossed	number	12	12
Pipeline installed by HDD [a]	number of locations	4	4
Land Use [a, c, d]			
Agricultural Lands	acres	2.4	2.5
Forested Lands	acres	5.6	5.4
Open Lands	acres	47.8	46.1
Developed Lands	acres	13.0	13.2
Open Water		1.7	1.9
Wetlands [e]			
PEM/PSS	acres	20.0	14.8
PFO	acres	81.0	88.4
Total Land Disturbance		**171.6**	**172.4**
Waterbodies crossed [e]		7	8

[a] Within areas where realignments are anticipated, as shown on figure 3.6-5. Based on review of alignment sheets, aerial imagery, and alternatives filed by Driftwood.

[b] Assumes a standard construction width for 48-inch-diameter pipeline of 130 feet in uplands and 75 feet in wetlands <500 feet, abutting the existing rights-of-way where collocated, and otherwise centered on the pipeline.

[c] Assumes clearing and maintenance of a 10-foot-wide ROW above pipeline installed via the HDD construction method.

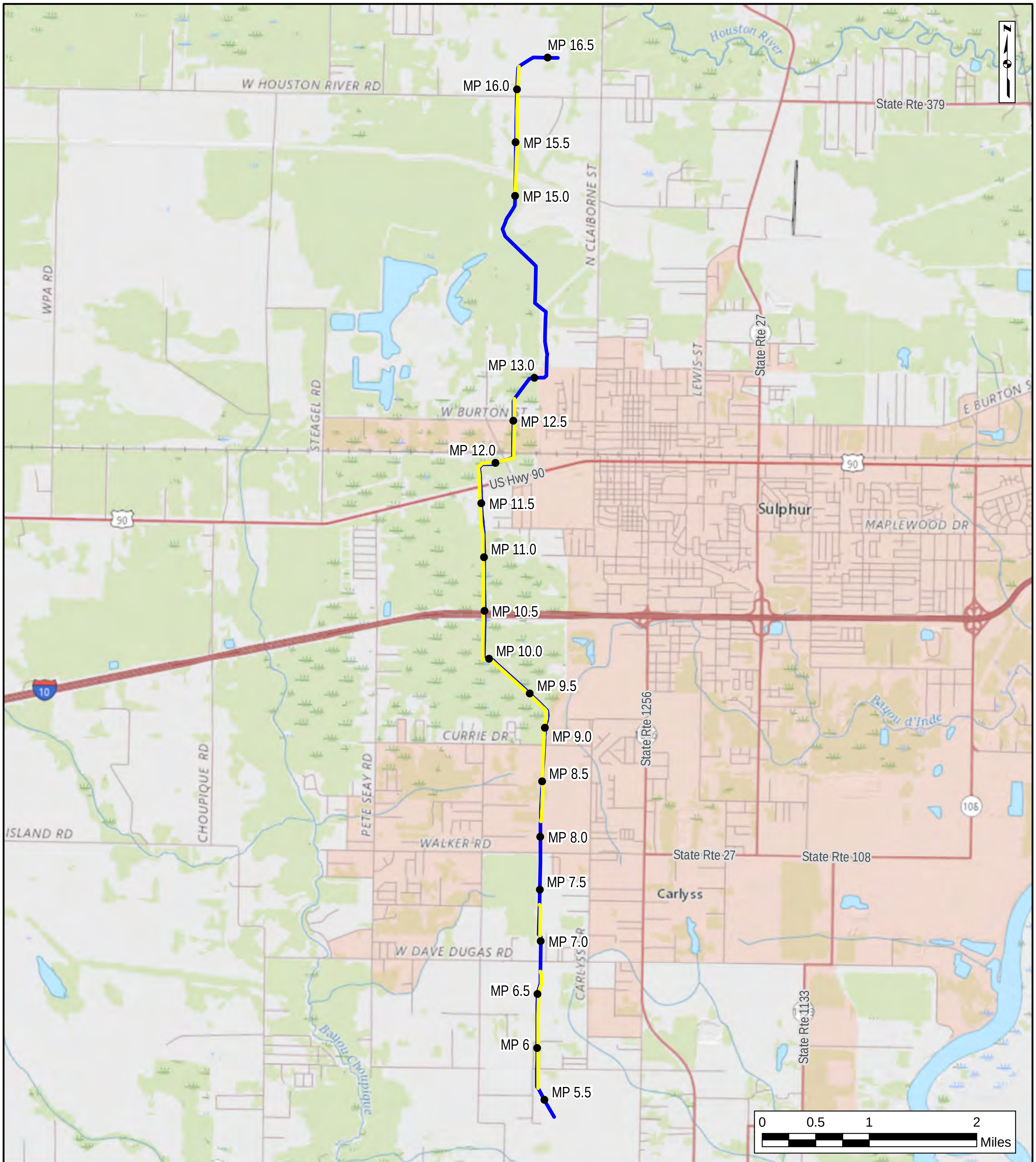
[d] Based on Driftwood's field evaluation of conditions.

[e] Based on field wetland delineation or aerial extrapolation of field results.

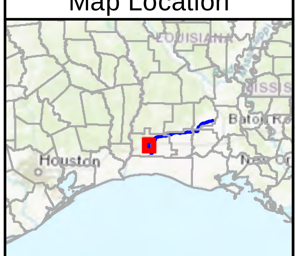
The numbers in this table have been rounded for presentation purposes. As a result, the totals may not reflect the sum of the addends.

The Port Arthur Pipeline Variation would disturb an additional 0.8 acre (<0.5 percent), relative to the proposed alignment. Land use disturbed by the Port Arthur Pipeline Variation would shift slightly, resulting in more disturbance of PFO wetlands and developed lands (7.4 and 0.3 acres, respectively) and less disturbance of PEM/PSS wetlands and open lands (5.2 and 1.7 acres, respectively) relative to the proposed alignment. Differences in disturbance of the remaining land use or vegetation types between the Port Arthur Pipeline Variation and the proposed alignment are minimal.

The Port Arthur Pipeline Variation would affect an additional 0.2 acre of open water and would cross one additional waterbody than the proposed alignment. These impacts would be short-term and would result in a minor increase in impact on surface waters during construction.



Map Location



Legend

- Milepost
- Port Arthur Pipeline Variation
- Proposed Centerline

Figure **3.6-5**: Port Arthur Pipeline Variation
Driftwood Project
Calcasieu Parish, Louisiana

NOTES:
Map Projection: NAD 1983 StatePlane Louisiana South FIPS 1702 Feet
Image Source: Esri online World Imagery Service.

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Based on review of alignment sheets and Driftwood's Port Arthur Pipeline Variation, we would anticipate the same number of landowners (as indicated by number of parcels) would be affected, and the same number of residences would be within 50 feet of construction.

The Port Arthur Pipeline Variation would shift four HDD locations (discussed in more detail in section 2.1.3) approximately 50 feet but would not affect the impacts on the waterbodies crossed. Noise levels anticipated due to HDD construction at NSAs within 0.5 mile of entry or exit points are summarized in table 4.12-15. Of the four locations, no change in the HDD entry or exit point would be anticipated for HDD A1, and no NSAs are located within 0.5 mile of HDD A3. Therefore, there would be no change in impact from the Port Arthur Pipeline Variation at these two locations. The Port Arthur Pipeline Variation would shift the entry site at HDD A2 slightly closer to the closest NSA, which could result in additional impact on that NSA relative to the proposed alignment. Driftwood currently is proposing mitigation for the proposed alignment for the HDD A2 entry site and would be required to ensure mitigation measures would be sufficient to mitigate impacts on that NSA, if the Port Arthur Pipeline Variation were implemented. The Port Arthur Pipeline Variation would shift the exit site to the west slightly for HDD 1, which would move the location slightly farther from the closest NSA and closer to the second-closest NSA. Noise levels associated with the exit location for HDD 1 for the proposed alignment are anticipated to be below our threshold of 55dBA L_{dn}. Because the exit location would move away from the NSA, we anticipate the potential for noise impacts also would decrease.

No significant difference in impact on geological resources, soils resources, groundwater resources, wildlife habitat, fisheries resources, special status species, recreation, visual impact, air quality, or safety would be anticipated between the proposed route and Port Arthur Pipeline Variation. Workspace would be wholly or partially located within the environmental corridor surveyed for cultural and biological resources. As such, the impacts and mitigation measures developed for sensitive features would generally be the same for both routes.

While both routes would result in similar impacts on environmental resources due to their relatively close alignment and overall length, we note that the adoption by DWPL of the Port Arthur Route Variation does convey an environmental advantage compared to the use of DWPL's proposed alignment because it would allow collocation of the Port Arthur Pipeline with its affiliate pipeline, which would move approximately 3.4 acres of disturbance onto existing utility rights-of-way. DWPL's use of the Port Arthur Pipeline Variation, when considered in combination with Port Arthur's pipeline, would result in lower cumulative impacts on land uses due to this shift. Therefore, **we recommend that**:

<u>Prior to construction,</u> DWPL should adopt the Port Arthur Route Variation into the Pipeline route and file with the Secretary revised alignment sheets that show its modified route and workspaces in the area, for review and written approval by the Director of OEP.

Based on our analysis, we also determined that both DWPL's proposed alignment and the Port Arthur Pipeline Variation would meet the project objectives, and the impacts associated with either route would be environmentally acceptable and appropriately mitigated through DWPL's proposed compensatory wetland mitigation (section 4.5.3).

Driftwood provided a comment on the draft EIS regarding our recommendation requiring DWPL to provide a construction coordination plan that identifies the specific construction measures that DWPL and Port Arthur Pipeline Louisiana Connector have agreed to implement in the construction of the parallel portions of their respective projects between MP 5.6 and MP 16.2 in the non-exclusive easement. In their comment, Driftwood requested that a similar recommendation be included in the final EIS for the Port Arthur Pipeline Louisiana Connector. In a comment on the draft EIS prepared for the Port Arthur Pipeline Louisiana Connector, Port Arthur stated that it would coordinate with Driftwood along the parallel portions of the respective projects, should construction activities take place at the same time. Because the applicants will voluntarily coordinate, we have removed the recommendation.

3.6.2.5 Longleaf Pine Savanna Route Variation

We received a comment on the draft EIS requesting an analysis of an alternative route between MPs 20.8 and 21.6 that would avoid and/or reduce impacts on longleaf pine savanna, a vegetation community of special concern. Long leaf pine savanna is discussed in section 4.6.1.4. We analyzed two route variations to DWPL's proposed alignment to evaluate the potential to minimize or avoid impact on longleaf pine savanna (figure 3.6-6).

Our alternatives analysis is based on readily accessible public information; however, there are no readily accessible public information sources that identify longleaf pine savanna. Longleaf pine savanna is typically identified by field surveys.

We reviewed aerial photographs of the route and adjacent areas between MPs 20.8 and 21.6. Based on our assessment of these aerial photographs, the area south of the proposed alignment appears to be bottomland hardwood forest, and the area north of the proposed alignment appears to be higher quality longleaf pine savanna, crossed by an existing pipeline easement. Table 3.6.7 provides a comparison of Driftwood's proposed route and our two route variations.

Table 3.6-7

Comparison of the Longleaf Pine Savanna Variation

Features	Unit	Proposed Route	Longleaf Pine Savanna North Variation	Longleaf Pine Savanna South Variation
Length	miles	1.30	1.40	1.30
Length of Collocation	miles (percent)	0 (0%)	0.7 (52%)	0 (0%)
Residences within 50 feet of construction ROW [a]	number	0	0	2
Number of parcels [a]	number	13	11	9
Roads Crossed	number	1	1	1
Vegetation Association [b]				
Potential Longleaf Pine Savanna	miles	0.5	0.8	0.2
Potential Bottomland Hardwood	miles	0.6	0.0	0.9
Land Use [a, c, d]				
Developed, Low Intensity	acres	0.5	3.2	0.2
Developed, Open Space	acres	1.0	0.2	0.0
Emergent Herbaceous Wetlands	acres	0.1	0.0	0.8
Evergreen Forest	acres	6.4	5.1	6.7
Hay/Pasture	acres	1.2	0.0	0.0
Herbaceous	acres	1.0	0.4	0.2
Shrub/Scrub	acres	3.4	8.8	4.5
Woody Wetlands	acres	3.4	0.3	4.1

Table 3.6-7

Comparison of the Longleaf Pine Savanna Variation

Features	Unit	Proposed Route	Longleaf Pine Savanna North Variation	Longleaf Pine Savanna South Variation
Total NLCD Land Disturbance	**acres**	**17.0**	**18.0**	**16.5**
NWI [d, e]				
PEM/PSS	acres	1.4	0.4	2.7
PFO	acres	0.4	0.0	0.4
Waterbodies crossed [b]	number	4	3	3

[a] Within areas where realignments are anticipated, as shown on figure 3.6-6. Based on review of alignment sheets, and aerial photographs.

[b] Based on interpretation of aerial photographs.

[c] Based on National Land Cover Database (NLCD, 2016). Available at https://www.sciencebase.gov/catalog/item/581d050ce4b08da350d52363. Wetland acreage estimated by NLCD is not equal to wetland acreage estimated by NWI.

[d] The proposed alignment used a 110-foot construction ROW (i.e., DWPL's standard construction ROW width for 48-inch-diameter pipeline in wetlands). For consistency, we assumed a 110-foot construction ROW for the route variations.

[e] NWI wetlands were based on 1988 aerial photographs (**color infrared** imagery). Available at: http://www.fws.gov/wetlands/ Wetland acreage estimated by NWI is not equal to wetland acreage estimated by NLCD.

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

The Longleaf Pine Savanna North Variation would result in a longer route and greater land disturbance when compared to the proposed alignment. Based on aerial photographs, the route variation would cross 0.3 mile more potential longleaf pine savanna. Because the Longleaf Pine Savanna North Variation would result in additional disturbance and disturb more potential longleaf pine savanna, we conclude this alternative would not offer a significant environmental advantage over the proposed action, and we did not analyze it further.

Map Location

- MP
- Proposed Route
- Longleaf Pine Savanna North Variation
- Longleaf Pine Savanna South Variation
- Potential Longleaf Pine Savanna
- Potential Bottomland Hardwood
- NRCS Soils

NWI Wetlands

- PEM
- PFO
- Open Water

Figure 3.6-6: Longleaf Pine Savanna Route Variations
Driftwood Project
Calcasieu Parish, Louisiana

NOTES:
1. Map Projection: NAD 1983 UTM Zone 15N Foot US
Image Source: Esri online World Imagery Service.
2.Data Sources: ESRI, USGS, USFWS, NRCS, TRC

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The Longleaf Pine Savanna South Variation would result in a decrease of overall disturbance. The Longleaf Pine Savanna South Variation would cross fewer parcels than the proposed route, but would cross within 50 feet of two residences as opposed to the proposed route which would not be located within 50 feet of any residences. Although this variation would cross less potential longleaf pine savannah, it would result in more overall disturbance in forested and wetland areas, as well as affect more residences; therefore, we conclude this alternative would not offer a significant environmental advantage over the proposed action, and we did not analyze it further.

3.7 ABOVEGROUND FACILITY ALTERNATIVES

We evaluated alternative aboveground facility locations. The factors considered for an aboveground facility are different than those considered for a pipeline route because an aboveground facility is a point location rather than a linear facility and because, unlike a pipeline, an aboveground facility converts existing land use to industrial use, is visible during operations and, in most cases, generates noise and air emissions. In evaluating these locations, we consider: hydraulic modeling, available land; current land use, as well as adjacent land use; location accessibility; engineering requirements; and impacts on the natural and human environments.

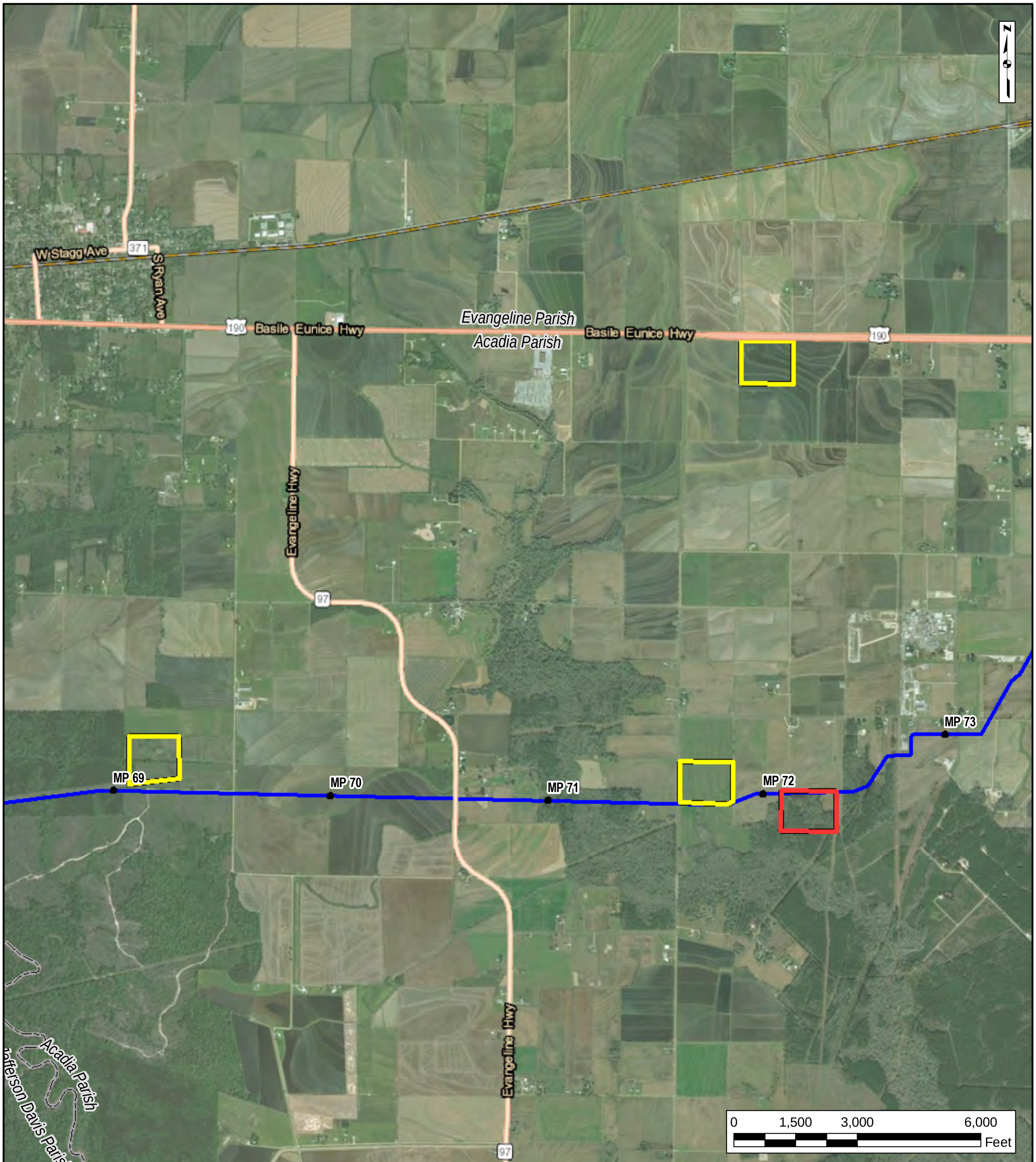
The locations of metering and regulation stations are largely determined by interconnections with other pipeline systems and delivery points. We reviewed the locations of meter stations in relation to other pipeline systems, and although the locations were not always collocated with existing aboveground facilities, the relatively small footprint of these facilities and the proposed locations generally minimized environmental impacts. Similarly, the locations of proposed MLVs are based in part on PHMSA regulations, and MLVs and other appurtenant aboveground facilities occupy a small footprint within existing or proposed pipeline rights-of-way and generally have no additional environmental impact. DWPL's reassessment of locations of aboveground facilities for which comments were received during scoping are included in table 1.3-1. We identified no significant environmental impacts associated with these facilities and therefore did not analyze alternative locations in depth. Our analysis of the locations of compressor stations is discussed below. The analyses were based on comparable information (e.g., NWI for wetlands and waterbodies, USDA information for land use) for each alternative.

3.7.1 Compressor Station 01

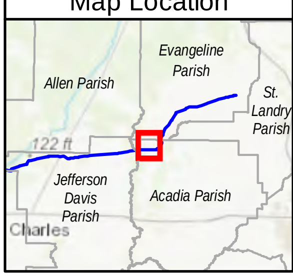
We did not identify significant environmental concerns regarding the location of CS-01; therefore, we did not evaluate alternative sites.

3.7.2 Compressor Station 02

Comments were filed during scoping regarding noise, light, and vibration from Driftwood's proposed location for CS-02. A comparison of alternative sites considered for CS-02 is summarized within table 3.7-1 and shown on figure 3.7-1. Because the alternative sites did not provide an environmental advantage (see below) further analyses, such as availability for purchase or lease, were not performed.



Map Location



Legend

- Milepost
- Proposed Pipeline Route
- CS Proposed Site Location
- CS Alternative Site Location

Figure 3.7-1: CS-02 Alternative Locations
Driftwood Project
Acadia Parish, Louisiana

NOTES:
Map Projection: NAD 1983 StatePlane Louisiana South FIPS 1702 Feet
Image Source: Esri online World Imagery Service.

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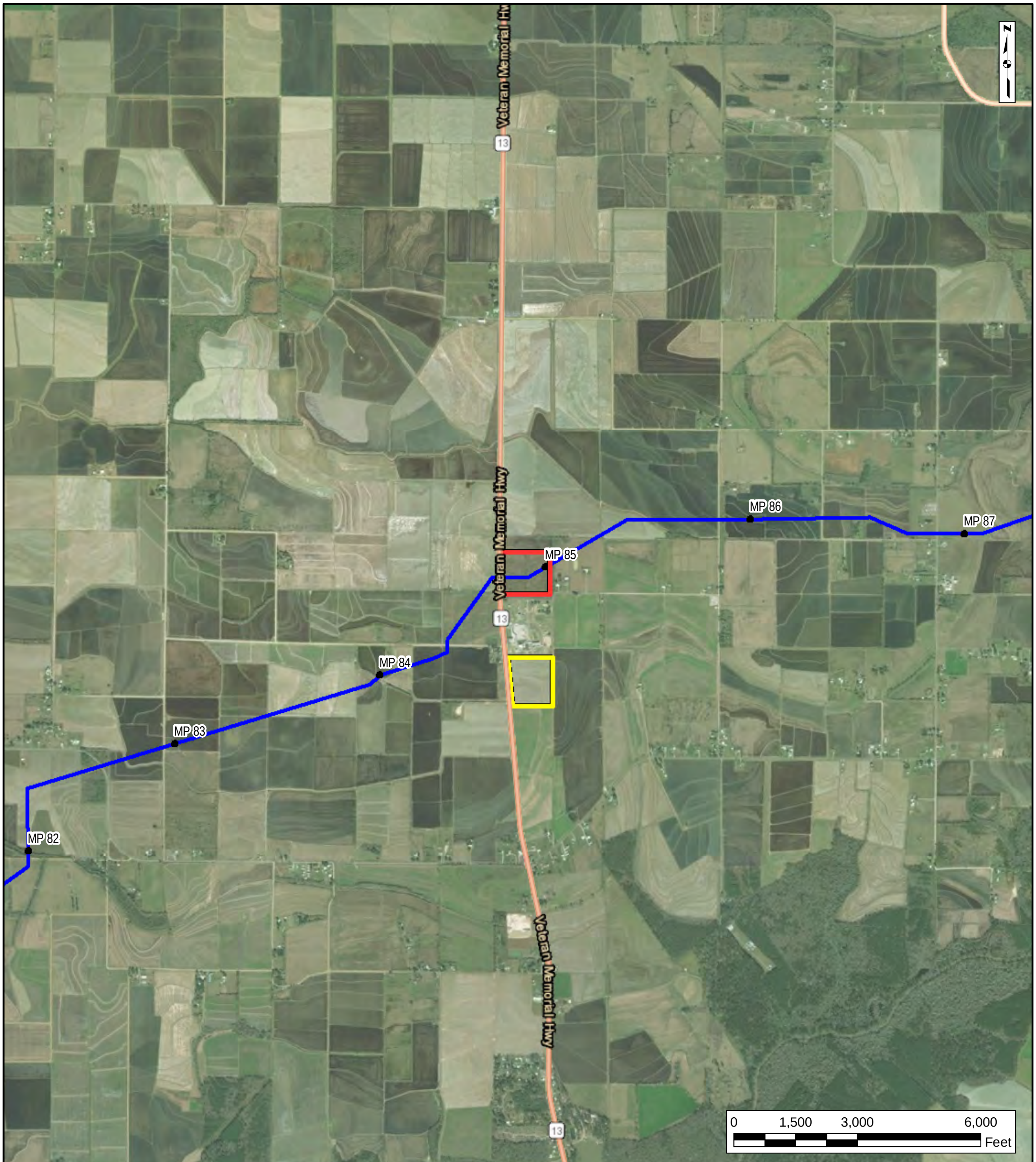
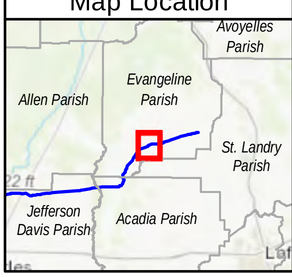


Map Location



Legend

- Milepost
- Proposed Pipeline Route
- CS Proposed Site Location
- CS Alternative Site Location

Figure 3.7-**2**: CS-03 Alternative Locations
Driftwood Project
Evangeline Parish, Louisiana

NOTES:
Map Projection: NAD 1983 StatePlane Louisiana South FIPS 1702 Feet
Image Source: Esri online World Imagery Service.

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Table 3.7-1

Comparison of Compressor Station 02 (CS-02) Alternative Locations

Features Unit	Proposed Location	Alternative 1	Alternative 2	Alternative 3
Compression	78,500	87,600	77,000	81,000
Area (acres)	30.1	30.1	30.1	30.1
Length of lateral pipelines (miles) [a]	0	0.1	5.8	0.8
Collocation of lateral pipelines [a]	No lateral	0	2.7	0.8
NSAs within 0.5 mile [a]	11	3	7 [b]	7
Distance to closest NSA (miles) [a]	0.1	0.3	0.2	0.2
Type of Land Use [c]				
Developed Lands	1.3	0.0	0.6	2.0
Agricultural Lands	10.1	16.8	29.4	28.1
Forested Lands	18.7	12.8	0.0	0.0
Open Lands	0.0	0.5	0.0	0.0
Wetlands	0.0	0.0	0.0	0.0

[a] Estimated based on review of aerial photography and boundaries shown on figure 3.7-1

[b] Within 0.3 mile of Millers Flying Service (private airfield FAA LA01)

[c] USGS National Land Cover Database

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

Alternative 1 to CS-02 is located near MP 68.5 on partially forested, partially agricultural lands on the east side of Alfa Romeo Road. A minor route adjustment would be required to route the Pipeline through this site, although length and vegetation affected would be similar to Driftwood's proposed Pipeline route. This location is up to 5 miles downstream of interconnections for MS-08 through MS-12, which would require additional operating horsepower to maintain gas flow. Increases in horsepower would result in increases in air emissions and noise from the station. Fewer NSAs (residences) are within 0.5 mile of Alternate 1 to CS-02 than Driftwood's proposed site, and the closest NSA would be further from the compressor station site. Use of this alternative would also reduce impacts on forests by about 6 acres. Our comparison concludes that this alternative location did not provide a significant environmental advantage over the proposed location, and we did not analyze it further.

Alternative 2 to CS-02 is located about 1 mile east of MP 75.0 on primarily agricultural lands near highway 190. A minor route adjustment would be required to route the Pipeline through this site, although length and vegetation affected would be similar to Driftwood's proposed Pipeline route. Because this alternative is located upstream of connections at MS-08 through MS-12, about 5.8 miles of additional suction-lateral pipelines would be required to pull gas in from each of these pipelines, resulting in a significant increase in amount of disturbance and increased horsepower to compensate for the differences in pressures. The number of NSAs (residences) within 0.5 mile of Alternative 2 to CS-02 would be lower than at Driftwood's proposed site for CS-02, and one private airfield is within about 0.3 mile of Alternative 2 to CS-02. Our comparison concludes that this alternative location did not provide a significant environmental advantage over the proposed location, and we did not analyze it further.

Alternative 3 for CS-02 is located on primarily agricultural lands near MP 71.2. Because of reductions in pressure on the Pipeline from connections at MS-09 to MS-12, an additional 0.8-mile-long suction-lateral pipeline would be required to pull gas from the Egan Pipeline at MS-08 upstream of this compressor station location. The number of NSAs (residences) within 0.5 mile of Alternative 3 for CS-02 would be lower than the proposed location, with the closest NSA about 1,000 feet away. Although the use of the Alternative 3 to CS-02 site would eliminate impacts on 18.7 acres of trees, the site is located within an agricultural field that would not provide a visual or sound buffer to nearby residences relative to Driftwood's proposed location. Our comparison concludes that this alternative location did not provide a significant environmental advantage over the proposed location, and we did not analyze it further.

3.7.3 Compressor Station 03

During scoping meetings, we received input from landowners regarding noise and vibration from Driftwood's proposed location for CS-03. A comparison of alternative sites considered for CS-03 is summarized in table 3.7-2 and shown on figure 3.7-2.

Table 3.7-2

Comparison of Compressor Station 03 (CS-03) Alternative Locations

Features Unit	CS 03 – Proposed Location	CS 03 – Alternative Location
Area (acres)	27.3	27.3
Length of lateral pipelines (miles)	0	0.5
Collocation of lateral pipelines	No lateral	0.5
NSAs within 0.5 mile	6	8
Distance to closest NSA (feet) [a]	150	150
Type of Land Use [b]	Open land/forested	Agricultural
Developed Lands	1.18	0.14
Agricultural Lands	26.2	0.0
Forested Lands	0.0	0.0
Open Lands	0.0	27.2

[a] Estimated based on proposed alignment and boundaries shown in figure 3.7-2.
[b] NLCD
[c] NWI
The numbers in this table have been rounded for presentation purposes. As a result, the totals may not reflect the sum of the addends.

The alternative location for CS-03 would be located south of the existing Transcontinental Gas Pipeline Company, LLC compressor station within an agricultural field, compared to open lands for Driftwood's proposed site. A minor route adjustment would be required to route the Pipeline to the alternative location, although the length and vegetation affected would be similar to Driftwood's proposed Pipeline route. Based on a review of aerial photography, about eight residences would be within 0.5 mile of the alternative location compared to five residences for the proposed site; the closest residences for both the alternative location and the proposed site for CS-03 are about 150 feet from the alternative boundaries as shown on figure 3.7-2. Driftwood has committed to noise and vibration reduction measures at CS-03 and would comply with regulatory requirements. As such, there would be little difference in noise and vibration impacts on the NSAs. Our comparison concludes that the alternative location does not provide a significant environmental advantage over the proposed location, and we did not analyze this alternative further.

4.0 ENVIRONMENTAL ANALYSIS

This section describes the affected environment as it currently exists and discusses the environmental consequences of the Driftwood LNG Project. The discussion is organized by the following major resource topics: geology; soils; water resources; wetlands; vegetation; wildlife; aquatic resources; special status species; land use, recreation, special interest areas, and visual resources; socioeconomics (including transportation and traffic); 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 preconstruction 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 preconstruction conditions during the life of the Project. We considered an impact to be significant if it would result in a substantial adverse change in the physical environment. In the following sections, we address direct and indirect effects collectively, by resource. Section 4.14 of this final EIS analyzes the Project's contribution to cumulative impacts.

The analysis contained in this final EIS is based upon Driftwood's application and supplemental filings. However, if the Project is approved and proceeds to the construction phase, it is not uncommon for a project proponent to require minor modifications (e.g., minor realignments, changes in workspace configurations, etc.). In addition, we have recommended that DWPL adopt two of the alternative routes under consideration, as described in section 3.6.2 of this final EIS. The MP 12.9 Route Variation, discussed in section 3.6.2.2, would reduce the total land impact by about 16.6 acres, and the Port Arthur Pipeline Variation, discussed in section 3.6.2.4, would increase the total land impact by about 0.8 acre.

4.1 GEOLOGICAL RESOURCES

4.1.1 Geologic Setting

The Project is within the West Gulf Coastal Plain section of the Coastal Plain physiographic province. The West Gulf Coastal Plain region consists of fluvial, tidal, and extensive deltaic sediments with varied depositional sequencing. Bedrock is greater than 2,000 feet below ground surface, therefore no blasting of bedrock would be required to support the Project.

4.1.1.1 LNG Facility

The topography at the LNG Facility is flat, ranging from 0-8 feet above mean sea level. Historical maintenance dredging of the adjacent Calcasieu Ship Channel may have resulted in hydraulic fill being placed near the LNG Facility (Bechtel, 2016). DWLNG would modify the site topography to support construction of the LNG Facility. Structural fill and land-excavated material from construction of the Marine Facilities would be used to raise site topographic elevations to meet federal safety regulations. DWLNG anticipates that about 3 million cubic feet of fill material, about half of it from onsite excavation of the LNG berth and half of it from offsite sources, would be needed to bring the LNG Facility to the design grades.

DWLNG conducted onshore geotechnical investigation and a nearshore geophysical investigation at the LNG Facility site (Fugro, 2017a; Fugro, 2017b). The results indicate the top 30 feet of surficial geologic deposits primarily contain clay and silt and sandy clay. In some areas, fill containing sand and sandy clay is present to a depth of 5 feet. At depth, the general site conditions are stratified silty-clay and sand. Unconsolidated material was observed to at least 300-feet below the surface (Fugro, 2017a). A surficial geology map of the LNG Facility area is presented as figure 4.1-1. Where permanent facilities would be constructed, DWLNG would excavate the soft silty soils and use the cut material as non-structural fill on site, consolidate the soils by pre-loading, or stabilize the soils with amendments. Pre-loading involves placing a temporary soil pile over the area to consolidate by squeezing out excess pore water. Stabilization would involve blending in a mixture of dry cement and lime to tie-up excess soil moisture and stiffen the soil.

Shallow foundations (spread footings and/or mats) would be used for light to moderate, non-settlement-sensitive structures and temporary structures. Heavy and/or settlement-sensitive structures would be supported on deep piles about 90-feet long. DWLNG expects that the majority of the main facility structures and the LNG tanks would be pile supported.

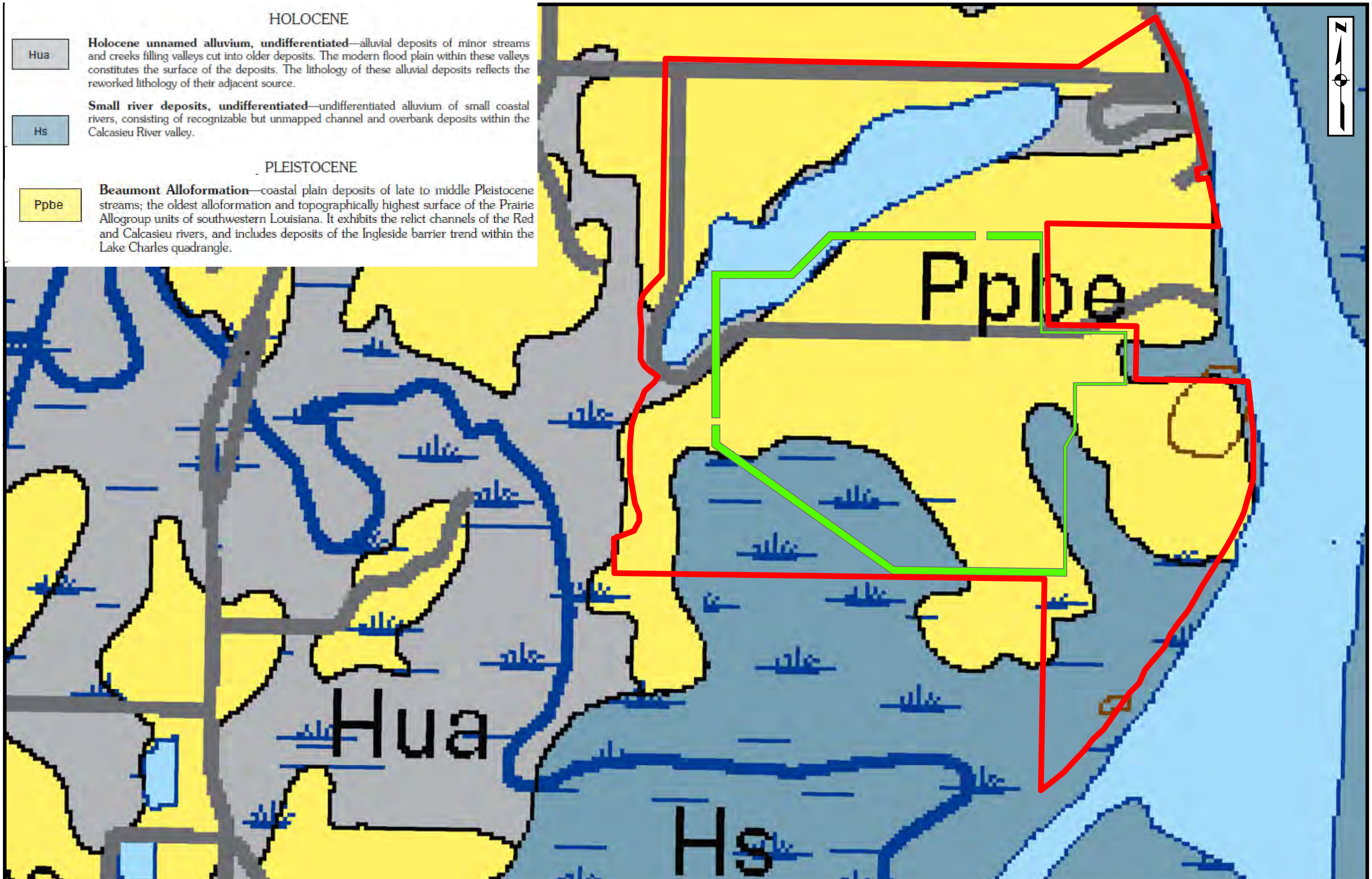
DWLNG conducted nearshore geophysical and geotechnical investigation. Bottom sediments of the Calcasieu Ship Channel consist of a mixture of sand, silts, and clay (Fugro, 2017a). The existing barge slips from the previous use of the LNG Facility site are stabilized with riprap; the remaining shoreline is unprotected. DWLNG would modify the shoreline by dredging to create the Pioneer Docks, the MOF, and the Marine Berth. DWLNG intends to contour the sides of the marine berth to a stable slope of about 3:1 and armor with riprap and articulated-concrete-block mattresses to protect from scour and erosion. Bulkheads for the MOF would be constructed using a combined sheet pile wall system that uses intermediate sheet piles and king piles.

4.1.1.2 Pipeline

The pipeline and associated aboveground facilities would be in Holocene to middle Pleistocene aged alluvium consisting of sand, silt, and clay. The topography of the area is flat to gently sloping with elevations ranging from 1 to 62 feet above mean sea level.

Fugro completed a geotechnical investigation at several areas along the pipeline route and associated aboveground facilities (Fugro, 2016a). The unconsolidated material observed consisted of natural cohesive soils underlain by sand, silt, and clay that ranged from loose to very dense. Localized areas of near-surface soft clay is anticipated to be encountered (Fugro, 2016a). In these areas, shallow foundations (spread footings and/or mats) may require shallow soil stabilization by mixing dry cement and lime to bind excess soil moisture and stiffen the soil. The average depth of stabilization is predicted to be 5 feet in clayey soils, where encountered. Driftwood does not anticipate using piles at compressor stations.

Eleven locations would be crossed by HDD drilling methods (see section 2.5.3.1 for details). Geotechnical investigations would be necessary for final HDD design, and we anticipate they would be completed for all locations prior to HDD construction. As shown in table 2.5-2, Fugro has completed a geotechnical investigation at five HDD locations (HDD 1, HDD 2, HDD A4, HDD 4, and HDD 5) to support the design of the HDD plans. Bechtel developed an HDD Plan (FERC eLibrary accession number 20170331-5058) to assess potential failure scenarios and detailing preventative and management measures including profile design and management and monitoring drill fluid pressure and volume. HDD drilling fluids would be assessed by Driftwood prior to disposal at a licensed disposal facility or spread in a landowner-approved upland area.



Legend

Facility Boundary

Berm

0 500 1,000 2,000 Feet

NOTES:
Basemap Imagery: USGS 30 x 60 Minute Geologic Quadrangle, Lake Charles, 2002

Figure **4.1-1**: Surficial Geology of the LNG Facility Area
Driftwood LNG Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

4.1.2 Mineral Resources

Non-fuel mineral resources nearby the LNG Facility and Pipeline includes construction sand and gravel, and salt (U.S. Geological Survey [USGS], 2015a). No non-fuel mines were identified within 0.25 mile of the LNG Facility or the Pipeline (LDNR, 2017; USGS, 2015b).

Oil and gas resources are prevalent in Louisiana. The LNG Facility and the Pipeline are not within and do not cross any active oil and gas field. Nineteen oil and gas wells are within the construction right-of-way for the Pipeline. All of these wells are listed as plugged and abandoned or dry and plugged (LDNR, 2017). DWPL would avoid these wells during construction and use a fence barrier to prevent encroachments by the construction crew. If orphaned wells are identified during construction, Driftwood would use the procedures in Driftwood's UDP (FERC eLibrary accession number 20170621-5139).

Because no mining or oil and gas extraction is currently active within the Project area, we conclude that construction and operation of the LNG Facility and Pipeline would not affect these activities.

4.1.3 Paleontological Resources

Because of the relatively young age of the geologic materials to be encountered during construction, they are unlikely to contain significant paleontological resources. If paleontological remains are found, Driftwood would follow the process described in the Driftwood UDP. Therefore, we conclude that construction and operation of the LNG Terminal and Pipeline facilities are unlikely to affect paleontological resources.

4.1.4 Geologic Hazards and Mitigation Measures for Project Pipeline Facilities

4.1.4.1 Seismic Environment, Growth Faults, and Risk

USGS (2014b) probabilistic Seismic Hazard Maps for the U.S. maps represent an assessment of the best available science in earthquake hazards and incorporate current findings on earthquake ground shaking, faults, and seismicity. Seismic risk can be quantified by the motions experienced by the ground surface or structures during a given earthquake, expressed in terms of gravity. According to the USGS a peak ground acceleration of 10 percent of gravity is generally considered the minimum threshold for damage to older structures or structures not made to resist earthquakes. The seismic risk for the LNG Facility and the Pipeline are as follows (USGS, 2014b)[11]:

[11] Ground motions are affected by underlying soils, spectral acceleration periods, and damping. The ground motion acceleration values for the USGS maps are representative of Site Class B (hard rock), peak ground accelerations, and 5% of critical damping. Site Classes, spectral acceleration periods, and damping are described in standards and recommended practices published in the American Society of Civil Engineers (ASCE) 7, Minimum Design Loads for Buildings and Structures, the International Code Council, International Building Code (IBC), and the FEMA, National Earthquake Hazards Reduction Program (NEHRP), Recommended Seismic Provisions for New Buildings and Other Structures. Site Class is primarily determined in accordance with ASCE 7 from measurements of shear wave velocities of the subsurface, and softer soils can amplify ground motions by a factor of 1.6 to 2.5 for short spectral periods (0.2 sec) and 2.4 to 3.5 for 1-second spectral acceleration periods.

- a seismic event with a 2 percent probability exceedance in a 50 year period would generate ground motions with peak ground accelerations from 4 to 6 percent of gravity in areas of hard rock; and
- a seismic event with a 10 percent probability exceedance in a 50 year period would generate ground motions with a peak ground acceleration from 1 to 2 percent of gravity in areas of hard rock.

Although earthquakes near the Project, such as the 1983 Lake Charles earthquake, have occurred, the above seismic risk is consistent with historical records that show that the region is mostly seismically inactive.

Gulf normal faults or growth faults, are a type of fault that occurs in the Gulf Coast region (figure 4.1-2), and develop in thick sediments where the Earth's surface is subsiding rapidly or being pulled apart. They are also common in the Gulf of Mexico. These faults are detached from basement bedrock and rarely produce seismic ground movements. The movement of an active growth fault can range from less than 0.1 inch per year to more than 1.0 inch per year (Gagliano, 2003). The width of the fault zone experiencing movement at a given time is typically 30 to 50 feet. The primary risk from the presence of a growth fault is from a displacement (creep) that affects building foundations and structural damage to infrastructure (Bechtel, 2016). Growth faults have been identified in Louisiana since the 19th century, with fault activity in southern Louisiana in the modern period (post 1960s) greatly exceeding the previous average rates. The precise reasons for recent accelerated activity are unknown; however, Petersen, et al. (2016) has identified 21 zones as having the potential for significant earthquakes attributed to human activities (induced seismicity).

The Pipeline would be within the "Southern Fault-line Scarps and Traces" region. Within this region, growth faults are the only type of active faulting (USGS and LGS, 2006). The Pipeline crosses growth faults near MPs 2.5, 54.4, 63 to 64, and 74.1, presented as figures 4.1-3, 4.1-4, 4.1-5, and 4.1-6, respectively. The growth fault along MP 54.4 and MP 74.1 is the China scarp. Because swamps within the floodplain of Serpent Bayou indicate there has been displacement within the last 11,700 years along the China scarp (Heinrich, 2000); the growth fault(s) in this location is considered active. As previously noted, the Project is in an area of relatively low seismic risk.

★☆ Facility Location

♦ Milepost

Proposed Mainline

Growth Fault

Parish Boundary

Data Citation: McCulloh, R. P., and P. V. Heinrich, 2012, Surface faults of the south Louisiana growth-fault province, in Cox, R. T., M. P. Tuttle, O. S. Boyd, and J. Locat, eds., Recent Advances in North American Paleoseismology and Neotectonics East of the Rockies: Geological Society of America Special Paper 493, p. 37–50, doi:10.1130/2012.2493(03).

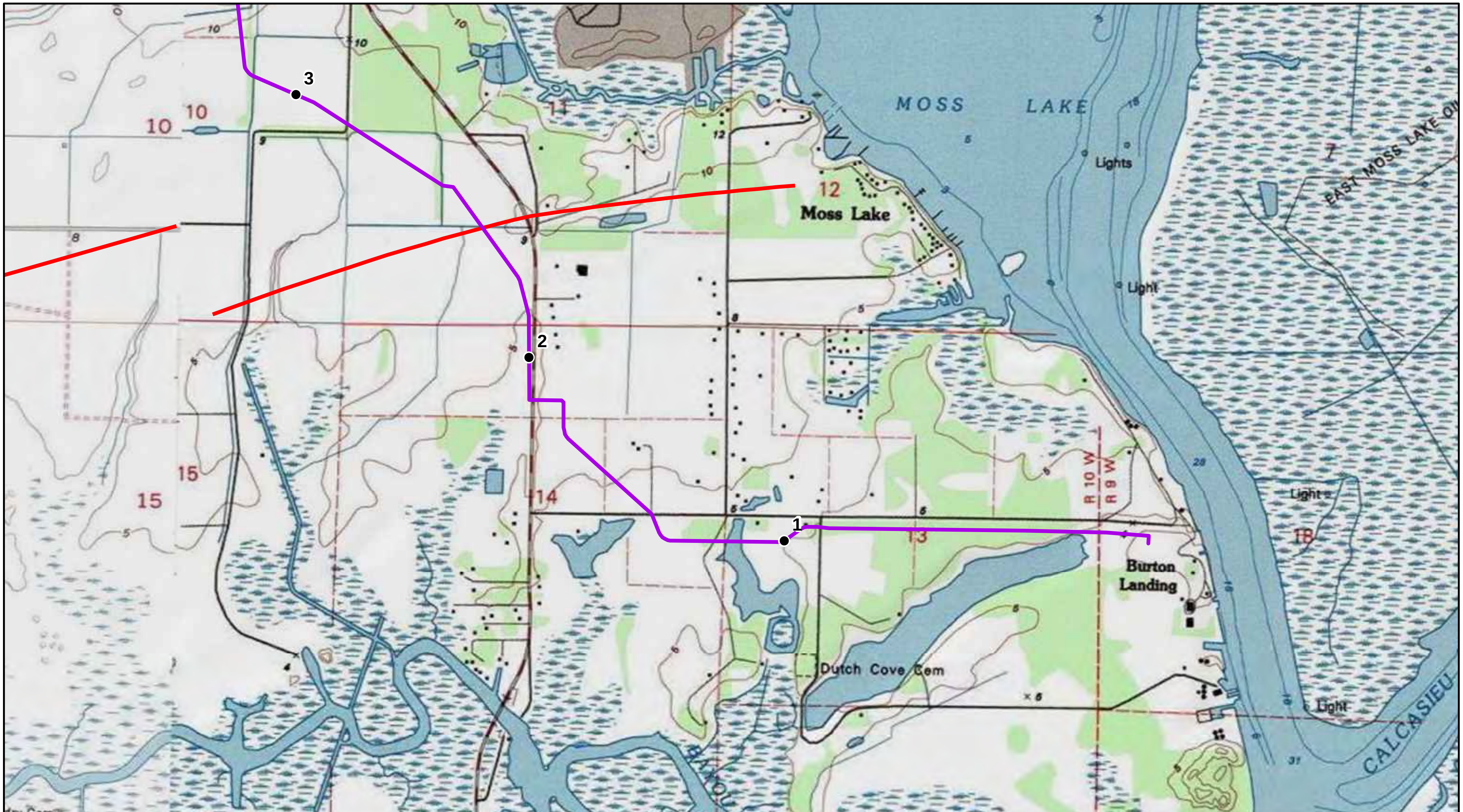
Miles
0 4 8

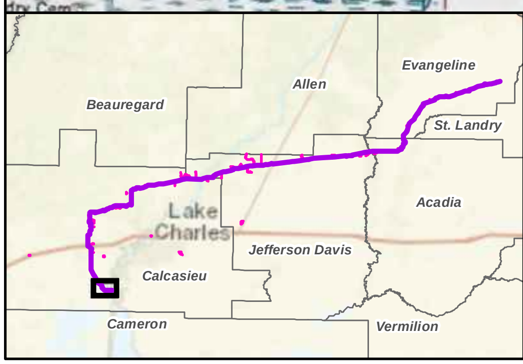
N

Figure 4.1-2
Growth Fault Overview Map
Driftwood LNG Project
Calcasieu, Jefferson Davis, Acadia & Evangeline Parish, Louisiana

	Scale: 1:490,000
NAD1983 LA S 1702 ft	Date: August, 2017

Author: CW





- Milepost
- Growth Fault
- Proposed Mainline
- Parish Boundary

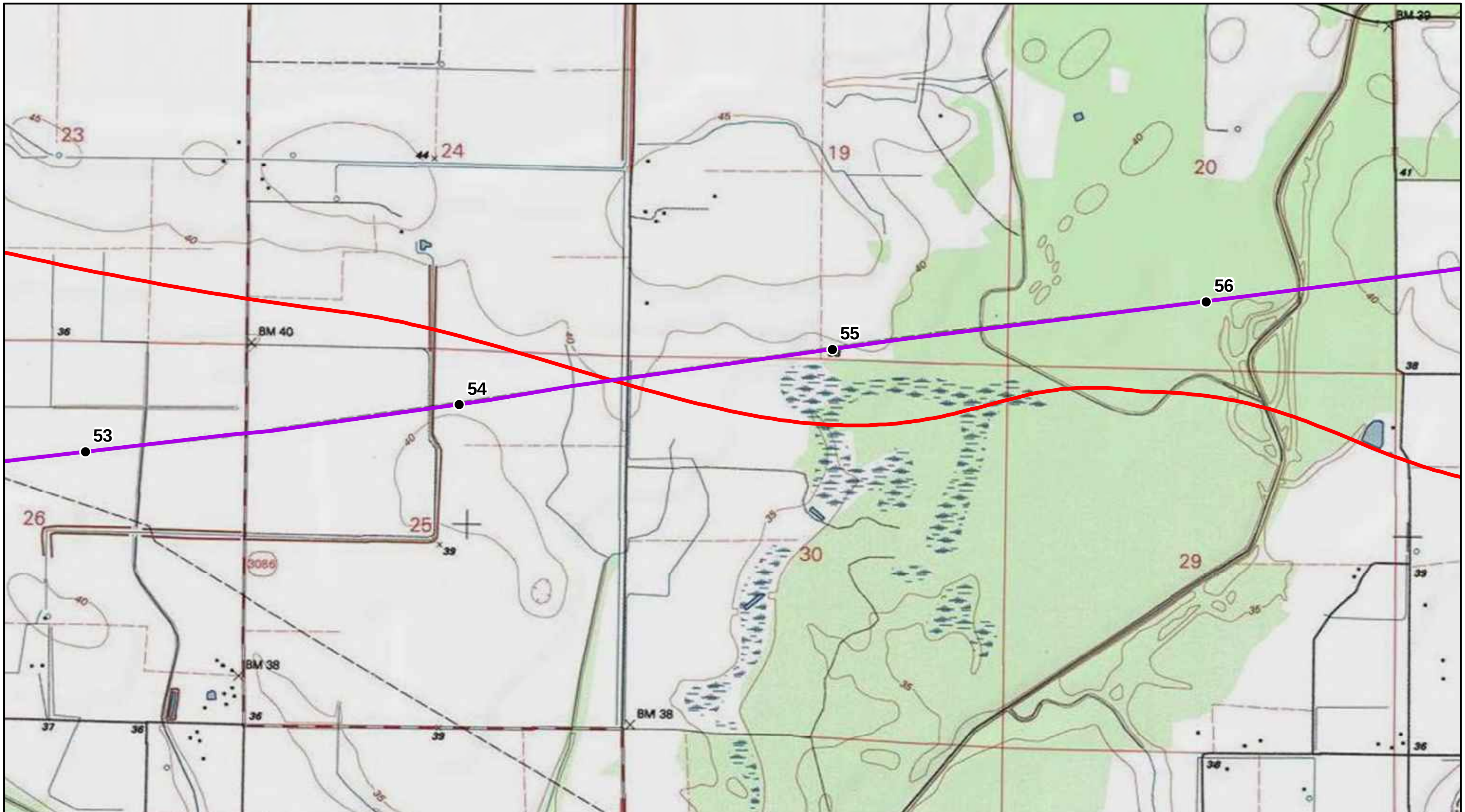
Data Citation: McCulloh, R. P., and P. V. Heinrich, 2012, Surface faults of the south Louisiana growth-fault province, in Cox, R. T., M. P. Tuttle, O. S. Boyd, and J. Locat, eds., Recent Advances in North American Paleoseismology and Neotectonics East of the Rockies: Geological Society of America Special Paper 493, p. 37–50, doi:10.1130/2012.2493(03).

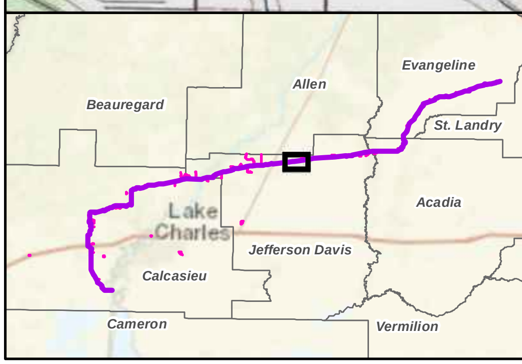
Feet
0 1,250 2,500

Figure 4.1-3
Growth Fault at MP 2.5
Driftwood LNG Project
Calcasieu Parish, Louisiana

	Scale: 1:24,000
NAD1983 LA S 1702 ft	Date: August, 2017

DRAWN: GIS





- Milepost
- Growth Fault
- Proposed Mainline
- Parish Boundary

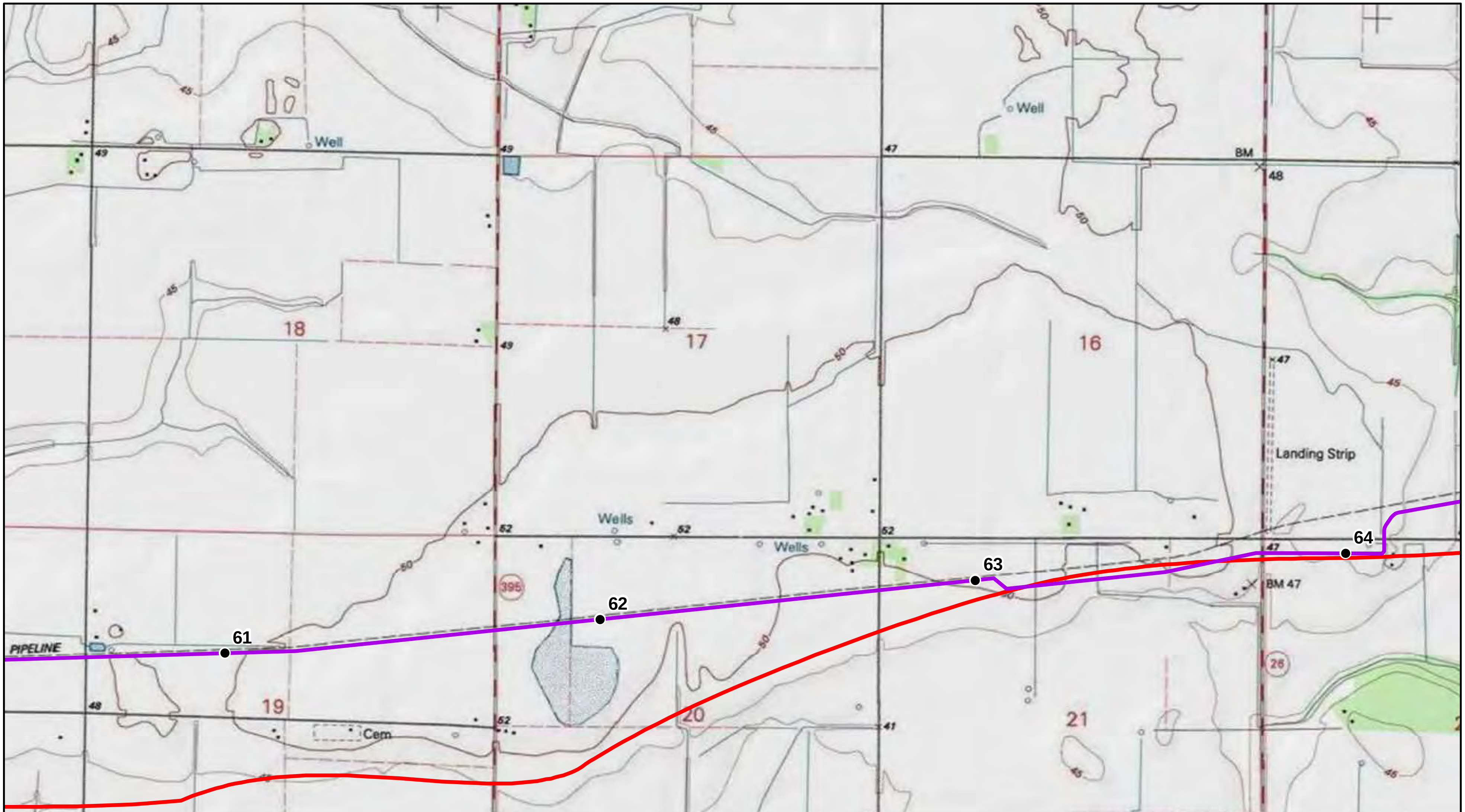
Data Citation: McCulloh, R. P., and P. V. Heinrich, 2012, Surface faults of the south Louisiana growth-fault province, in Cox, R. T., M. P. Tuttle, O. S. Boyd, and J. Locat, eds., Recent Advances in North American Paleoseismology and Neotectonics East of the Rockies: Geological Society of America Special Paper 493, p. 37–50, doi:10.1130/2012.2493(03).

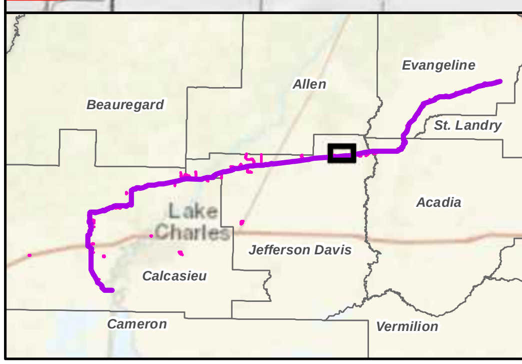
0 1,250 2,500 Feet

Figure 4.1-4
Growth Fault at MP 54.4
Driftwood LNG Project
Jefferson Davis Parish, Louisiana

	Scale: 1:24,000
NAD1983 LA S 1702 ft	Date: August, 2017

DRAWN: GIS





- Milepost
- Growth Fault
- Proposed Mainline
- Parish Boundary

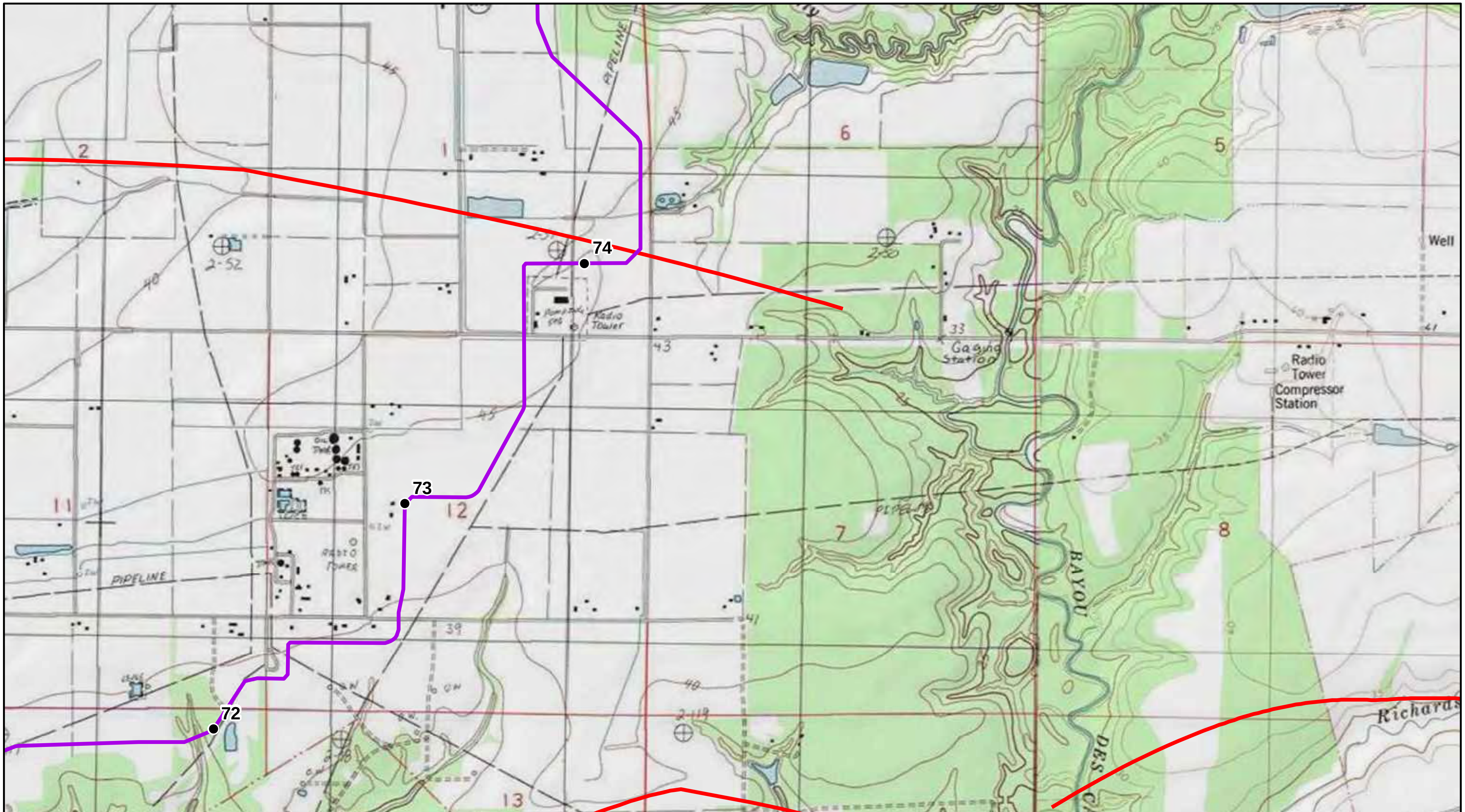
Data Citation: McCulloh, R. P., and P. V. Heinrich, 2012, Surface faults of the south Louisiana growth-fault province, in Cox, R. T., M. P. Tuttle, O. S. Boyd, and J. Locat, eds., Recent Advances in North American Paleoseismology and Neotectonics East of the Rockies: Geological Society of America Special Paper 493, p. 37–50, doi:10.1130/2012.2493(03).

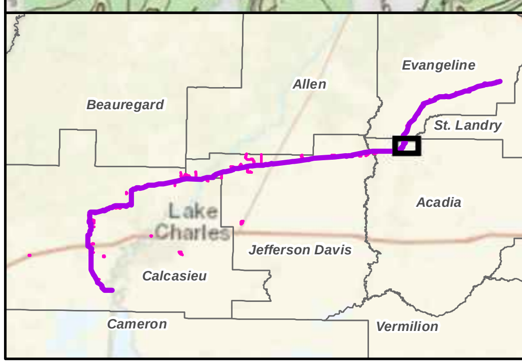
Feet
0 1,250 2,500

Figure 4.1-5
Growth Fault at MP 63-64
Driftwood LNG Project
Jefferson Davis Parish, Louisiana

	Scale: 1:24,000
NAD1983 LA S 1702 ft	Date: August, 2017

DRAWN: GIS





Milepost

Growth Fault

Proposed Mainline

Parish Boundary

Data Citation: McCulloh, R. P., and P. V. Heinrich, 2012, Surface faults of the south Louisiana growth-fault province, in Cox, R. T., M. P. Tuttle, O. S. Boyd, and J. Locat, eds., Recent Advances in North American Paleoseismology and Neotectonics East of the Rockies: Geological Society of America Special Paper 493, p. 37–50, doi:10.1130/2012.2493(03).

Feet
0 1,250 2,500

N

Figure 4.1-6
Growth Fault at MP 74.1

Driftwood LNG Project
Acadia Parish, Louisiana

	Scale: 1:24,000
NAD1983 LA S 1702 ft	Date: August, 2017

DRAWN: GIS

Conclusions

The Project area is not along a tectonic plate boundary where frequent, high-energy earthquakes would typically be common. Rather, the Project location is an intraplate setting with historically low seismic risk and minimal seismic activity. Therefore, we do not anticipate that earthquakes and related seismic hazards would have an impact on the Pipeline.

Growth faults are a vertical displacement and the rate of movement is relatively low; therefore, an increase in load over the Pipeline would be low. Because of the low load increase and the fact that the Pipeline would be designed to accommodate any shift, we do not anticipate that the Pipeline would be affected by growth faults.

4.1.4.2 Soil Liquefaction

Soil liquefaction is a process whereby the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading. The result is a transformation of soil to a liquid state. Typically, three general circumstances are necessary for liquefaction to occur and can be used as a liquefaction hazard screening (USGS, 2014b). These circumstances are:

- Presence of young (Pleistocene) sands and silts with very low or no clay content, naturally deposited (beach or river deposits, windblown deposits), or man-made land (hydraulic fill, backfill);
- Saturated soils where the space between individual particles is completely filled with water. This water exerts a pressure on the soil particles that influences how tightly the particles themselves are pressed together. This is most commonly observed near waterbodies such as rivers, lakes, bays, and oceans, and the associated wetlands; and
- Severe shaking, which is most commonly caused by a large earthquake. Prior to an earthquake, the water pressure is relatively low. However, earthquake shaking can cause the water pressure to increase to the point where the soil particles can readily move relative to each other. This is limited by the distance from the large earthquake epicenter. That is, liquefaction potential decreases as distance from the epicenter of a large earthquake increases.

The low seismic risk in the Project area renders the likelihood of this geologic hazard occurring during construction and operation of the pipeline as low.

4.1.4.3 Flooding

Driftwood would equip the pipeline with buoyancy control measures, such as anchors, aggregate-filled saddle bags, or concrete coating in areas subject to flooding. Because DWPL would design the pipeline and aboveground facilities to withstand flooding, we have determined that flooding would not have an adverse effect on the Pipeline. Construction and operation of the aboveground facilities would require a permit, if needed, from each municipality. DWPL would design the aboveground facilities according to the flood plain requirements. Based on the low volume and the design of the structures associated with aboveground facilities, we conclude that the Pipeline and associated aboveground facilities would not affect, or be affected by, flooding.

4.1.4.4 Settlement

Activities that could contribute to minor subsidence near the pipeline, such as oil and gas wells, have been identified near the Pipeline. Because DWPL would design the pipeline and aboveground facilities to withstand minor subsidence, we find that subsidence would not have an adverse effect on the Pipeline.

4.1.4.5 Scour and Erosion

DWPL would cross most natural, flowing major waterbodies (i.e., rivers) by the HDD method (with the exception of Bayou Serpent at MP 45.9 and ponds that are not subject to flow or scour). At these locations, the pipeline would be buried below the maximum scour depth calculated to occur during the 100-year flood event. Waterbodies not crossed using HDD would be crossed using the open-cut method. As discussed in section 2.5.3.1 of this document, these crossings would be constructed and restored according to the Driftwood Procedures. As a result, we conclude scouring and erosion would have minimal impact on the Pipeline.

4.1.5 Geologic Hazards And Mitigation Measures For The Project LNG Facility

Natural hazards including seismicity, faulting, soil liquefaction, flooding, storm surge, tsunami, seiche, settlement, scour, and erosion for the LNG Facility are discussed in detail in section 4.13.1 of this final EIS.

4.2 SOILS

4.2.1 Soil Types and Limitations

The soils affected by the Project were identified and assessed using the Soil Survey Geographic (SSURGO) database and published soil surveys for the applicable parishes, where available (see table 4.2-1). The SSURGO database is a digital version of the original parish soil surveys developed by the USDA, Natural Resources Conservation Service (NRCS) for use with geographic information systems (GIS). It provides the most detailed level of soils information for natural resource planning and management. The attribute data within the SSURGO database provides the proportionate extent of the component soils and their properties for each soil map unit.

Table 4.2-1 summarizes the soils that would be affected by the Project based on soil characteristics. Soil types affected are illustrated in figure 4.2-1 on the following page, and figure 4.2-2 in Appendix D.

Table 4.2-1

Acres of Soil Characteristics Affected, by Facility Type

	Total Acres [b]	Prime Farmland [c]	Compaction Prone [d]	Highly Erodible [e]		Re-vegetation Concerns	Shallow Depth to Bedrock [g]	Rocky/ Stony Soils [h]
				Water	Wind [f]			
LNG Facility	718.3	0.0[c]	384.6	140.6	0.0	0.0	0.0	0.0
Pipeline [a]	1,807.3	1,621.5	1,713.8	22.4	22.1	0.0	0.0	0.0
Pipe and Contractor Yards	107.7	94.6	94.6	6.6	0.0	0.0	0.0	0.0
Pipeline Aboveground Facilities	141.5	134.8	128.4	4.0	0.0	0.0	0.0	0.0

[a] The area affected includes the permanent pipeline ROW, temporary workspace, and additional temporary workspace. Soil characteristics are not included for the park-and-ride facilities and offsite construction areas. The soils data in the table does not include areas of open water.

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

[c] As designated by the NRCS. Prime farmland includes those soils considered prime if a limiting factor is mitigated (e.g., through artificial drainage). The 384.6 acres of potential prime farmland soils on the LNG Facility site are zoned for heavy industrial use, which is not consistent with the designation "Prime Farmland;" they are not included in this total. See section 4.2.2.

[d] Soils that have a surface texture of sandy clay loam or finer, and a drainage class range from 'somewhat poorly drained' through 'very poorly drained.'

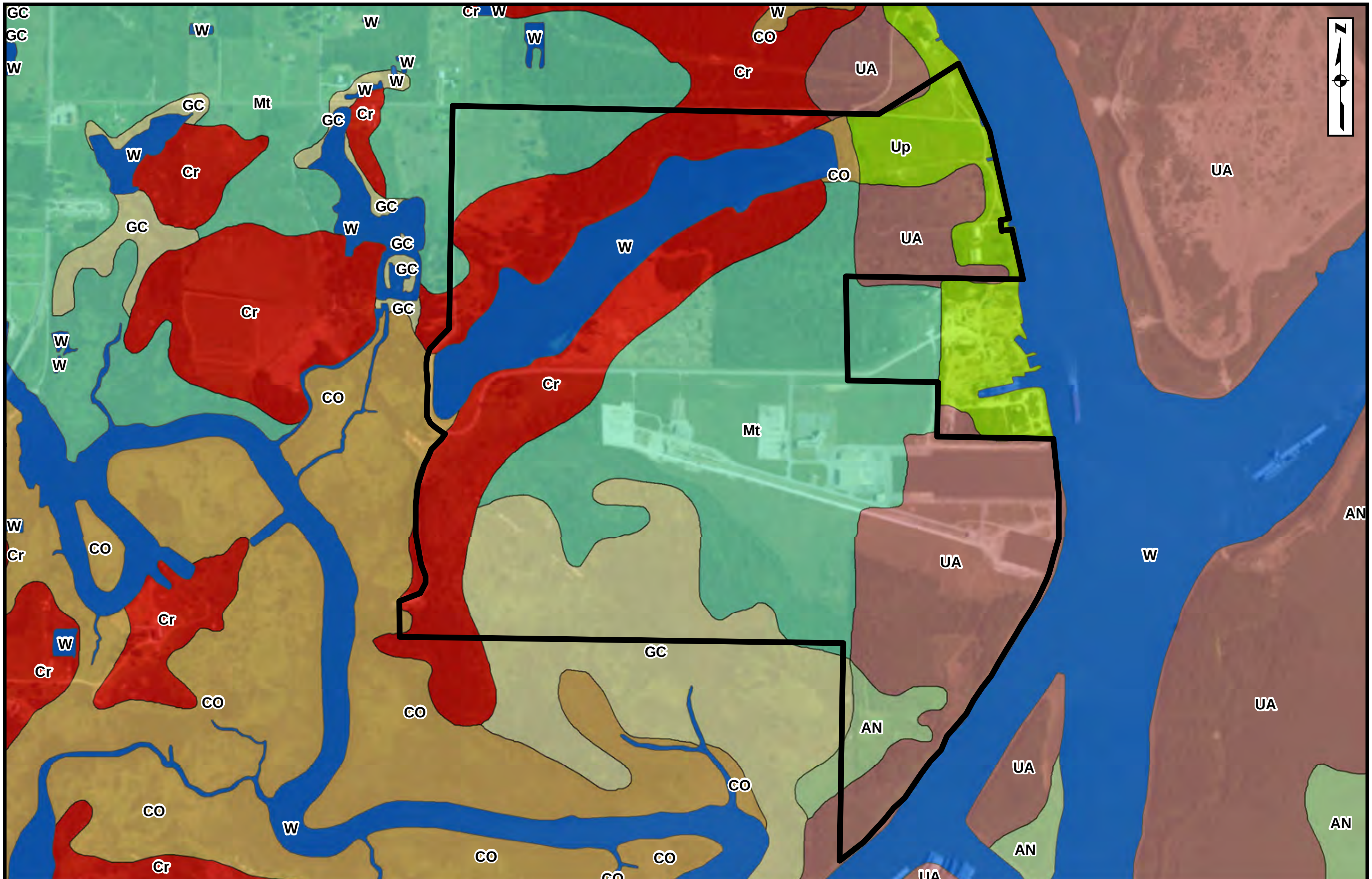
[e] Soils in land capability subclasses 4e through 8e and soils with an average slope greater than 9 percent.

[f] Soils with a wind erodibility group classification of 1 or 2. A wind erodibility group is a grouping of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to blowing. The wind erodibility index (I), used in the wind erosion equation, is assigned using the wind erodibility groups. Soils with a wind erodibility group classification of 1 consist of very fine sand, fine sand, sand, or coarse sand surface layers with a wind erodibility index ranging from 160 to 310 tons per acre per year. Soils with a wind erodibility group classification of 2 consist of loamy very fine sand, loamy fine sand, loamy sand, and loamy coarse sand; very fine sandy loam and silt loam with 5 or less percent clay and 25 or less percent very fine sand; and sapric soil materials with a wind erodibility index of 134 tons per acre per year.

[g] Soils identified as containing bedrock within 60 inches of the soil surface.

[h] Soils that have either: a cobbly, stony, boulder, shaly, very gravelly, or extremely gravelly modifier to the textural class of the surface layer, or a surface layer for which more than 5 percent of total weight is made up of stones larger than 3 in.

Source: USDA NRCS, 2015a, b, Roy and Midkiff, 1988, Clark et al., 1962, Touchet et al., 1974, Midkiff, 2003.



Legend

Facility Boundary

Soil Name (Label)

Clovelly muck (CO)

Gentilly muck (GC)

Crowley-Vidrine silt loams (Cr)

Mowata-Vidrine silt loams (Mt)

Aquents, frequently flooded (AN)

Udifluvents, 1 to 20 percent slopes (UA)

Urban land (Up)

Water (W)

NOTES:

Basemap Imagery: ESRI World Imagery and Transportation

Reproduced under license in ArcGIS 10.4

Soil Data: USDA NRCS SSURGO

0 1,000 2,000 Feet

Figure **4.2-1**: Soils in LNG Facility Site

Driftwood LNG Project

Driftwood LNG LLC and Driftwood Pipeline LLC

Calcasieu Parish, Louisiana

4.2.1.1 LNG Facility

Soils within the LNG Facility site are fine to very fine textured, very poorly to somewhat poorly drained soils that formed in alluvial, eolian, and marine deposits (USDA NRCS, 2015a, b).

4.2.1.2 Pipeline

The pipeline, compressor stations, meter stations, and other aboveground facilities would be built on soils that consist of very deep, fine textured, poorly to moderately well-drained soils that formed in alluvial, fluviomarine, and eolian deposits (USDA NRCS, 2015a,b).

4.2.2 Prime Farmland Soils

The USDA defines prime farmland as "land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops" (Soil Science Division Staff, 2017). In general, prime farmland soils experience adequate and dependable precipitation, a favorable temperature and growing season, have acceptable acidity or alkalinity, and have few or no surface stones. They are permeable to water and air. Prime farmland soils are not excessively erodible or saturated with water for long periods of time. Soils that do not meet these criteria may be considered prime farmland if the limiting factor can be mitigated (e.g., by draining or irrigating).

4.2.2.1 LNG Facility

About 385 acres of the LNG Facility site contains soils mapped as prime farmland. Although these soils are mapped as prime farmland, current land use and zoning (heavy-industrial) are not consistent with this designation. Driftwood consulted with NRCS regarding prime farmland and received a letter dated January 9, 2017, confirming that these soils are exempt from the rules and regulations of the Farmland Protection Policy Act – Subtitle I of Title XV, Section 1539-1549, and therefore no prime farmland conversion authorization or mitigation is required for the construction and operation of the Project.

4.2.2.2 Pipeline

Construction and operation of the Pipeline and associated access roads would affect prime farmland soils. Because the construction workspace and permanent easement would be restored to pre-construction conditions, most impacts on prime farmland soils from construction of the Pipeline would be short-term and would not affect the potential use of prime farmland for future agricultural purposes. DWPL would follow the measures in the Driftwood Plan during construction and restoration, including topsoil segregation; temporary erosion controls such as silt fence, staked hay or straw bales, and sand bags, as necessary; soil decompaction; and revegetation. We have determined that the use of the Driftwood Plan would minimize potential impacts on prime farmland soils and restore the areas along the route to pre-construction conditions.

4.2.2.3 Other Aboveground Facilities

Construction and operation of the additional aboveground facilities, including compressor stations and meter stations, would permanently convert areas of prime farmland soils to industrial use. Similarly, the area within the Temporary Offsite Construction Area would be converted to industrial use. This acreage would be a small amount relative to overall prime farmland (which is about 479,000 acres in Calcasieu, 371,000 acres in Jefferson Davis, 370,000 acres in Acadia, and 337,000 acres in Evangeline Parishes), and therefore would not be a significant impact on prime farmland soils in the area.

4.2.3 Compaction-Prone Soils

Soil compaction modifies the structure and reduces the porosity and moisture-holding capacity of the soil. The degree of soil compaction during construction depends on moisture content and soil texture. Fine textured soils with poor internal drainage and high shrink-swell potential are the most susceptible to compaction. Construction equipment traveling over wet soils could disrupt soil structure, reduce pore space, increase runoff potential, and cause rutting. Moist or saturated soils are more likely to compact or rut.

4.2.3.1 LNG Facility

Although compaction-prone soils within the LNG Facility site would be affected, they would be developed, replaced by structures, paving, and gravel and would not be used to support vegetation; therefore, compaction is not a concern.

4.2.3.2 Pipeline

If construction of the Pipeline occurs when compaction-prone soils are saturated, compaction and rutting could occur. Driftwood would mitigate compaction impacts in residential and agricultural areas through use of timber mats and low-pressure tires on vehicles crossing compaction-prone soils to reduce rutting and through decompaction techniques (e.g., tiller), according to the Driftwood Plan.

4.2.3.3 Other Aboveground Facilities

Compaction-prone soils would be permanently converted to industrial use by aboveground facilities (compressor stations and meter station) and by pipe and contractor yards. These areas would not be used to support vegetation; therefore, compaction is not a concern.

4.2.4 Erosion Potential

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

Clearing, grading, and equipment movement could accelerate the erosion process and, without adequate protection, result in discharge of sediment into waterbodies and wetlands. Soil loss due to erosion could also reduce soil fertility and impair revegetation rates. Driftwood would further minimize the erosion potential of these soils by adhering to the erosion protection measures in the Driftwood Plan and Procedures during construction.

4.2.4.1 LNG Facility

The erosion potential of soils at the LNG Facility site is minimal due to the level nature of the site. Driftwood would further minimize the erosion potential of these soils by adhering to the erosion protection measures in the Driftwood Plan during construction. Following construction, the site would be occupied by industrial facilities or revegetated to industrial open space with little potential for erosion.

4.2.4.2 Pipeline

Construction would disturb soils, resulting in a temporary increase in the potential for erosion. To limit the effects of erosion, Driftwood would carry out the erosion control measures in the Driftwood Plan and Procedures during construction and restoration of the pipeline right-of-way. Driftwood would follow and maintain these erosion and sedimentation control measures, such as silt fencing, during construction and through restoration until revegetation has occurred. Following restoration, Driftwood would monitor the disturbed areas, maintain erosion control structures, and repair observed erosion.

Driftwood has proposed an alternative measure to FERC's Plan section V.A.1, requesting that commencement of cleanup operations may not occur immediately when access to the Pipeline is required for additional construction procedures (hydrostatic testing, pigging to dry, caliper pig anomaly testing, cathodic protection installation, fiber-optic installation and testing, parallel or lateral pipeline installation, tie-in connections). Environmental and safety mitigation measures, including erosion and sediment control mitigation measures and site-specific plans, would remain in place and be routinely inspected and maintained. Timber mats would remain in place, where required for access. We generally consider the cleanup activities addressed by this alternative measure to be part of normal construction procedures. Furthermore; we interpret parallel or lateral pipelines and tie-in locations to be discreet locations and not lengthy portions of pipeline. Therefore, we have determined that this delay in commencement of cleanup operations would be appropriate in these limited locations.

Based on adherence to the Driftwood Plan, we have determined that following these measures during construction and restoration would minimize overall soil erosion.

4.2.4.3 Other Aboveground Facilities

Construction would disturb soils, resulting in a temporary increase in the potential for erosion. To limit the effects of erosion, Driftwood would adhere to the erosion control measures in the Driftwood Plan and Procedures during construction and restoration of the pipeline right-of-way. Driftwood would follow and maintain these erosion and sedimentation control measures, such as silt fencing, during construction and through restoration until revegetation has occurred. Following restoration, Driftwood would monitor the disturbed areas, maintain erosion control structures, and repair observed erosion. We have determined that following these measures during construction and restoration would minimize overall soil erosion.

4.2.5 Poor Revegetation Potential

No soils associated with poor vegetation potential would be affected by the Project.

4.2.6 Contaminated Soils and Sediment

4.2.6.1 LNG Facility

Existing Contaminated Soils and Sediment

A series of Phase I Environmental Site Assessments have been conducted at the LNG Facility site between January 2016 and February 2017. Phase I Environmental Site Assessments are desktop (i.e., non-sampling) evaluations that identify recognized environmental conditions at a site. The Phase I Environmental Site Assessment of the largest of the four parcels that comprise the LNG Facility site identified an area of existing groundwater and soils contamination adjacent to the LNG Facility site along the eastern half of the northern shore of the existing North Slip. Other than this one area, the Phase I

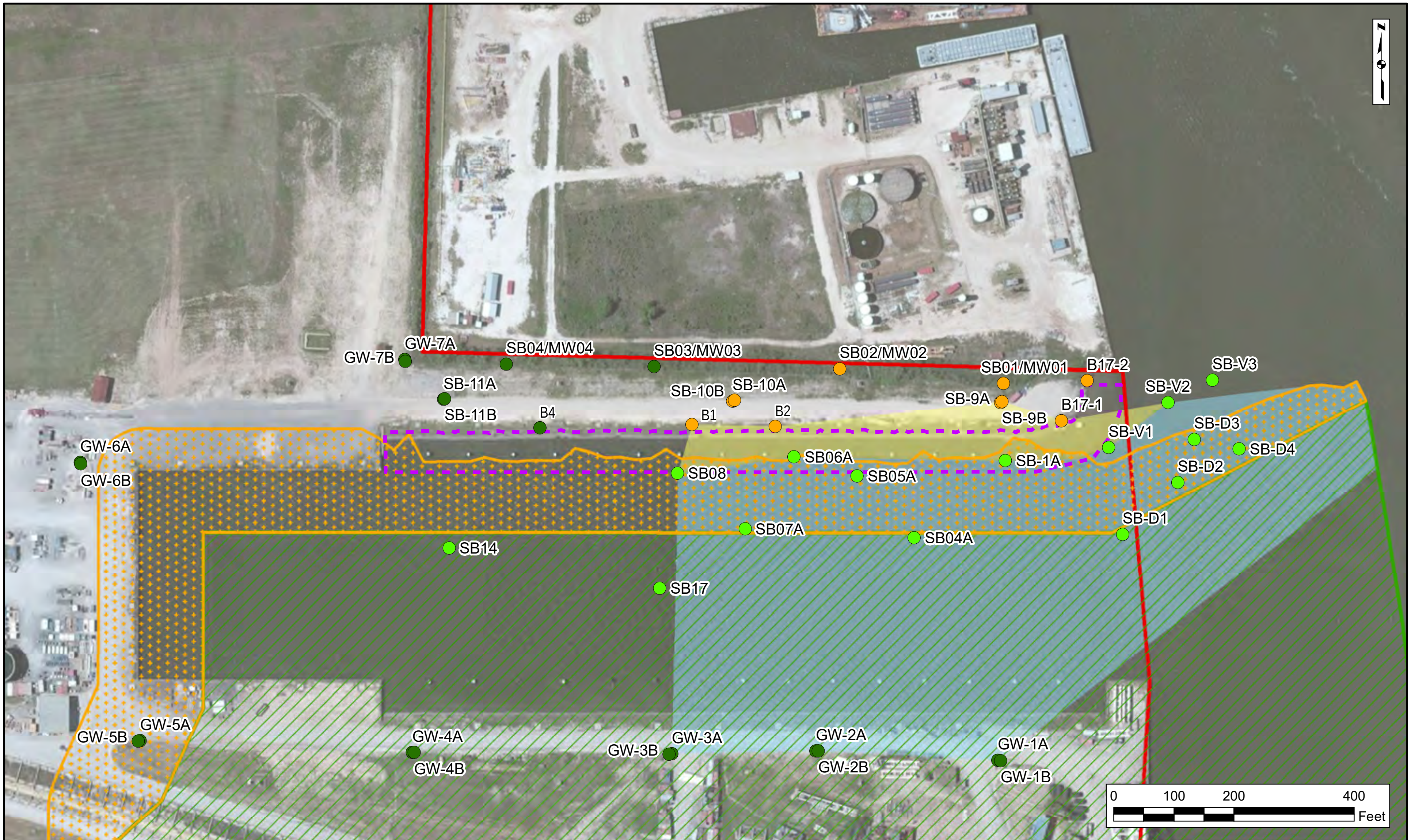
Environmental Site Assessments identified no additional potential sources of soils, sediment, or groundwater contamination on the remainder of the LNG Facility site.

The source of the existing contamination is historical ship building, repair, and barge-cleaning operations at the Bollinger Calcasieu Shipyard property, located to the north of the existing North Slip. This property is not currently active, and DWLNG has a land use agreement option on the property that would prohibit any building or other activities on the property for the life of the LNG Facility. Historical soil and groundwater investigations were performed during the 2012 to 2013 timeframe at the "Former Bollinger Calcasieu Shipyard Site" and the "Fredeman Pit Site" (located on the shipyard property) under LDEQ's Risk Evaluation / Corrective Action Program (RECAP) (LDEQ Agency Interest No. 2164). These historical studies were the primary basis for the finding of existing contamination in the LNG Facility site Phase I Environmental Site Assessments described above.

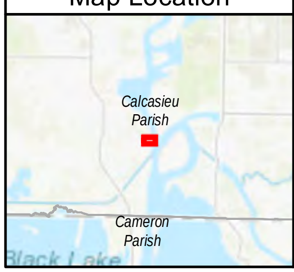
Additional soil, sediment, and groundwater sampling was performed at the Driftwood LNG Facility site (LDEQ Agency Interest No. 40194) from January 2016 through January 2018 to further define the limits of affected soils, sediment, and groundwater in the vicinity of the North Slip (figure 4.2-3). Based on Driftwood's review of the results of the various soil/sediment and groundwater sampling efforts and the area for planned dredging of the marine facilities, it was determined that the westernmost location in which soil contamination was detected is soil boring B1; the southernmost limit between B1, B2, and SB9B/9A; and the easternmost limit between borings B17-1 and B17-2. Soil boring B1 exceeded limiting LDEQ RECAP Soil Screening Standards[12] for chlorinated Volatile Organic Compounds (VOC) (trichloroethene and vinyl chloride) from samples collected between 20 to 25 feet below ground surface (bgs). At depths below 25 feet bgs, chlorinated VOCs were below the limiting RECAP Soil Screening Standards. Soil boring B2 exceeded the limiting RECAP Soil Screening Standard for chlorinated VOCs (dichloroethene, tetrachloroethene, and trichloroethene) from samples collected between 20 to 25 feet bgs. Below 25 feet, chlorinated VOCs were below the limiting RECAP Soil Screening Standard. Soil samples collected from borings B17-1 and B17-2 showed chlorinated VOC concentrations and benzene above limiting RECAP Soils Screening Standards to a depth of approximately 20 feet bgs. Additional soil sampling showed that all samples collected south of the B1, B2, and SB9B/9A line (within the North Slip, sample locations SB-08, SB-6A, SB-5A, and SB-1A), and east of B17-1 and B17-2 (within the Calcasieu River, sample locations SB-V1, SB-V2, SB-V3, SB-D1, SB-D2, SB-V3, and SB-V4) to a total depth of 48 feet below the mud line, were found to not be affected by chlorinated VOCs and/or hydrocarbon compounds (benzene) in excess of limiting RECAP Soil Screening Standards.[13] We received comments on the draft EIS, recommending that the EPA's Inland Testing Manual (ITM) should be used for analysis of dredged material to be placed in an inland location, such as proposed for the Project's BUDM development. The ITM (section 3.1, Tiered Testing and Evaluation) recommends that, "if the available information is sufficient to make factual determinations, no further testing is required." The ITM's testing approach begins with Tier I (Section 4.0,

[12] Limiting RECAP Soil Screening Standard applied for soil samples from onshore borings was the lower of the RECAP industrial screening standard (Soil_SSi) and the RECAP soil protective of groundwater (Soil_SSGW) screening standard.

[13] Limiting RECAP Soil Screening Standard applied for soils/sediment samples from offshore (North Slip and Calcasieu River) soil borings was the lower of the RECAP non-industrial screening standard (Soil_SSni) and the RECAP soil protective of groundwater (Soil_SSGW) screening standard.



Map Location



Legend

- Boring with Soil/Groundwater Concentrations Detected Above Limiting RECAP Standards
- Boring with Soil/Groundwater Concentrations Below Limiting RECAP Standards
- Boring with Soil/Sediment Concentrations Below Limiting RECAP Standards
- Facility Boundary
- Area with Unassessed Groundwater
- Area with Unassessed Soil/Sediment/Groundwater
- Area to be Dredged to 48 Feet Below NAVD88
- Sideslope of Dredged Area
- Existing Concrete Revetment

Figure 4.2-3: Soil and Groundwater Investigations
Driftwood Project
Calcasieu Parish, Louisiana

NOTES:
1. Map Projection: NAD 1983 StatePlane Louisiana South FIPS 1702 Feet
Image Source: Esri online World Imagery Service.
2. "Known Contamination" = observed soil/GW concentrations exceeding LDEQ RECAP soil and GW screening standards

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Tier I Evaluation), the purpose of which, "is to determine whether factual determinations can be made on the basis of existing information," and suggests that appropriate sources of information include "Records of State agencies" (Section 4.1, Compilation of Existing Information). Because the LDEQ has defined the extent of the contaminated site, developed a course of remediation for the site, and has reviewed and approved a project-specific risk management plan, the intent of the ITM's Tier I is satisfied. In addition, contaminated sediments delineated within the site would be managed with separate remediation and excavation actions as prescribed by the LDEQ, and only sediments defined by the LDEQ as "uncontaminated dredged material" would be used for the Project's proposed marsh development.

It should be noted, however, that there is a small portion of the planned dredging area between onshore sampling locations (B1, B2, SB9B/9A, B17-1, and B17-2) where VOC concentrations in soils/sediments are above the limiting RECAP Soil Screening Standard and the offshore sampling locations where VOCs in soils/sediment were not detected above RECAP soil standards (SB-08, SB-6A, SB-5A, SB-1A and SB-V1). Soils/sediments between these sampling locations has not been assessed, due to an existing riprap revetment, which for Project purposes, would be used as the northern sideslope of the proposed LNG berth. We acknowledge Driftwood's clarification received as a comment on the draft EIS that the area north of sample points SB-08, SB-6A, and SB-1A (which includes the area unassessed for sediment contamination) would not be dredged. As shown in Figure 4.2-3, which was adjusted in response to this comment, we define the area unassessed for sediment contamination within sampling locations B1, B2, SB-9B, B17-1, SB-V2, SB-V1, SB-1A, SB06A, and SB08. Based on Driftwood's clarification, the area unassessed for sediment contamination would not be dredged.

Mobilization of Existing Contaminated Soils/Sediments

Dredging of the marine berth area would be performed using a cutterhead suction dredge. Dredged soils, sediments, and groundwater would be pumped in slurry form through temporary piping from the dredging location to BUDM areas located between 1.75 to 8.5 miles southwest of the LNG Facility site along the north and south shores of the ICW. The temporary piping would either be laid on top of existing upland and marsh or floated in the ICW, anchored behind the existing rock embankment along the north side of the waterway. The dredged material would be pumped into shallow open water areas within the 10 BUDM areas, as described in section 2.5.2.6.

Soils and sediment affected with VOCs above RECAP standards could be transported with the dredge slurry and deposited within the BUDM. As discussed above, there is a small area of potentially affected sediment between onshore and offshore sample locations. Driftwood has clarified these areas would not be disturbed during construction of the Marine Facility. However, if contaminated soils and sediment is encountered during dredging (e.g., between sample locations B1, B2, SB9B/9A, B17-1, and B17-2 and sample locations SB-08, SB06A, SB05A, SB1A, or SB-V1 shown on figure 4.2-3) and transported in a slurry form to the BUDM sites, these materials would be distributed across the marsh restoration area and could potentially affect sediment quality, water quality, fisheries, wildlife, and other resources within the BUDM sites and downstream of these areas.

DWLNG has developed a UDP (FERC eLibrary accession number 20170621-5139) and a Risk Management Plan (RMP) (FERC eLibrary accession number 20170331-5058) to address the possibility of encountering contaminated material while dredging in these areas or while excavating and/or dredging in other areas during site development. If indicators of chemical contamination are identified during dredging activities, DWLNG would follow the measures in the UDP and RMP, which include stopping dredging immediately if a sheen or any presence of contamination is encountered, containment of material within the excavation/dredging area, and notification of appropriate agencies, as detailed in these plans. On May 9, 2017, the LDEQ provided Driftwood with written notification that it had no objection to the RMP (FERC eLibrary accession number 20170621-5139) designated for the avoidance and non-disturbance of areas with detected contamination and with the UDP. On February 26, 2018, Driftwood met with LDEQ representatives to discuss the studies performed.

The LDEQ reviews and regulates potential sources of pollution to ensure activities are consistent with state laws and regulations. Final monitoring and mitigation requirements for mobilization of contaminated sediments would be subject to review and approval by LDEQ under the CWA Section 401 Water Quality Certification process, which is part of the Section 404/10 permit process. Driftwood submitted a Section 404/10 Joint Permit Application in March 2017, which is still under review by the COE; the LDNR issued the CUP on May 29, 2018, and LDEQ issued the CWA Section 401 Water Quality Certification on September 7, 2018. Based on Driftwood's commitment to avoid disturbance of contaminated sediments, and on measures outlined in the UDP and RMP, we conclude the Project would not mobilize existing contaminated soils.

Inadvertent Spills or Leaks

Inadvertent spills or leaks of hazardous materials used during construction and operation of the LNG Facility pose a potential risk of contamination of surface water resources. Spill-related impacts from the construction and operation are typically associated with fuel storage, equipment refueling, small quantity chemical storage, and equipment maintenance.

Use of the Driftwood Spill, Prevention, Control, and Countermeasures (SPCC) Plans would minimize the potential for impacts associated with an inadvertent spill or leaks of hazardous materials. Key aspects of these plans include monitoring storage and refueling activities; the provision of secondary containment for fuel and hazardous material storage at staging areas, construction yards, and compressor station sites; and requirements for immediate response and cleanup should a spill or leak occur. The SPCC Plans include preventive measures such as designated refueling areas; spill containment apparatus for lube oil containers and other hazardous liquids in the maintenance and work areas; procedures for the safe handling of hazardous liquids, their storage, and disposal; personnel training; spill response procedures; absorbent materials requirements; and inventory to minimize spill-related impacts during construction and operation of the facilities.

Use of the various spill prevention, containment, and cleanup measures outlined in the Driftwood SPCC Plans should avoid or minimize potential impacts on soils and other environmental resources due to spills of fuels and hazardous materials.

4.2.6.2 Pipeline

Based on data from the EPA Facility Registry Service (EPA, 2017a); the US Department of Health and Human Services (2017) TOXMAP environmental health maps (2017); and LDEQ Electronic Document Management System (LDEQ, 2017a), there are no known sources of contaminated materials crossed by the Pipeline route. During construction, Driftwood would use measures outlined in the UDP for soils, sediment, or groundwater suspected of contamination. We have determined that, if the UDP is adhered to, there is little risk of disturbance and distribution of contamination.

As with the LNG Facility, inadvertent spills or leaks of hazardous materials pose a potential risk of contamination of surface water resources. Driftwood would implement the spill prevention, containment, and cleanup measures outlined in the Driftwood SPCC Plans to prevent and mitigate the effects of spills of fuels and hazardous materials, should one occur during construction.

4.3 WATER RESOURCES

4.3.1 Existing Groundwater Resources

The LNG Facility and Pipeline would be located in the Gulf Coastal Plain physiographic province, which is underlain by the Coastal Lowlands aquifer system, a regional aquifer that extends from southern Texas across southern and central Louisiana and into southern Mississippi. The upper part of the Coastal Lowlands aquifer is referred to as the "Chicot aquifer" which is situated above the underlying "Evangeline aquifer" (USGS, 1998). The Chicot Aquifer System covers an area of about 9,000 square miles and extends from eastern Texas to the Atchafalaya River in eastern Louisiana. In general, the Chicot aquifer system is shallower to the northern boundary and deepens southward towards the Gulf of Mexico, corresponding to a thickening of the surficial confining unit from north to south (Sargent, 2004). The Chicot aquifer serves as the principal source of groundwater for municipal, industrial, agricultural, and domestic use in the Project area supplying about 98 percent of the total groundwater withdrawal in 2014. The Evangeline aquifer provides a small quantity of local groundwater supply (about 2 percent in 2014).

The Chicot Aquifer consists of a complex series of unconsolidated or poorly consolidated wedges of discontinuous beds of sand, silt, and clay. In southwestern Louisiana, the aquifer consists of three separate fresh-water-bearing hydrologic units referred to as the "200-foot sand," the "500-foot sand," and the "700-foot sand," with the naming convention based on the average depths at which these units are encountered in the area (USGS, 1998).

The 200-foot sand water-bearing zone ranges in thickness from 50 to 100 feet and is between 100 feet and 300 feet below the ground surface in Calcasieu Parish (Lovelace, 1999). This part of the aquifer consists of layers of medium sands disrupted by clay lenses and is a productive unit that has the highest water quality of the three aquifer layers. The 200-foot sand zone is primarily used for domestic and irrigation purposes (USGS, 2017).

The 500-foot sand water-bearing zone ranges in thickness from 170 to 200 feet and is between 300 and 900 feet below ground surface in Calcasieu Parish (Lovelace, 1999). This part of the aquifer consists of medium to coarse sands with clay lenses and is a highly productive unit that is capable of yielding up to up to 4,000 gpm of water. The 500-foot sand zone is the most heavily utilized and is used primarily as a source of industrial and public supply water (USGS, 2017).

The 700-foot sand water-bearing zone ranges in thickness from about 85 to 150 feet and is between 500 feet and 1,500 feet below the ground surface in Calcasieu Parish (Lovelace, 1999). This part of the aquifer consists of fine to coarse sands and is the least productive of the three layers. The 700-foot sand zone is used as a source of public water supply and industrial use in the northern portions of the aquifer in areas that have not yet been affected by increased salinity (USGS, 2017).

Depth to a major groundwater-bearing zone in Calcasieu Parish varies from less than 50 feet in many areas of the Parish, including areas of the Pipeline to the north and east, to greater than 200 feet in areas of the Pipeline in the east and the south. Depth to groundwater within shallow-sand zones near the Pipeline route across Acadia and Evangeline Parishes is variable, but typically is less than 50 feet. Water-bearing, shallow-sand zones are largely absent along the Pipeline route in northern Jefferson Davis Parish (Sargent, 2004).

At the LNG Facility site, studies indicate that, while the site is generally underlain by heterogeneous layers of low permeability silt and clay, two more-permeable water-bearing groundwater zones are present relatively near the surface. The water-bearing zones are referred to as the "20-foot sand zone," an approximately 10-foot-thick layer of sand, with silt and clay about 20 feet below the ground surface (about elevation -15 feet NAVD88) and the "38-foot shell hash zone," a relatively thin layer of shell hash in a silt matrix about 38 feet below the ground surface (about elevation -33 feet NAVD88).

4.3.1.1 Sole Source Aquifers

The EPA oversees the Sole Source Aquifer (SSA) Protection Program to protect high-production aquifers that supply 50 percent or more of a region's water supply (EPA, 2017b). The program is administered under Section 1424(e) of the Safe Drinking Water Act of 1974 and requires the EPA to review and approve federal financially assisted projects within SSA regions that have the potential to create a significant hazard to public health. The Chicot Aquifer System in Louisiana is a EPA-designated sole-source aquifer (53 Fed. Reg. 20893; June 7, 1988). The Chicot SSA underlies the entire Project area including the LNG Facility and Pipeline.

4.3.1.2 Public and Private Water Supply Wells

The Safe Drinking Water Act Amendments of 1986 requires that each state develop and implement a Wellhead Protection Program. Louisiana's Wellhead Protection Program is a component of the LDEQ's Drinking Water Protection Program and is designed to protect the quality of public drinking water supplies obtained from community water wells. The LDEQ delineates a protection area around each well, with a radius ranging from 1,000 feet to 1 mile. The radius of the protection area is developed based on well screen depth, well construction date, and aquifer source water. An inventory is taken of all potential sources of contamination in the wellhead protection area and a management plan is created to minimize the potential risk of contamination to the public water supply. The public water supply system and the community develop and implement management options, which often include some combination of local or regional planning/zoning ordinances, source prohibitions, and public education initiatives (LDEQ, 2017b).

LNG Facility

Two public water supply districts operate near the LNG Facility. The Calcasieu Water Supply District 9 services the Carlyss area, about 5 miles north of the LNG Facility, and the Calcasieu Water Supply District 2 services the Mossville area, about 9 miles north of the LNG Facility. The LDNR Strategic Online Natural Resources Information System (SONRIS) database indicates that each of these districts derive their water supplies from several groundwater supply wells (LDNR, 2017). None of the wells associated with these two Districts are within 1 mile of the LNG Facility, and the LNG Facility does not fall within a designated wellhead protection area.

The SONRIS database identified six active private water wells within 0.25 mile of the LNG Facility. These include three domestic water wells to the north of the LNG Facility adjacent to two homesteads; two commercial public supply wells at an industrial facility across the ICW; and an industrial water well within the adjacent Bollinger Calcasieu Tract. None of these wells are located within 150 feet of Project workspaces.

Pipeline

Based on consultation with LDEQ, the Pipeline would cross five wellhead protection areas in Calcasieu Parish and one wellhead protection area in Evangeline Parish (table 4.3-1).

Table 4.3-1

Wellhead Protection Areas Crossed by the Pipeline

Parish	Public Water System	Distance Crossed (miles)	Crossing Start (MP)	Crossing End (MP)	Distance of Well from Construction Workspaces
Calcasieu	Calcasieu Waterworks District 9	1.9	7.6	9.5	400 feet
Calcasieu	Calcasieu Waterworks District 9	1.9	7.6	9.5	1,000 feet
Calcasieu	Rosemont Trailer Park	1.8	7.5	9.4	1,000 feet
Calcasieu	Southpark Mobile Home Park	1.0	6.6	7.6	0.8 mile
Calcasieu	Calcasieu Waterworks District 1	1.4	30.6	32.0	0.8 mile
Evangeline	Mamou Road Water System	0.8	83.6	84.2	0.9 mile

Source: LDNR, 2017.

The SONRIS database (LDNR, 2017) indicates that there are eight active private water wells within 150 feet of the Pipeline construction area (table 4.3-2). No natural springs or seeps have been identified within 150 feet of the Pipeline centerline.

Table 4.3-2

Water Wells Within 150 feet of Pipeline Construction Workspaces

Parish	Well Type	MP
Calcasieu	Domestic	6.7
Jefferson Davis	Irrigation	60.7
Jefferson Davis	Irrigation	62.9
Jefferson Davis	Oil/Gas Rig	63.4
Jefferson Davis	Proposed Project Pipeyard	0.0
Evangeline	Irrigation	84.5
Evangeline	Irrigation	86.2
Evangeline	Irrigation	90.8

Source: LDNR, 2017.

4.3.1.3 Existing Groundwater Quality

The LDEQ's Aquifer Sampling and Assessment Program assesses groundwater quality in Louisiana's major freshwater aquifers. The most recent groundwater monitoring data performed under this program and available from the LDEQ for the Chicot aquifer was completed in July 2010 through June 2011 (LDEQ, 2011).

Under this program, groundwater samples are compared to Maximum Contaminant Level (MCL) values established by EPA under the Federal Safe Drinking Water Act. MCLs are established for pollutants that may pose a health risk in public drinking water. Primary MCLs are established for certain parameters and represent the highest level of a contaminant that the EPA allows in public drinking water. Secondary MCLs have also been established for certain parameters and are defined as non-enforceable guidelines for the taste, odor, or appearance.

Results of the groundwater quality assessment for the wells in the Project area indicated no exceedances of Primary MCLs for field parameters such as pH, temperature, or salinity, or for conventional parameters such as ammonia, metals, or organic compounds. A few minor exceedances were reported for Secondary MCLs, including one for color (Evangeline Parish), two for total dissolved solids (Acadia and Jefferson Davis Parishes), and seven for iron (one in Acadia, four in Calcasieu, one in Evangeline, and one in Jefferson Davis Parishes). Iron exceedances in the Chicot aquifer are not unusual, as 16 of the 23 wells tested in the Aquifer Sampling and Assessment Program exceed the Secondary MCL for iron.

The LDEQ has concluded that groundwater produced from this aquifer is hard but is of good quality when considering short-term or long-term health risk guidelines. LDEQ further concluded that the aquifer is of fair quality when considering taste, odor, or appearance guidelines, with the "fair" designation being due to the number of wells (16) that exceeded the Secondary MCL for iron (LDEQ, 2011).

In some areas of southwest Louisiana, groundwater withdrawals from the Chicot aquifer have resulted in lowered water levels (water table drawdown) and saltwater encroachment. The rate of decline in these areas is due primarily to industrial use in the Lake Charles area and rice irrigation, where intense pumping of the 500-foot sand has resulted in the water level declining by as much as 1 to 2 feet per year (LDNR Ground Water Resources Committee [GWRC], 2012; Lovelace et al, 2001, 2002).

While chloride levels have remained relatively stable since the mid-1970s, elevated chloride levels (i.e., greater than 100 milligrams per liter [mg/L]) observed at public supply wells in eastern and southern Lake Charles suggest that additional upwelling of saltwater from the 700-foot sand unit to the 500-foot sand unit may occur in the future (Lovelace, 1999; LDEQ, 2009).

The LDNR's Office of Conservation regulates groundwater usage on a statewide basis through designation of Areas of Ground Water Concern and Critical Areas of Ground Water Concern. Areas of Ground Water Concern are defined as areas where aquifer sustainability is not being maintained due to either migration of a saltwater front, water level decline, or subsidence. The State of Louisiana has three designated Areas of Ground Water Concern, all of which are in north Louisiana within the Sparta aquifer.

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 GWRC, 2012). In 2012, the LDNR and USGS entered into a joint partnership to increase groundwater monitoring. As a result, the number of wells within the State of Louisiana being monitored for water level, chlorides, and water quality has nearly doubled.

4.3.1.4 Existing Groundwater Contamination

RECAP investigations conducted in 2012 and 2013 at a property located adjacent to the north of the planned Marine Facility site (see discussion of "Former Bollinger Calcasieu Shipyard Site" and the "Fredeman Pit Site" in Section 4.2.6.1) identified areas of groundwater contamination along the Bollinger southern property line. Subsequent groundwater sampling performed on the LNG Facility site from February 2016 through January 2018 confirmed the presence of groundwater contamination along the northern shore of the North Slip consisting of chlorinated VOC concentrations in excess of RECAP groundwater screening standards. Contaminated groundwater was detected in the 20-foot sand water-bearing zone within eight monitoring wells adjacent to the northern shore of the North Slip and along the eastern half of the slip adjacent to the Calcasieu River (B1, B2, MW-01, MW-02, SB-9A, SB-10A, B17-1, and B17-2). Dense non-aqueous phase liquid was detected in the 38-foot shell-hash water-bearing zone in one of the monitoring wells (MW-01), and chlorinated VOC concentrations above RECAP groundwater screening standards were observed in the 38-foot shell-hash water-bearing zone in all but one (B-1) of the remaining seven monitoring wells. Driftwood's evaluation in 2018 (FERC eLibrary accession number 20180305-5138) did not identify dense non-aqueous phase liquid in the 38-foot shell hash or other soil layers. Groundwater VOC concentrations exceeding the RECAP groundwater screening standards were not observed in wells immediately south of the North Slip (GW-1A, GW-1B, GW-2A, GW-2B, GW-3A, GW-3B, GW-4A, and GW-4B). Because of the logistical and technical challenges of collecting groundwater samples from underwater borings advanced within both the North Slip and the Calcasieu River, concentrations of contaminants in groundwater were not assessed in these offshore borings. As previously discussed, the source of the chlorinated VOC groundwater contamination is historical ship building, repair, and barge-cleaning operations at the Former Bollinger Calcasieu Shipyard property.

We received a comment on the draft EIS from Driftwood, disagreeing with our characterization of the groundwater in the offshore sediments as "unassessed." RECAP standards for soil (allowing higher concentrations of contaminants) have been applied to groundwater samples in this area, and therefore do not provide the level of confidence indicated by Driftwood. It is possible, although not confirmed, that groundwater affected by chlorinated VOCs above RECAP groundwater screening standards extends into the adjacent shoreline area of the Calcasieu River and the North Slip. Both of these areas would be dredged for construction of the Marine Facility berths. Although groundwater discharging to these offshore areas may exceed the RECAP groundwater screening standards for VOCs, contaminant levels are not of sufficient concentration to have affected offshore sediments above the limiting RECAP Soil Screening Standards as shown by the analytical results of soil/sediment samples collected from borings advanced in the slip area and offshore in the river. Based on our analysis, we conclude it is unlikely there is significant groundwater contamination in the sampled area. However, our conclusion does not change the fact that the media remains unassessed by approved sampling protocols.

Phase I Environmental Site Assessments performed at the site indicate that the remainder of the LNG Facility site is unlikely to contain contaminated soils, sediment, or groundwater. As described in Section 4.2.6.2, there are no known sources of contaminated soils, sediment or groundwater crossed by the Pipeline route.

4.3.2 Groundwater Impacts and Mitigation

4.3.2.1 LNG Facility

Constructing the LNG Facility would temporarily affect groundwater. In inland areas, initial excavation activities are likely to encounter near-surface groundwater (e.g., in wetlands), and would not extend down to the 20-foot sand water-bearing zone. Installation of drainage wicks as described in Section 4.1.4.4 and piles as described in section 2.5.2 would use specialized equipment and would not require excavation. During construction, shallow aquifers could sustain minor, indirect impacts in overland flow and groundwater recharge/infiltration due to the clearing and grading activities and soil compaction. During operation of the LNG Facility, permanently occupied areas of the site would be converted to impervious or semi-pervious surfaces associated with aboveground facilities and plant roads, which would similarly result in minor, impacts on overland flow and groundwater recharge/infiltration.

As described previously, constructing the Marine Facility and the MOF would involve a combination of land-based excavation and water-based dredging activities. The land based excavations would intersect the 20-foot sand water-bearing zone, which begins near elevation -7 feet NAVD88. The excavation would be an open cut with appropriate side slopes to maintain stability. The LNG Spill Containment and the Refrigerant Spill Containment Sumps would require deeper excavations that would intersect the 20-foot sand water-bearing unit. Sheet piling would be driven around the perimeter of these planned excavations to provide shoring.

Dewatering

Driftwood would remove approximately 3,500 to 5,500 gallons per day (about 2.4 to 3.8 gallons per minute (gpm)) during construction of the Marine Facility and the MOF. Well points[14] or sump pumps would be used to dewater sites to support construction of the Marine Facility and the MOF, while sump pumps would be used for the LNG Spill Containment and Refrigerant Spill Containment Sumps excavations. Driftwood estimates that the dewatering rates for excavation of the LNG Spill Containment and Refrigerant Spill Containment Sumps would be about 40 gallons per day (less than 0.03 gpm) due to the screen intake interval for the dewatering wells constructed in a lower clay unit. Dewatering would continue for a period of approximately four to six months. Water collected during dewatering activities would be managed in accordance with the Driftwood ESCP. Water would be pumped to sedimentation control structures (e.g., straw bale structures) and/or routed through discharge filter controls (e.g., sediment filter bag or filter socks), and would then flow into a ditch, channel, or swale that would use additional sediment removal controls (e.g., stone check dams) as necessary. The relatively low discharge rate combined with use of these BMPs would reduce the potential for erosion and sedimentation impacts.

Dewatering would temporarily lower groundwater levels in the immediate vicinity of the activity. A temporary lowering of the water table could affect groundwater flow (seepage) and quality; however, these affects would be minor and highly localized. A groundwater seepage evaluation performed by Driftwood predicted that static groundwater table elevations in the area north of the North Slip would be unaffected by dewatering, seepage velocities induced by dewatering would be negligible, and the low dewatering pumping rates and limited duration of dewatering activities would not be expected to cause migration of groundwater contamination. In addition, the physical presence of the North Slip serves as a natural barrier to groundwater flow. Dewatering of the excavation in the MOF area is similarly predicted to have minimal impact on local groundwater flow gradients.

Dewatering near the LNG Spill Containment and Refrigerant Spill Containment Sumps would also temporarily lower the water table and modify groundwater flow patterns near the dewatering activity. The sumps are each located over 1,500 feet from the nearest groundwater monitoring location with known contamination. As with dewatering of the land-based excavation, Driftwood's evaluation predicted that dewatering for construction of the sumps would not affect static groundwater table elevations in the contamination area, would result in negligible changes in seepage velocities, and due to low pumping rates and a relatively limited duration of pumping, would not be expected to result in migration of groundwater contamination from the area of groundwater contamination.

[14] Well pointing would involve the placement of small water withdrawal wells outside the zone contained by sheet piles.

Mobilization of Existing Contaminated Groundwater During Dredging

Because dredging of the Marine Facility would be taking place within and immediately offshore of the North Slip, it is possible that dredging activities would result in a short-duration migration of contaminated groundwater known to be present in the 20-foot and 38-foot water-bearing zones in the area along the northern shore of the North Slip into the Calcasieu River. In its comments on the draft EIS, Driftwood states that, based on its seepage analysis (eLibrary accession number: 20170822-5131), which included a 2D model of groundwater flow, groundwater contamination north of the existing barge slip is not expected to migrate during wet excavation (dredging) of the Marine Facilities. However, we note that the seepage analysis also reports "the direction of groundwater flow is expected to be east-south towards the river", recognizing that groundwater flow is present, and that the seepage analysis is specific to dry excavation of the Marine Facilities. Dredging of the Marine Facility berth would adjust the shoreline, reducing the distance from locations with known groundwater contamination and the waterbody; therefore, wet excavation (dredging) of the Marine Facility berth may result in short-term changes to migration of contaminated groundwater. Nonetheless, we maintain that the migration of contaminated groundwater to the Calcasieu River, should it occur, would result in minor, temporary impacts on water quality in the river, as contamination would be rapidly disperse with river currents. Contaminants are anticipated to be VOCs, which would rapidly volatize at the water surface.

Dredged soils, sediments, and groundwater from this area would be pumped in slurry form to one or more of the 10 BUDM areas located along the north shore of the ICW. If contaminated soils, sediment and groundwater (as discussed in sections 4.2.6.1 and 4.3.1.4) is encountered during dredging of the unassessed material located between the onshore sampling locations (B1, B2, SB9B/9A, B17-1, and B17-2) and the offshore locations (SB-08, SB-6A, SB-5A, SB-1A, and SB-V1), the cutterhead-suction dredging method would transport the contaminated groundwater to the BUDM sites about 1.75 to 8.5 miles away and distribute it across the marsh restoration area. If contaminated groundwater were discharged into the BUDM sites, it has the potential to affect sediment quality, water quality, fisheries, wildlife, and other resources within the BUDM sites and downstream of these areas.

As discussed in section 4.2.6.1, DWLNG has developed an RMP to address the possibility of encountering contaminated material while dredging in these areas or while excavating and/or dredging in other areas during site development. The Driftwood LNG dredging plan for excavation and dredging of soils and sediment, in accordance with a COE CWA permit, states that Driftwood would limit excavation and dredging in the marine berth to sediments that have been sampled and documented below applicable soil and groundwater standards as published by the LDEQ RECAP. The area between sample points B-1, B-2, and MW-01 (with "known contamination") and sample points below applicable criteria such as SB-08, SB-6A, and SB-1A would not be dredged. In the unlikely event that indicators of chemical contamination are identified during dredging activities, including odors, a sheen on water, or any presence of contamination is encountered, DWLNG would follow the measures in the UDP and RMP, which include stopping dredging immediately, containment of material within the berth area, and notification of appropriate agencies, as detailed in these plans. The RMP was reviewed and approved by the LDEQ.

As previously indicated, the LDEQ reviews and regulates potential sources of pollution to ensure activities are consistent with state laws and regulations.

Other Potential Impacts on Groundwater

Installing piles and sheet piling to support the LNG facility would result in minor interruptions in groundwater flow patterns and minor localized changes in the elevation of the groundwater table. Pilings could also increase the potential for vertical transmission of groundwater between shallow and deeper aquifer units. Installation of piles is not planned for areas of known soil or groundwater contamination and as such would not result in the vertical transmission of contaminated groundwater. Impacts associated with pile installation would be minor, localized, and temporary.

Inadvertent spills or leaks of hazardous materials used during construction and operation of the LNG Facility could impact underlying groundwater quality. These impacts and the mitigation measures, which include implementation of the Driftwood SPCC Plans, are described in section 4.2.6.1 of this final EIS. Use of the various spill prevention, containment, and cleanup measures of the Driftwood SPCC Plans would avoid or minimize potential impacts on groundwater due to spills of fuels and hazardous materials.

As noted in section 2.1.1.4, Driftwood does not plan to use any direct withdrawal of groundwater as a water supply source during construction or operation of the LNG Facility. Therefore, other than construction dewatering impacts discussed above, there would be no impacts on groundwater quality or quantity associated with groundwater withdrawal. Impacts on groundwater resources, including the sole-source Chicot aquifer, associated with the construction and operation of the LNG Facility would be minor, localized, and temporary. These impacts could include minor changes in groundwater flow patterns and groundwater table elevation and minor changes in groundwater recharge/infiltration due to soil compaction and increased areas of impervious and semi-impervious surfaces. Implementation of the Driftwood and SPCC Plans would minimize potential impacts on groundwater quality due to inadvertent spills or leaks of hazardous materials during construction and operations. We conclude that with the implementation of the aforementioned plans, the potential for the project to affect flow patterns, reduce groundwater recharge/infiltration rates, or contaminate the Chicot aquifer or water-supply wells near the LNG Facility would be minimal.

4.3.2.2 Pipeline

Along much of the Pipeline route, the bottom of the Pipeline trench would be well above productive water-bearing zones; however, it is expected that shallow groundwater could be encountered in many areas. Where trench dewatering would be necessary, it would be performed according to the Driftwood Procedures, in a manner that does not cause erosion and does not result in silt-laden water flowing into any waterbody. Trench dewatering could result in localized, minor changes to the water table. However, trench dewatering at a given location would be performed for a generally short period of time, and dewatering effluent would be discharged in a nearby upland area. Therefore, potential dewatering impacts would be minor, temporary, and localized, and water table elevations would reestablish soon after the trench is backfilled.

The use of heavy construction equipment could compact soils which would reduce recharge/infiltration rates and modify surface water flows, both of which could affect underlying groundwater. Areas cleared of vegetation for pipeline construction can experience similar reductions in water infiltration until revegetation is established. The Driftwood Plan includes measures, such as plowing compacted subsoil before replacing segregated topsoil, that would reduce impacts on groundwater. With the use of these procedures, impacts on groundwater due to changes in the ground surface of the right-of-way would be minor and temporary.

Trenching and excavation associated with the construction of the Project's three compressor stations would be similar to that associated with Pipeline construction, relative to maximum excavation depth and unlikely potential to encounter groundwater during construction.

Inadvertent spills or leaks of hazardous materials could affect groundwater. Implementation of the various spill prevention, containment, and cleanup measures of the Driftwood SPCC Plans would avoid or minimize potential impacts on groundwater due to spills of fuels and hazardous materials.

As described previously, the Pipeline would cross through six public water supply wellhead protection areas; however, none of the wells serving these are within 150 feet of the construction workspace. Eight private active wells have been identified within 150 feet of the Pipeline construction area. To minimize potential impacts on wells, DWPL would implement measures identified in its SPCC Plans. Fuels and lubricants would be stored and refueling and lubricating of construction equipment would occur at least 200 feet from private wells or 400 feet from community and municipal wells. Prior to initiating clearing and grading activities, groundwater wells within the Project workspace would be located and marked to avoid adverse impacts during pipeline construction. DWPL would conduct pre- and post-construction testing of the wells within 150 feet of workspaces, which would include testing for pH, total suspended solids (TSS), flow, and oil/grease or total petroleum hydrocarbons. If unidentified wells or springs are encountered during construction, DWPL would coordinate with the appropriate regulatory agencies and the respective landowner to develop a groundwater mitigation plan.

During operation of compressor stations, domestic wastewater from bathrooms and sinks would be routed to a septic system for subsequent subsurface sewage disposal. The estimated water demand for a compressor station is about 40 gallons per day, and as such the volume of water treated and discharged each day via a septic system should be minimal. Should a septic-system-related contaminant release occur, impacts would be limited to the area immediately adjacent to the septic system and not significantly affect groundwater quality in the area.

We conclude that impacts of the Pipeline and associated aboveground facilities would be minor and temporary and that with the implementation of the aforementioned plans, the Project would not significantly affect groundwater.

4.3.3 Surface Water Resources

There are seven designated uses established by the LDEQ for surface waters in Louisiana, as shown in the following list. Three of these uses (drinking water supply, outstanding natural resource waters, and oyster propagation water) apply only to the listed primary waterbody and not to any tributaries or distributaries of such waterbodies. The remainder of these uses apply to the tributaries or distributaries of designated waterbodies.

Primary Contact Recreation: any recreational or other water contact use involving prolonged or regular full-body contact with the water and in which the probability of ingesting appreciable amounts of water is considerable.

Secondary Contact Recreation: any recreational or other water contact use in which body contact with the water is either incidental or accidental and the probability of ingesting appreciable amounts of water is minimal.

Fish and Wildlife Propagation: the use of water for aquatic habitat, food, resting, reproduction, cover, and/or travel corridors for any indigenous wildlife and aquatic life species associated with the aquatic environment.

Drinking Water Supply: the use of water for human consumption and general household use.

Oyster Propagation: the use of water to maintain biological systems that support economically important species of oysters, clams, mussels, or other mollusks so that their productivity is preserved and the health of human consumers of these species is protected.

Agricultural: the use of water for crop spraying, irrigation, livestock watering, poultry operations, and other farm purposes not related to human consumption.

Outstanding Natural Resource Waters: waterbodies designated for preservation, protection, reclamation, or enhancement of wilderness, aesthetic qualities, and ecological regimes.

4.3.3.1 Existing Surface Water Resources

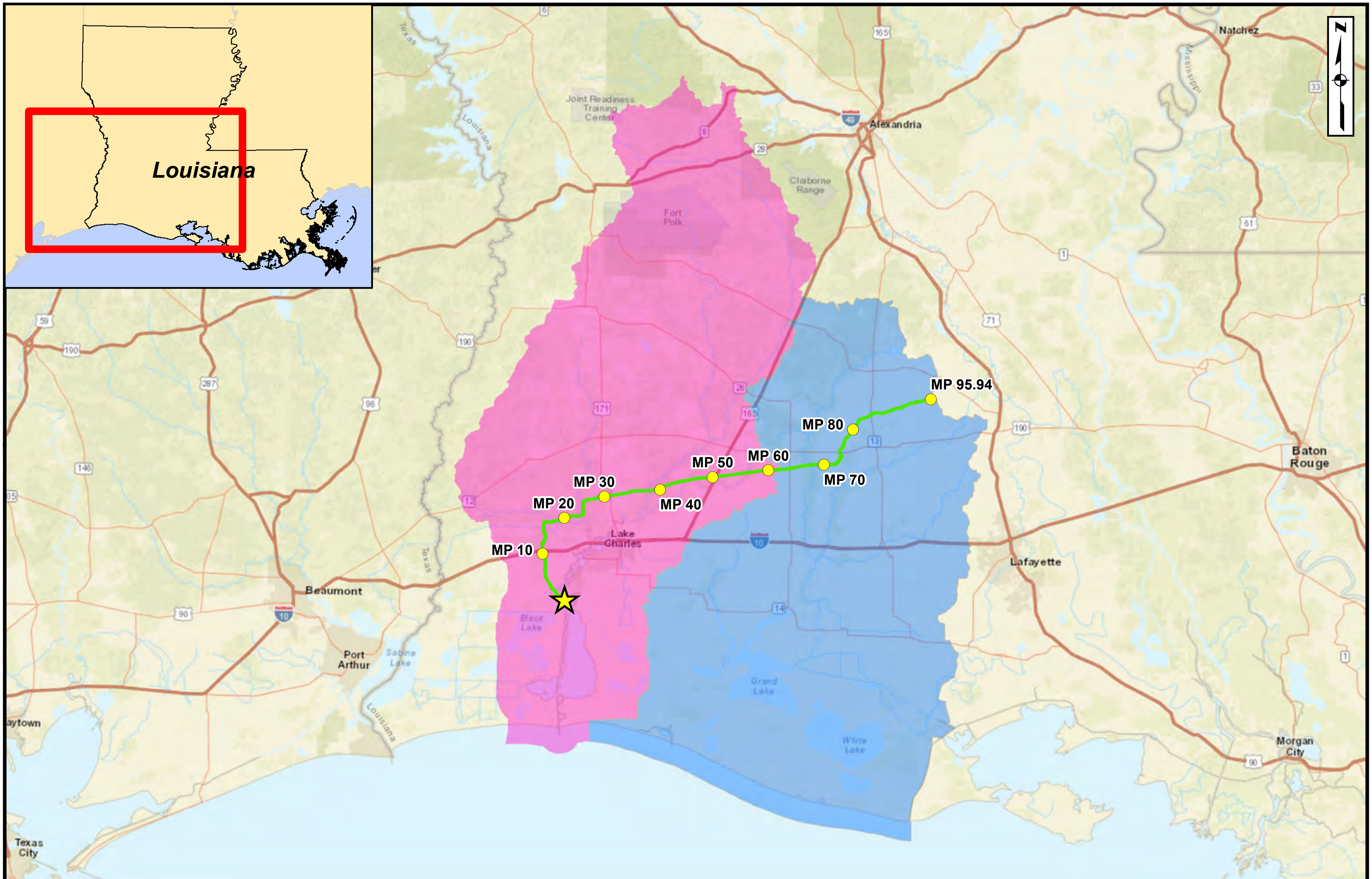
LNG Facility

The LNG Facility would be located within the Calcasieu River Basin in southwest Louisiana (figure 4.3-1). The Calcasieu River basin drains an area of 4,105 square miles and discharges to the Gulf of Mexico. The Calcasieu Saltwater Barrier (a man-made dam across the Calcasieu River located over 10 miles upstream of the LNG Facility) divides the Calcasieu basin into the Upper Calcasieu (freshwater) and Lower Calcasieu (estuarine) basins.

The Calcasieu River is about 200 miles in length and originates about 88 miles northeast of Lake Charles, Louisiana. Near the LNG Facility, tributaries to the Calcasieu River include Bayou Choupique and the ICW (figure 4.3-2 and 4.3-3). As with most estuarine systems, salinity levels near the LNG Facility vary due to amount of rainfall, tidal movements, and shifts in wind and water currents (LDWF, 2014b,c). Based on LDEQ data, turbidity measured as ambient TSS conditions in Lake Calcasieu and the Calcasieu Ship Channel were found to be between 10 and 45 mg/L based on LDEQ data, with spikes up to 100 mg/L in localized areas during routine maintenance dredging by COE in 2008, 2009, 2010, and 2014 (LDEQ, 2017b).

Bayou Choupique is a 20-mile long tributary to the Calcasieu River that drains marsh areas to the south and west of the LNG Facility area into the ICW immediately south of the LNG Facility, which in turn discharges to the Calcasieu River. Several unnamed tributaries discharge to Bayou Choupique, along with major named tributaries that include Spring Gully and Wing Gully, which enter upstream of the confluence of Bayou Choupique and the ICW. Bayou Choupique was previously a direct tributary of Calcasieu Lake, prior to the construction of the ICW, which intercepted the flow. The marshes of Bayou Choupique are used for recreational fishing for red drum and southern flounder.

The ICW is a constructed waterway that runs between the Sabine River in the west and the Calcasieu River and supports east-west flow between these two semi-distinct hydrologic units. The ICW is currently maintained as a 125-foot-wide and 12-foot-deep channel. It forms the southeast boundary of the LNG Facility site, south of the LNG berths.



Legend

- ☆ Driftwood LNG Facility Site
- ● Milepost
- — Pipeline Route

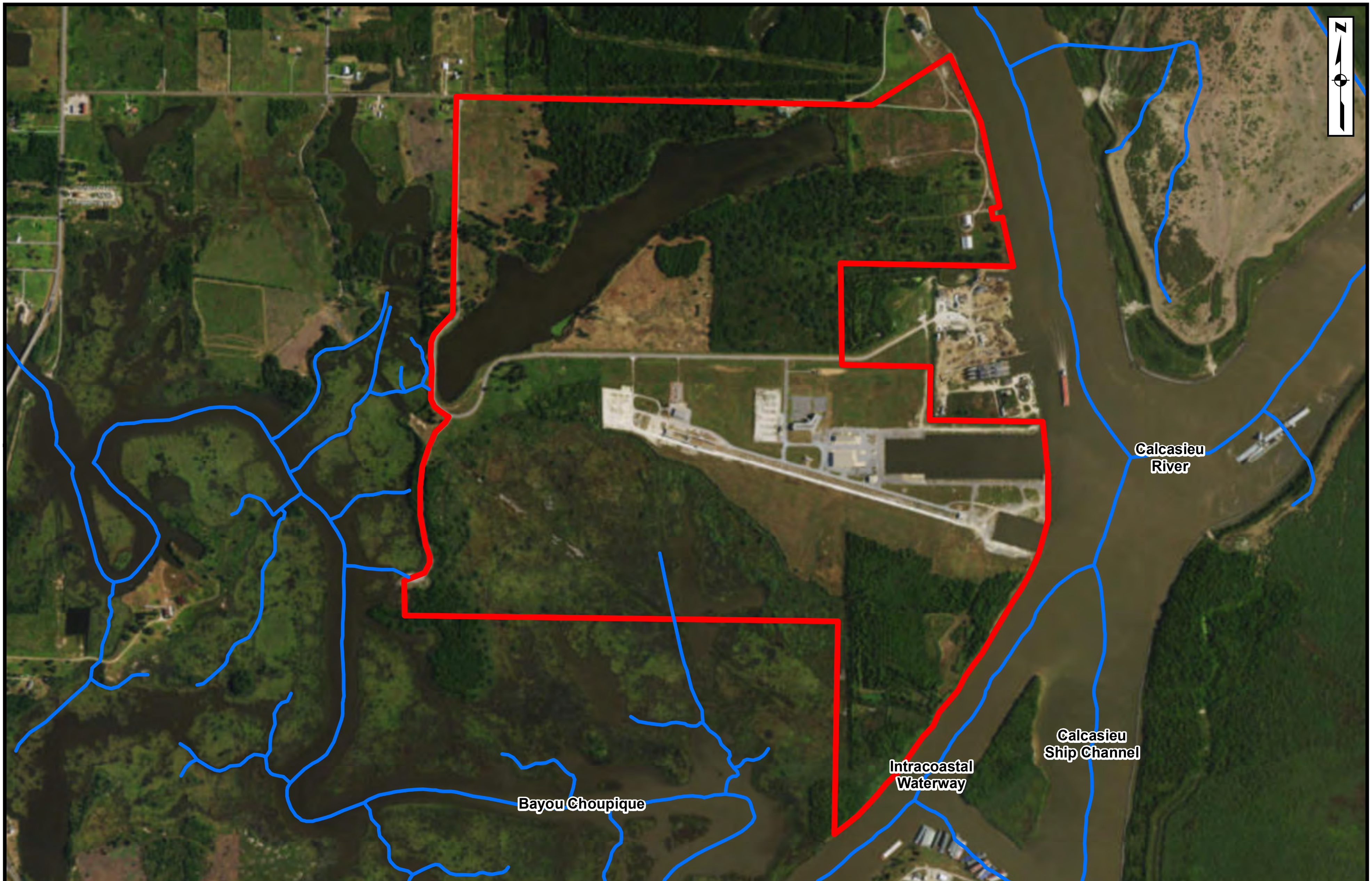
BASIN

- MERMENTAU
- CALCASIEU

0 5 10 20 Miles

NOTES:
Basemap: ESRI World Street Map
Reproduced under license in ArcGIS 10.4
Data: LDEQ Watershed Basins, 2015

Figure 4.3-1: Map of Calcasieu and Mermentau River Basins
Driftwood LNG Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu, Jefferson Davis, Acadia, and Evangeline Parishes, Louisiana



Legend

Facility Boundary

Perennial Stream/River

0 500 1,000 2,000 Feet

NOTES:
Basemap: ESRI World Imagery
Data: National Hydrography Dataset, Louisiana, 2011
Reproduced under license in ArcGIS 10.4

Figure 4.3-2: NHD Mapped Surface Water Resources
Driftwood LNG Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

Legend

Facility Boundary

Waterbodies

0 500 1,000 2,000 Feet

NOTES:

Basemap: ESRI World Imagery

Reproduced under license in ArcGIS 10.4

Data: ERM Field Survey, 2016

Figure 4.3-3: Waterbodies Delineated within the LNG Facility

Driftwood LNG Project

Driftwood LNG LLC and Driftwood Pipeline LLC

Calcasieu Parish, Louisiana

Calcasieu Lake is an approximately 50,000-acre brackish, tidal estuary located about 3.5 miles downstream of the LNG Facility. The lake is 16 miles long from north to south, varying in width from five miles at the north end to seven miles in the southern region. The lower end of Calcasieu Ship Channel provides the only major connection between the lake and the Gulf of Mexico. Tidal exchange between the Gulf and the lake is confined within the banks of the Calcasieu Ship Channel, creating strong tidal currents during conditions with large tidal fluctuations. Calcasieu Lake is considered a partially mixed estuary in which tidal inundation creates a salt wedge in the upper estuary, forcing a mixing zone with the upper freshwater discharge into the system from the Calcasieu River to the north (COE, 2010b).

Bayou Choupique is located immediately to the south of the LNG Facility site and drains to the ICW. Near the LNG Facility, the Calcasieu River (including the Calcasieu Ship Channel), ICW, and Bayou Choupique have been all assigned designated uses of primary contact recreation, secondary contact recreation, and fish and wildlife propagation, and each of these waters is fulfilling LDEQ's water-quality requirements (LDEQ, 2017d). In addition, the Calcasieu River supports oyster propagation and is meeting the water-quality requirements for that use. Downstream of the LNG Facility, Calcasieu Lake has been assigned designated uses of primary contact recreation, secondary contact recreation, fish and wildlife propagation and oyster propagation and is similarly fulfilling LDEQ's water-quality requirements for these uses.

Several surface water resources are present within the LNG Facility site including: a 45-acre lake, roadside drainage ditches along Global Road and Burton Shipyard Road, a drainage ditch that traverses the central area of the site, and a number of smaller drainage ditches that capture surface water and direct it into the main drainage ditch and then east to the Calcasieu River (figure 4.3-3). In addition to these waterbodies, there are open-water areas in the estuarine wetlands located on the south side of the site and four small man-made ponds located on site. Surface waters within the site generally drain into Bayou Choupique.

Table 4.3-3 in appendix A identifies the 26 surface waters within the LNG Facility site and associated offsite work areas, including 22 surface waterbodies that would be filled during construction of the LNG Facility. The table includes flow regime, state water-quality designation, fishery designation, width (at ordinary high water mark for flowing waters), and construction impact.

Pipeline

The Pipeline is located within the 4,105-square mile Calcasieu River Basin and the adjacent 6,630-square mile Mermentau River Basin (figure 4.3-1). As listed in table 4.3-4 in appendix A, the Pipeline route would cross 317 separate waterbodies, including 88 perennial streams, 80 intermittent streams, 136 ephemeral streams, and 13 open waterbodies (lakes, ponds, etc.). Open cut construction methods would be used for 281 crossings. The HDD crossing method would be used at 15 crossings and the conventional-bore method would be used for 2 crossings. The remaining waterbodies are located within the construction workspace and would not be crossed by the Pipeline.

All of these waterbodies are designated as warmwater fisheries and have water-quality designations of primary and secondary contact recreation and fish and wildlife propagation. Numerous waterbodies along the Pipeline route are also designated for agricultural use. At the point of the Pipeline crossing near MP 37.5, the Calcasieu River has been designated as an outstanding natural resource water. The Calcasieu River at this location is also classified as an LDWF-designated Natural and Scenic River. The Houston River Canal has a designated use of drinking water supply. The Calcasieu River and Houston River Canal would be crossed by HDD, and tributaries to the Houston River Canal would be crossed by conventional bore or open cut. None of waterbodies crossed are designated for oyster propagation at the point of crossing.

Of the 426 waterbodies affected by the Pipeline and associated facilities listed in table 4.3-4, 386 are associated with waterbodies listed on the LDEQ, 2016 303(d) report as not being fully supportive of at least one of their designated uses (LDEQ 2017d). Typical suspected impairments in many of these waterbodies are consistent with agricultural practices (e.g., nitrate, nitrite, phosphate, turbidity), especially near the eastern portion of the project area. The "Water Quality Classification" column in table 4.3-4 in appendix A provides additional details.

The Pipeline would cross 8 waterbodies equal to or greater than 100 feet wide at the point of crossing. DWPL would use the HDD crossing method at three of these major waterbody crossings, the open-cut method at four of the major waterbody crossings, and the remaining waterbody is located within the construction workspace and would not be crossed (section 2.5.3.1).

Generally, the aboveground facilities would not affect waterbodies. However, construction of CS-02 would involve temporary disturbance (construction activity within) of two unnamed ephemeral tributaries to Bayou Barwick, an impaired waterbody. The two waterbodies would be returned to pre-construction contours upon completion of construction. Use of Contractor Yard 3 and two pipe yards would involve temporary disturbance of unnamed impaired waterbodies. Additionally, there would be 84 access road crossings (52 temporary, 32 permanent) of waterbodies, many with identified impairments.

4.3.3.2 Surface Water Impacts and Mitigation

LNG Facility

Constructing and operating the LNG Facility would temporarily and permanently impact surface waters. Specifically, site grading activities, fill activities, and the dredging and construction of the marine facilities, vessel traffic, hydrostatic testing, and spills or leaks of hazardous materials would affect these resources.

<u>Site Modification</u>

As described previously, excavation of the Marine Facilities and MOF would be initially performed on land, "in the dry," (excavating the berths starting on land) and then work towards the water. Once onshore excavation is complete, the remaining piece of land between the site and the Calcasieu River would be breached to allow water to enter the MOF and Marine Facility. This area would then be dredged to final depth and contours (dredging impacts are discussed below).

Twenty-two onsite surface waterbodies would be permanently filled during the construction of the LNG Facility (table 4.3-3 in appendix A). Most are open waterbodies without direct connection to the Calcasieu River or Bayou Choupique, but provide general site drainage to a tributary of Bayou Choupique.

The loss of the surface waterbodies in the LNG Facility site along with the general modification of the site would result in the loss of aquatic habitat, affect surface water flow, and could temporarily increase the rates of turbidity and sedimentation observed in nearby waterbodies.

Soil contamination has not been identified in surface soils or in soils from areas proposed for land-based excavation or dredging (but see section 4.2.6.1 for potential soil and groundwater contamination), so increased stormwater runoff is not expected to result in the introduction of contaminated sediments to local surface waters. Land disturbing activities would be conducted according to the Driftwood Plan and Procedures, and ESCP. During construction, stormwater runoff from the disturbed portions of the site would be routed through a series of construction ditches according to the ESCP. These ditches would discharge into the stormwater discharge locations that would contain appropriate sediment barriers, or similar, equivalent structures, to collect the sediment.

The creation of impervious surface at the site would result in an increased volume of stormwater runoff. The LNG Facility stormwater management system (drainage ditches and retention ponds) has been designed to accommodate this increase. Additionally, this system would be consistent with the Project's ESCP and applicable LDEQ and EPA requirements.

With implementation of these mitigation measures, we have determined that stormwater discharges resulting from construction and operation of the LNG Facility would result in temporary and minor impacts on surface waters.

Dredging and Dredged Material Placement

As discussed in Section 2.5.2.6, construction of the Marine Facility, MOF, and Pioneer Docks would result in increases in turbidity. Increased turbidity can decrease water quality by increasing water temperatures, decreasing dissolved oxygen levels, inhibiting photosynthesis, and impacting benthic organisms. To assess the impact of turbidity resulting from construction of the marine berth, three scenarios were modeled by Driftwood to represent tidal variations, wind variations, and anticipated riverine discharge conditions (FERC eLibrary accession number 20170331-5058). The study assessed four sensitive areas of interest, a wetland area near the ICW just south and west of the LNG Facility, a wetland to the south and east of the LNG Facility adjacent to the Calcasieu Ship Channel, a wetland in the northern part of Lake Calcasieu to the western side, and an area of oyster beds on the eastern side of Lake Calcasieu (Bechtel, 2017).

The study found that there is not a strong seasonality observed in turbidity (measured as TSS concentrations) in the areas analyzed. Most of the deposition on the river bottom as a result of dredging activities would be from the coarse silt fraction of the dredging spill material and would occur within the main Calcasieu Ship channel and its banks. Driftwood's modeling predicted minor increases in turbidity of about 10 to 15 mg/L in suspended sediment concentration during normal conditions and larger increases during dry (lower-flow) conditions, which typically occur in the summer months (between May to October). Similarly, the modeling predicted minor amounts of deposition of less than 0.2 mm in the wetland areas and Lake Calcasieu during the one-month simulation period. The highest level of deposition would be found in the immediate vicinity of the dredger. Farther from the dredger, the amount of deposition drops off quickly. Areas of higher flow would have less deposition.

The study also found that sediment that would remain suspended in the water column would be predominantly composed of the clay fraction of the dredging spill material. Turbidity directly adjacent to the dredger path show maximum values up to 2500 mg/L, while values to the north and south of the site ranged from 150 mg/L to 200 mg/L depending on flow levels (table 4.3-6). For the most part, turbidity decreased as flows increased; however a surge pattern tended to drive more flow and suspended sediment north of the LNG site and into the lake but decreased it in the sensitive areas (wetlands and oyster beds).

Although turbidity impacts were not modeled for dredging activities at the MOF and Pioneer Docks, the proposed volume of dredging at these two facilities is an order of magnitude lower than at the marine berth (the modeled activity) and would generally occur before the dredging at the marine berth began, reducing the potential for cumulative turbidity impacts. The MOF is located north of the marine berth and therefore farther from the sensitive receptors considered during the turbidity modeling; impacts would be expected to be less severe than shown by the model. Impacts on aquatic organisms from dredging and sedimentation are addressed in section 4.8.3.

Table 4.3-5

Turbidity During Dredging

Representative Sample Point ID	Approximate Distance and Direction	Total suspended sediment concentration under dredge spill conditions (mg/L)			
		March 2015		June 2015	
		Mean	Max	Mean	Max
Adjacent to dredger	N/A	100	2,500	--	--
Calcasieu Ship Channel from site to northern confluence with Lake Calcasieu	0 – 2 mi S	9.8 – 20.0	100 – 150 [a]	12.6 - 20	47.6 - 150
Wetland Area 1	1.5 mi SW	0	<3.4	<1.4	<3.4
Wetland Area 2	1.5 mi SE	12.0 – 14.0	30.0 – 40.0	10.0	25.0
Calcasieu Ship Channel from northern to southern Lake Calcasieu confluence	2 – 19 mi S	7.0 – 9.8	17.0 – 60.0	2.6 – 12.6	13.6 – 47.6
Northernmost portion of Lake Calcasieu	2.5 mi SE	18.0	50.0	<7.0	<23.6
Wetland Area 3	4.2 mi S	12.0 – 14.0	30.0 – 40.0	12.0	<20.0
Oyster beds	6.5 mi SE	10.0 – 12.00	30.0 – 40.0	<4.0	<10.0
Southernmost portion of Lake Calcasieu	17.8 mi SE	2.0	<10.0	<4.2	<10.2
Calcasieu Ship Channel from southern Lake Calcasieu confluence to intersection with Gulf of Mexico	19 – 22.5 mi S	2.0 – 7.0	10.0 – 17.0	1.4 – 2.6	~13.6
Channel intersection with Gulf of Mexico	22.5 mi S	2.0	<10.0	<1.4	<13.6

[a] Suspended sediment concentration is dispersed within a short distance.

To minimize impacts on aquatic resources due to increased turbidity, Driftwood would use a hydraulic cutterhead suction dredge for the Marine Berth. Because excavated material would be suctioned into a pipeline, resuspension of sediments and the associated increase in turbidity associated with the LNG Facility would be significantly reduced at the site of dredging. Based on our review of Driftwood's water quality analysis and Driftwood's commitment to use a hydraulic cutterhead suction dredge, we have determined that impacts on water resources from increased turbidity from dredging would be localized, temporary, and minor (i.e., confined primarily to the period of in-water activity and shortly thereafter).

We received a comment on the draft EIS that dredged channels may experience low dissolved oxygen conditions in bottom waters, as compared to undredged waterbodies and that low dissolved oxygen conditions reduce habitat quality for aquatic organisms. We acknowledge that areas of low dissolved oxygen may be found in dredged channels, and that low dissolved oxygen can reduce the quality of aquatic habitat. The waterbodies adjacent to the Driftwood LNG Facility site (the Calcasieu Ship Channel and the Intracoastal Waterway) are dredged channels and would be expected to contain a biota adapted to the conditions within the existing habitat. The LNG Berth would be excavated/dredged from a terrestrial habitat. We conclude that after this area is converted to aquatic habitat, it would be expected to be colonized by recruits from the adjacent Calcasieu Ship Channel, which are adapted to the dredged-channel habitat.

Maintenance dredging of the Marine Facility and MOF would be conducted by Driftwood as needed during operation of the LNG Facility; the frequency of this activity would be assessed during the detailed design phase and would align with the COE maintenance dredging permit. Materials from the maintenance dredging would either be placed in the BUDM area(s) or in one of the Port's local managed DMPAs. Potential impacts on water resources from maintenance dredging are similar to those discussed above, but would be shorter in duration due to the reduced amount of material being removed from the Marine Facility and MOF. Therefore, we conclude that maintenance dredging would have temporary and minor impacts on water resources.

Marine Vessel Impacts

Shoreline Erosion and Resuspension of Sediments

Propeller wash and wave action from ships calling on the LNG Facility and associated support vessels operating in the Calcasieu Ship Channel could affect shoreline erosion rates and cause the resuspension of sediments. Increased erosion would result in additional turbidity and sedimentation which would affect water quality near the LNG Facility. The resuspension of sediments would also increase the amount of turbidity and sedimentation into the marine environment which would affect water quality.

Given the amount of existing ship traffic in the Calcasieu Ship Channel, the addition of vessel traffic from the operation of the LNG Facility should not significantly increase the rate of shoreline disruption along the Calcasieu Ship Channel. Furthermore, to minimize and reduce the potential impacts of these disruptions on its own facilities, Driftwood would incorporate shoreline bulkheads and rock/riprap armoring of the marine berth and MOF to limit shoreline sediment resuspension and shoreline erosion.

Use of the waterways by LNG carriers, barges, and support vessels during construction and operation of the LNG Facility would be consistent with the planned purpose and use of active ship channels, and associated impacts on water quality within the ship channel would be minor.

Ballast Water Discharge

We received comments on the draft EIS expressing concern about ballast water effects on the aquatic environment. Driftwood estimates that LNG carriers using the Marine Facilities would discharge about 7 to 15 million gallons of ballast water per trip into the Calcasieu Ship Channel. Ballast water discharges could affect water quality by changing the salinity, pH, temperature, and dissolved-oxygen level in waters near the vessel. Ballast water is taken up during offloading of vessels at various ports, and salinity and pH would therefore reflect the conditions at the previous port of call. Ballast tanks are located near or below the waterline during transit, and temperature would likely be equilibrated to the surrounding water temperature. Dissolved oxygen generally decreases due to lack of photosynthesis in the lightless ballast tanks and microbial degradation of organic material, and dissolved oxygen would likely be lower than ambient conditions.

Salinity in the Calcasieu River at the marine berths can vary from less than 10 parts per thousand (ppt) to 30 ppt due to daily tidal movements, shifts in wind and water current, and freshwater contribution. The water temperature in the Calcasieu River can vary from 8.4 degrees Celsius (47 degrees Fahrenheit) during winter months to 32.1 degrees Celsius (90 degrees Fahrenheit) during summer months, and changes in response to weather, riverine input, and other factors (LDEQ, 2016). The pH of the Calcasieu River at the marine berths typically ranges from 6.8 to 8.0 (LDEQ, 2016). Dissolved oxygen concentrations in the Calcasieu River are variable and dependent upon many factors including temperature, rainfall, tidal magnitude, depth, current, and phytoplankton activity. LDEQ water quality data indicates that dissolved oxygen levels in the Calcasieu River near the LNG Facility range from 4.2 to 9.6 mg/L (LDEQ, 2016). As such, the estuarine environment is naturally subject to variable salinity, temperature, pH, and dissolved oxygen. Tidal flow and river currents would dissipate the ballast water upon discharge, reducing the duration that the discharged ballast water would remain different from ambient water. Based on the aforementioned factors, we conclude that ballast water discharges would result in minor, temporary, and localized impacts on water quality within the Calcasieu River.

Cooling Water Withdrawal/Discharge

We received comments on the draft EIS regarding the potential of cooling water withdrawal or discharge to affect temperature. During operation, LNG carriers at the Marine Facility would withdraw water from the Calcasieu River for use in cooling the vessel's main engines, condensers, diesel generators, and other auxiliary equipment. Escort tugboats would not need use cooling water, as they would be equipped with keel coolers. As shown in table 4.3-6, the volume of water required for cooling would vary depending on vessel type and operations.

Table 4.3-6

LNG Carrier Cooling Water Flow Rates and Water Use Volumes

Vessel Type	Maneuvering Time (hours)	Time at Berth Loading (hours)	Flow Rate at Maneuvering (gallons/ hour)	Maneuvering Volume (gallons)	Flow Rate at Berth (gallons/ hour)	Volume at Berth (gallons)	Total Volume (gallons)
Steam Turbine Carrier	1.5	18	2,641,721	3,962,582	343,424	6,181,632	10,144,214
DFDE Carrier	1.5	18	792,516	1,188,775	396,255	7,132,590	8,321,365

Source: FERC, 2015b.

Cooling water return temperatures vary widely, depending on the type of LNG carrier and mode of operation, and are generally in the range of 3-4°C (5.4-7.2°F) greater than the ambient temperature of surrounding waters. The withdrawal and discharge of water for vessel cooling would increase water temperatures in the vicinity of the moored vessels. However, due to the limited temperature differences and the relatively small volume of discharge compared to the total volume in the Calcasieu River, we anticipate that the increased water temperature levels would diminish shortly after discharge. Therefore, cooling water discharges would have temporary and minor impacts on water quality. The withdrawal of water from the vessel transit routes can result in the impingement and entrainment of aquatic resources which is discussed in further detail in section 4.4.3.1.

Hydrostatic Testing

Prior to commencement of operation, the LNG Facility would require hydrostatic testing of the plant piping and the LNG storage tanks, as further described in section 2.5.2.16. Water to be used for testing of the LNG storage tanks would be withdrawn from the Calcasieu Ship Channel, held in the tanks and piping over a 24-hour period, and then discharged back to the Calcasieu River over a 13-day period.

Driftwood may use a short-lived biocide, such as sodium or calcium hypochlorite, to control biological growth in the hydrostatic test water during testing. Sodium bisulfate would be added to the water prior to discharge. This would bind to the chlorine from the hypochlorite and make it biologically unavailable. In accordance with the LPDES Permit for Discharge of Hydrostatic Test Water requirements, the water would be tested for TSS, oil and grease, and pH, and treated (if test results indicate that the water would not meet LPDES requirements) prior to being discharged to the Calcasieu Ship Channel.

Therefore, we conclude that water quality impacts on surface waters associated with withdrawal and discharge of hydrostatic test water would be minor and temporary.

Inadvertent Spills or Leaks

An inadvertent release of equipment fluids or other hazardous materials could adversely affect surface water quality near the LNG Facility site. To prevent and manage spills and leaks, Driftwood would implement measures in its SPCC Plan during construction as described in section 4.2.6.1 of this final EIS and would develop and implement an SPCC Plan during operation, as described in section 2.5 of this final EIS. Therefore, we conclude that impacts on surface waters due to potential spills or leaks during construction and operation of the LNG Facility would be temporary and minor.

Conclusion

Surface water impacts resulting from the construction and operation of the LNG Facility could result from site grading activities, fill activities, dredging and construction activities associated with the marine facilities, vessel traffic, hydrostatic testing, and spills or leaks of hazardous materials. With implementation of the mitigation measures identified for each activities, we have determined that construction and operation of the LNG Facility would result in temporary and minor impacts on surface waters.

Pipeline

Pipeline Construction

Waterbody crossings are summarized in table 4.3-4 in appendix A. Provided there is no perceptible flow at the time of crossing and the EI verifies that water would be unlikely to flow between the initial disturbance and final stabilization of the feature, waterbodies would be crossed using standard upland construction techniques.

If flow is present in the waterbody, waterbody crossings would be completed using either the open-cut method or trenchless methods (i.e., conventional bore or HDD) as described in the table. In general, use of open-cut methods would result in the loss of aquatic vegetation and habitat, disturbance of stream bed contours, and increased turbidity and sedimentation. Mobilization of sediments, including those impairments that cause waterbodies to be listed as not fully supportive of designated uses, would increase turbidity and temporarily decrease water quality and increased sedimentation could affect downstream aquatic habitat. In-stream construction could also cause the dislodging and transport of channel bed sediments and the alteration of stream contours, which can alter stream dynamics and result in increased deposition and/or erosion in the downstream reach of the stream. Increased light penetration caused by bank clearing and increased turbidity can potentially result in diminishment of photosynthetic oxygen production and decreased dissolved oxygen concentration. These impacts would generally be minor increases over the existing condition, and would be limited to the period of construction and restoration.

To minimize these impacts, Driftwood would implement numerous measures as described in the Driftwood Procedures. These measures include installing silt fencing, compacted earth berms, and other erosion control devices. Construction activities would be scheduled as reasonably practicable so that the ditch is excavated immediately prior to pipe-laying activities. All in-stream construction activities involved with waterbody crossings (with the exception of HDD activities) would be completed within 24 to 48 hours according to the Driftwood Procedures. Following construction, all waterbodies would be restored to their pre-construction conditions to the extent practicable.

The Houston River Canal would be crossed in two places using conventional boring methodology. These crossings would be constructed independently by separate construction crews and later tied in to the rest of the Pipeline. The conventional bore method would involve the excavation of pits on either side of the crossing and the placement of a bore machine within one of the pits. This device would bore under the waterbody and install the pipeline segment. Once the bore has reached the other pit, the pipeline segment would be tied in with the pipeline installed on the other side.

Fifteen waterbodies would be crossed via HDD including the Houston River, Calcasieu River, and Bayou des Cannes. HDD activities at the Calcasieu River crossing would conform to the LDWF BMPs for Oil and Gas/Pipeline crossings across a State Scenic River (LDWF, 2017a), as requested by the LDWF in their comments submitted during the scoping period. These BMPs require that the HDD entry and exit points would have setbacks as far as practicable from the stream banks and that DWPL would clear no more than 10-foot-wide access road for placement of a pump and hose for withdrawing water no closer than 100 feet from the ordinary water mark of the river.

Inadvertent returns or the surface expression of drilling fluids during HDDs can cause impacts on surface waters. During the drilling process, as the drill passes through geologic formations, a portion or all of drilling fluid can be released and lost into the formation. This fluid typically is absorbed by the formation. In some cases, the drilling fluid may be forced to the surface, resulting in an inadvertent return. The release of drilling fluid in the drill hole is typically due to the pressure of the drill hole being greater than the containment capability of the overburden material; however, in low-pressure situations, fractures in the overburden material, low density soils, soft sands, or unconsolidated geology can also cause the release of fluids. Where fractures in the overlying material are present or are created during the installation process, HDDs can result in the introduction of drilling fluids into the sub-surface environment (loss of returns) and the surface expression of these fluids. An inadvertent return within a waterbody would temporarily increase turbidity and sedimentation and decrease water quality.

HDD operations require water which would be withdrawn from the crossed waterbodies. Withdrawing water from these waterbodies can result in the impingement and entrainment of aquatic resources which is discussed in further detail in section 4.4.3.1. Driftwood would minimize the potential for entrainment by screening the intake hoses, as committed to in the Driftwood Procedures.

To minimize the potential for a loss or surface expression of drilling fluids or if an inadvertent release of drilling mud during an HDD installation beneath a wetland or waterbody occurred, Driftwood would implement the measures outlined in its HDD Plan. These measures include geotechnical investigations to support finalization of site-specific plans, adequate depth of cover above the HDD, visual monitoring of the surface above the HDD crossing, tracking the amount of drilling fluid pumped downhole and total volume recovered from return pits, and keeping equipment to contain, control and clean up any drill fluid on site during installation. At the time of this document, Driftwood has completed and filed geologic investigation reports on 5 of the 15 waterbodies they propose to install using HDD.

Use of the Driftwood Procedures and HDD Plan, and performance of the work according to applicable permits would ensure that impacts described above would be minor and temporary.

Hydrostatic Testing

After the Pipeline is installed, it would be hydrostatically tested to ensure its ability to maintain the operating design pressure. Hydrostatic test water would be obtained from local waterbodies crossed by the Pipeline or purchased from a municipal source. A discussion of the hydrostatic testing water sources, volumes, and process is in section 2.5.3. A listing of the water sources and the quantity of water required is provided in table 2.5.1. Discharged hydrostatic test water would be controlled to prevent erosion at the discharge location through a dewatering structure to a well-vegetated area to reduce scour and minimize erosion. The discharge would comply with Driftwood Plan and the LDEQ General Permit for discharge of the hydrostatic test water.

The use of the hydrostatic testing program according to the requirements of the LDEQ LPDES General Permit for discharges of hydrostatic test water, the implementation of the Driftwood Plan, and the temporary nature of the activity would ensure that there are no water quality impacts associated with withdrawal and discharge of hydrostatic test water, other than a potential temporary, localized change in temperature based on the temperature of the discharge water in relation to the temperature of the ambient water.

Inadvertent Spills and Leaks

Inadvertent spills or leaks of hazardous materials from pipeline construction equipment could affect surface waters. An inadvertent spill or leak, including an inadvertent equipment fluid release could create a potential for contamination and degrade downstream water quality. To minimize the potential for a release spill or leak and any resulting impacts, Driftwood would implement the spill prevention, containment, and cleanup measures outlined in the Driftwood SPCC Plan as further described in section 4.2.6.1.

Conclusion

Temporary and minor surface water impacts could result from the construction and operation of the Pipeline could result from waterbody crossings including open-cut, HDD, and bore crossing methods; hydrostatic testing; and spills or leaks of hazardous materials. With implementation of the mitigation measures identified above, we have determined that the Project would not significantly impact surface waters.

4.4 FISHERIES AND AQUATIC RESOURCES

4.4.1 Fishery Classification

Classification of fisheries habitat includes both chemical and biological characteristics, such as water temperature, salinity, turbidity, dissolved oxygen, and whether the waterbody is part of a freshwater, marine, or estuarine system. Biological characteristics such as water depth, topography, vegetation, structure, and soil materials also influence the fisheries classification within a waterbody. Specific habitat types and conditions influence how fish species use a water source for feeding, spawning, migrating, and as a nursery area. Freshwater systems contain fisheries that are typically classified as coldwater, coolwater, or warmwater based on temperature regimes and the species inhabiting the system. All waterbodies in the Project area are classified as containing warmwater fisheries. Warmwater fisheries support fish that are able to tolerate water temperatures above 80 degrees Fahrenheit but can also tolerate cooler temperatures. Warmwater fish species include crappie (*Pomoxis* sp.), largemouth bass (*Micropterus salmoides*), sunfish (*Lepomis* sp.), and catfish (*Pylodictis* sp.).

Estuarine systems are defined as zones where freshwater waterbodies and ocean waters mix to yield ecosystems with salinity ranges between oceanic and freshwater. Species specific to freshwater systems are not capable of living in waters where saline conditions would restrict their ability to take in oxygen, while marine species are not able to live in freshwater. Other species may need access to both marine and freshwater; catadromous species live in freshwater but migrate to marine environments to reproduce, while anadromous species such as salmon live in saltwater but reproduce in freshwater. As such, estuaries support a large number of both freshwater and marine species which have adapted to live a portion or all their lives in these conditions.

4.4.2 Existing Resources

4.4.2.1 LNG Facility

The waterbodies within the LNG Facility site, including a 45-acre manmade lake within the LNG Facility that would be filled during site preparation, receive freshwater inputs from rain events and also are subject to saltwater intrusions from major storm or tidal events that push water up through the marsh from the south and west into the LNG Facility site. Based on the year-round warmwater, estuarine conditions associated with these surface waterbodies, a mixture of freshwater and estuarine dependent species may be present within the LNG Facility site.

The Calcasieu Saltwater Barrier (see section 4.4.3.1) generally limits the distribution of freshwater species south of the barrier. As a result, the fishery resources in the Calcasieu Ship Channel are classified as estuarine. The portion of the Calcasieu River below the saltwater barrier is heavily influenced by tidal waters from the Gulf of Mexico and is considered a warmwater estuarine fishery. It is anticipated that as the system fluctuates so too would the fisheries composition (Conner and Day, 1987).

The Calcasieu Ship Channel has been designated by the LDEQ (2017d) as supporting fish and wildlife propagation and oyster propagation designated uses. Substrates within the Channel are composed mainly of estuarine subtidal unconsolidated bottom sediment. Unconsolidated sediments within the Channel provide foraging habitat for benthic (bottom-dwelling) organisms and fish and are designated as EFH for red drum (*Sciaenops ocellatus*), shrimp (*Farfantepenaeus* sp.), reef fish, and coastal migratory pelagic species (see discussion in section 4.4.4). Substrates within the Channel are considered early successional due to frequent disturbance from maintenance dredging, propeller wash, and vessel traffic.

Table 4.4-1 lists representative fish and invertebrate species found near the LNG Facility and indicates which of these species are economically important for commercial or recreational fisheries. Life histories of many Gulf of Mexico fish species can be characterized as estuarine-dependent because these species typically spawn in the Gulf, allowing their larvae to be carried inshore by currents. Juvenile fish generally remain in estuarine nurseries for about a year, taking advantage of the estuary's greater availability of food and protection, before returning to the Gulf of Mexico to either spawn or spend the remainder of their lives. Estuary-dependent species potentially occurring within the LNG Facility area include Gulf menhaden (*Brevoortia patronus*), red drum, gray snapper (*Lutjanus griseus*), Spanish mackerel (*Scomberomorus maculatus*), blue crab (*Callinectes sapidus)*, brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*Farfantepenaeus duorarum*), and white shrimp (*Litopenaeus setiferus*). Driftwood's ichthyoplankton survey, discussed in more detail in section 4.4.3.1, identified eggs and larvae of many species, including bay anchovy (*Anchoa mitchilli*), Atlantic croaker (*Micropogonias undulatus*), darter goby (*Ctenogobius boleosoma*), Gulf menhaden, opossum shrimp (*Americamysis sp*.), white shrimp, northern brown shrimp, and non-ichthyoplanktonic invertebrates including crabs, copepods, amphipods, and jellyfish in the Calcasieu River in October 2017.

Table 4.4-1

Representative Fish and Invertebrate Species Potentially Occurring Near the LNG Facility

Common Name	Scientific Name
Freshwater	
Alligator gar	*Atractosteus spatula*
Black crappie	*Pomoxis nigromaculatus*
Blue catfish	*Ictalurus furcatus*
Bluegill	*Lepomis macrochirus*
Bowfin	*Amia calva*
Channel catfish	*Ictalurus punctatus*
Common carp	*Cyprinus carpio*
Flathead catfish	*Pylodictis olivaris*
Freshwater drum	*Aplodinotus grunniens*
Gizzard shad	*Dorosoma cepedianum*
Golden shiner	*Notemigonus crysoleucas*
Green sunfish	*Lepomis cyanellus*
Largemouth bass	*Micropterus salmoides*
Paddlefish	*Polyodon spathula*
Redear sunfish	*Lepomis microlophus*
Smallmouth buffalo	*Ictiobus bubalus*
Spotted gar	*Lepisosteus oculatus*
Striped bass	*Morone saxatilis*
Warmouth	*Lepomis gulosus*
White crappie	*Pomoxis annularis*
Yellow bass	*Morone mississippiensis*
Yellow bullhead	*Ameiurus natalis*
Catadromous	
American eel	*Anguilla rostrata*

Table 4.4-1

Representative Fish and Invertebrate Species Potentially Occurring Near the LNG Facility

Common Name	Scientific Name
Estuarine	
Atlantic croaker [a]	*Micropogonias undulates*
Black drum	*Pogonias cromis*
Blue crab [a]	*Callinectes sapidus*
Brown shrimp [a]	*Farfantepenaeus aztecus*
Common rangia	*Rangia cuneata*
Eastern oyster	*Crassostrea virginica*
Gafftopsail catfish	*Bagre marinus*
Gray snapper [a]	*Lutjanus griseus*
Gulf killifish	*Fundulus grandis*
Gulf menhaden [a]	*Brevoortia patronus*
Hardhead catfish	*Arius felis*
Hogchoker	*Trinectes maculatus*
Killifish	*Fundulus spp.*
Ladyfish	*Elops saurus*
Mosquitofish	*Gambusia affinis*
Pinfish	*Lagodon rhomboides*
Pink shrimp [a]	*Farfantepenaeus duorarum*
Puffer	*Sphoeroides parvus*
Red drum [a]	*Sciaenops ocellatus*
Sheepshead minnow	*Cyprindon variegatus*
Silver perch	*Bairdiella chrysura*
Silverside	*Menidia bervllina*
Southern flounder [a]	*Paralichthys lethostigma*
Spanish mackerel [a]	*Scomberomorus maculatus*
Spot	*Leiostomus xanthurus*
Spotted seatrout [a]	*Cynoscion nebulosus*
Striped mullet [a]	*Mugil cephalus*
White shrimp [a]	*Litopenaeus setiferus*

[a] This species is considered economically important, meaning commercial or recreationally sought after.

Recreational and Commercial Fisheries

The Calcasieu River is managed under statewide regulations for both recreational and commercial fishing (LDWF, 2014b,c). The LDWF manages and assesses the Calcasieu River by dividing it into the upper (139-mile) section, middle (35-mile) section, and lower (26-mile) section. The LNG Facility site exists near the transition of the middle section to the lower section of the river. Based upon data from the LDWF's (2014b,c) Waterbody Management Plan of the Calcasieu River, several species listed in table 4.3-1 are common commercial and recreational fisheries. The middle section of the Calcasieu River is dominated by freshwater species, while the lower Calcasieu River is dominated by estuarine species.

The lower section of the Calcasieu River supports both commercial and recreational fishing. Spotted sea trout, southern flounder, and red drum are targeted species for recreational fishermen. Commercial fishing on the lower section of the river occurs mostly in Calcasieu Lake and in certain portions of the Calcasieu River near where it opens to the Gulf of Mexico. Brown shrimp, white shrimp, blue crab, and eastern oyster are the species commonly sought after commercially. Red drum, white shrimp, and brown shrimp fisheries are managed by NMFS, which has developed management plans for the species and designated EFH. EFH in the Calcasieu River and Project area is discussed in more detail in section 4.4.4.

Spawning may be influenced by environmental variables including water temperature, river stage, and photoperiod, and is highly dependent on the species in terms of their environmental preferences, reproductive strategy, and the environmental conditions during spawning. Based on species-specific life history (Douglas, 1974; Ross, 2001) and spawning data obtained from the LDWF (2014b,c) and Sea Grant Louisiana (2017), peak spawning near the LNG Facility would occur in spring/summer for the freshwater commercial and recreational species and would occur over a longer annual period for marine species. Following the presence of adults during spawning season, a temporal lag of roughly a month would occur in which there would be a peak in the abundance of larval stages. Typical spawning periods of dominant commercial and recreational fisheries are presented in table 4.4-2.

Table 4.4-2

Typical Spawning Periods of Dominant Commercial and Recreational Fisheries

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater												
Alligator gar				X	X	X						
Black crappie				X	X	X						
Blue catfish				X	X	X	X					
Channel catfish				X	X	X	X					
Flathead catfish						X	X					
Largemouth bass				X	X	X						
Spotted bass				X	X	X						
White crappie				X	X	X						
Estuarine												
Blue crab				X	X	X	X	X	X			
Brown shrimp				X	X	X				X	X	
Oysters			X	X	X	X	X	X	X	X	X	
Southern flounder	X											
Spotted sea trout					X	X	X	X	X			
Red drum								X	X	X		
White shrimp			X	X	X	X	X	X	X	X	X	

Sources: Douglas, 1974; Ross, 2001; LDWF, 2014b,c; Sea Grant Louisiana, 2017.

4.4.2.2 Pipeline

Table 4.4-4 in appendix A lists the waterbodies that would be crossed or affected by the Pipeline, as well as the crossing method and LDEQ designated uses for each feature. All of the waterbodies affected by the Pipeline are freshwater and classified as warmwater fisheries. Of the 317 waterbodies affected, 216 are classified as ephemeral or intermittent, which typically provide limited habitat value for aquatic resources due to restricted water flow regimes. Table 4.4-3 lists representative fish and invertebrate species found in waterbodies crossed by the Pipeline. Based on review of species' habitats and life histories, and NMFS EFH Mapper (NMFS, 2017), no EFH would be crossed by the Pipeline.

Table 4.4-3

Representative Fish and Invertebrate Species Potentially Present in Waters Crossed by the Pipeline

Common Name	Scientific Name	Common Name	Scientific Name
Freshwater			
Alligator gar	*Atractosteus spatula*	Largemouth bass	*Micropterus salmoides*
Bigmouth buffalo	*Ictiobus niger*	Mosquitofish	*Gambusia affinis*
Black bullhead	*Ameiurus melas*	Paddlefish	*Polyodon spathula*
Black crappie	*Pomoxis nigromaculatus*	Pugnose minnow	*Osopoedodus emiliae*
Blackstripe topminnow	*Fundulus notatus*	Red ear sunfish	*Lepomis microlophus*
Blue catfish	*Ictalurus furcatus*	Silvery minnow	*Hybognathus nuchalis*
Bluegill	*Lepomis macrochirus*	Smallmouth buffalo	*Ictiobus bubalus*
Bowfin	*Amia calva*	Spotted gar	*Lepisosteus oculatus*
Brown bullhead	*Ameiurus nebulosus*	Striped bass	*Morone saxatilis*
Bullhead minnow	*Pimephales vigilax*	Threadfin shad	*Dorosoma pentense*
Chain pickerel	*Esox niger*	Warmouth	*Lepomis gulosus*
Channel catfish	*Ictalurus punctatus*	White crappie	*Pomoxis annularis*
Creek chubsucker	*Erimyzon oblongus*	Yellow bass	*Morone mississippiensis*
Common carp	*Cyprinus carpio*	Yellow bullhead	*Ameiurus natalis*
Flathead catfish	*Pylodictis olivaris*	Red swamp crayfish	*Procambarus clarkii*
Flier	*Centrarchus macropterus*	Southern White River crayfish	*Procambarus zonangulus*
Freshwater drum	*Aplodinotus grunniens*	Grass shrimp	*Palaemonetes pugio*
Gizzard shad	*Dorosoma cepedianum*	Paper pondshell	*Utterbackia imbecillis*
Golden shiner	*Notemigonus crysoleucas*	Round pearlshell	*Glebula rotundata*
Golden topminnow	*Fundulus chrysotus*	Sandbank pocketbook	*Lampsilis satura*
Green sunfish	*Lepomis cyanellus*	Threeridge	*Amblema plicata*
Catadromous			
American eel	*Anguilla rostrata*		

Recreational and Commercial Fisheries

Rivers, small creeks, and streams within the watersheds crossed by the Pipeline are used for both commercial and recreational fisheries (Lester et al., 2005). The primary waterbodies crossed by the Pipeline supporting commercial fisheries are the West Fork of the Calcasieu River, the Calcasieu River, and parts of the Houston River. Two fish species that are commonly harvested by commercial fishermen include alligator gar (*Atractosteus spatula*) and blue catfish (*Ictalurus furcatus*).

Recreational fishing occurs throughout Louisiana. Most of the recreational fishing in waterbodies crossed by the Pipeline is associated with sustenance fishing where a wide variety of fish species (sunfish and catfish) are targeted to provide food. A smaller component of the recreational fishing is associated with sport fishing where fishermen are targeting species such as the largemouth bass, spotted bass (*Micropterus punctulatus*), and crappie. Most of the sport fishing along the Pipeline occurs on the middle section of the Calcasieu River.

4.4.3 Impacts and Mitigation

4.4.3.1 LNG Facility

Potential impacts on aquatic resources during construction and operation of the LNG Facility include those associated with site modification, dredging, pile driving, hydrostatic testing, vessel traffic, stormwater runoff, lighting, LNG carrier ballast-water discharge and cooling water uptake, LNG storage tank deluge system, and inadvertent spills.

Site Modification

Construction and operation of the LNG Facility, construction laydown, other facilities, and access roads would result in the permanent conversion of estuarine emergent intertidal (E2) wetland habitat to industrial land use. Construction and operation of the marine berth and MOF would result in the permanent conversion of PEM and PSS wetland habitat to open water habitat (section 4.5.2). Twenty-two onsite surface waterbodies would be permanently filled during the construction of the LNG Facility (table 4.3-3 in appendix A). Most are open waterbodies without direct connection to the Calcasieu River or Bayou Choupique, but provide general site drainage to a tributary of Bayou Choupique.

During LNG Facility design, Driftwood avoided and minimized impacts on these habitats to the greatest extent feasible. However, movement of individual aquatic organisms in response to disturbance and permanent reduction in E2 wetland habitat may increase population densities in adjacent wetlands, resulting in increased inter- and intra-specific competition and reduced reproductive success of individuals. Plans for the BUDM sites, which Driftwood is developing in cooperation with the COE, National Oceanic and Atmospheric Administration (NOAA), LDNR OCM, and other agencies, would serve to mitigate impacts on aquatic resources that are dependent on wetland habitats (see section 4.5.3 for additional information). The loss of the surface waterbodies in the LNG Facility site along with the general modification of the site would result in the loss of habitat for the mixture of freshwater and estuarine dependent species present within the LNG Facility site. Based on the availability of large areas of similar habitat in the region, we have determined that impacts on aquatic resources due to site modification would result in a minor impact on aquatic resources.

Dredging

Construction of the Marine Facility, MOF, Pioneer Docks, and Turning Basin would require dredging within and adjacent to the Calcasieu River and the ICW. Potential impacts on aquatic resources resulting from dredging activities include direct take, habitat modification, and temporary increases in noise, turbidity, and suspended solid levels, which are described below.

Most fish species are highly mobile and would be expected to leave the area during dredging activities. Dredging would, however, result in direct mortality of benthic organisms (e.g., aquatic macroinvertebrates, mollusks, and crustaceans), which are important food sources for many species of fish, within the portion of the dredge footprint that currently provides open water habitat. Slower, less mobile benthic invertebrates would also be directly affected, while larger, more mobile species (e.g., blue crab) would experience temporary displacement. Following construction activities, more mobile species would be expected to return to the area; however, the abundance and diversity of less mobile species may experience a temporary decrease in comparison to the existing habitat within the Calcasieu River. These decreases would be similar to the effects of the COE's routine maintenance dredging conducted every two years in this reach of the Calcasieu Ship Channel. Dredging activities would also temporarily increase noise, turbidity, and suspended solid levels within the water column, which could reduce light penetration and the corresponding primary production (creation of organic compounds from carbon dioxide) of aquatic plants, algae, and phytoplankton. Increased turbidity and suspended solid levels could also adversely affect fish eggs and juvenile fish survival, benthic community diversity and health, foraging success, and the suitability of spawning habitat. Sediments in the water column could be deposited on nearby substrates, which could bury aquatic macroinvertebrates. Impacts on aquatic resources due to increased turbidity and suspended solid levels would vary by species; however, the aquatic resources present near the LNG Facility are likely accustomed to regular fluctuations in noise and turbidity levels from shipping, industrial activity, and the COE's routine maintenance.

To minimize impacts on aquatic resources due to increased turbidity and suspended solid levels, Driftwood would use a hydraulic cutterhead suction dredge for the Marine Facilities, as described in section 2.5.2.4. Based on our review of Driftwood's water quality analysis, Driftwood's commitment to use a hydraulic cutterhead suction dredge, and Driftwood's commitment to monitoring and implementation of mitigation measures if needed, we have determined that impacts on aquatic resources due to temporary increases in noise, turbidity, and suspended solid levels from dredging would be localized, temporary, and not significant.

We received a comment on the draft EIS indicating that aquatic organisms have distinct migratory pulses during the year. We considered this comment and conclude that it does not change our impact determination.

Maintenance dredging could occur at any time during the year. Potential impacts on aquatic resources from maintenance dredging are similar to those discussed above. However, impacts would be shorter in duration due to the reduced amount of material being removed from the Marine Facility and MOF. Therefore, we conclude that maintenance dredging would have temporary and minor impacts on aquatic resources.

Pile Driving

Construction of the LNG Facility would require the installation of about 48,420 piles to support LNG Facility structures. As discussed in section 2.3.1, pile driving activities would typically take place 12 hours per day, up to 7 days per week. Precast concrete piles would be installed onshore to support the liquefaction plants, LNG storage tanks, and other process equipment and structures. Onshore piles would be driven by up to 12 hydraulic piling rigs over a 3-year period. Vibratory hammer and hydraulic pile driving would be required to install about 420 steel pipe and sheet piles for jetty platforms and breasting and mooring dolphins over a 9-month period.

Driftwood has stated that pile driving associated with the marine facilities would be performed on land whenever possible. However, in-water pile driving may be needed in some cases. The primary impacts on aquatic resources from pile driving activities would be avoidance of the area, stress, or injury due to the increased underwater sound pressure levels. 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 and Hastings, 2009). 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 in excess of 150 dB re: 1 μPa can cause temporary behavior changes (startle and stress) that could decrease a fish's ability to avoid predators. The current interim thresholds 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, 2015; Stadlar and Woodbury, 2009; ICF Jones and Stokes, 2012).

The intensity of the sound pressure levels produced during pile driving depends on a variety of factors such as the type and size of the pile, the substrate into which the pile is being driven, the depth of water, and the type of pile-driving equipment being used (see detailed discussion of underwater noise sources and intensity calculations in section 4.12.2.2).

The highest-intensity noise of the in-water impact driving of the steel piles would attenuate to <208 dB re 1 μPa about 100 feet from the source. Fish more than 100 feet from the noise source would not be expected to experience irrecoverable injury.

Fish behavior is affected at much lower sound intensity than that causing fish injuries. As mitigation for the potential injury to fish near the pile-driving source, Driftwood would begin in-water pile driving with "soft-start" procedures, that is, by a series of lower-power blows, which generate lower-intensity noise, slowly increasing to full power over several minutes to allow mobile species to vacate the area before potentially damaging sound intensity is generated. Based on the incorporation of these mitigation measures, we have determined that underwater noise emissions during construction would not significantly impact fish, sea turtles, or marine mammals.

We received a comment indicating that the draft EIS for the Venture Global Calcasieu Pass Project (eLibrary accession number: 20180622-3001) concluded that the underwater noise of in-water pile driving could affect fish species up to 29 miles away. This comment also expressed concern that the underwater noise analysis in the draft EIS did not indicate similar impacts. We determined that the analysis conducted for the referenced project is not appropriate for the Driftwood LNG Project because the proposed piles to be driven are half the diameter, which reduces the distance over which impact may occur by over 80 percent, and Driftwood's location on an inland waterway further reduces the distance that sound waves could travel through the water. At open-water areas, such as the referenced project, the noise impacts travel with minimal reflection off obstructions, such as channel sideslopes. Within a constrained waterway, such as the proposed slip and the existing navigational channel, the distance over which noise impacts occur would be much reduced due to reflection from river/channel bottoms and sides and upstream from water currents.

Although land-based pile-driving activities would not be anticipated to result in underwater noise levels in exceedance of the thresholds described above, the potential exists for in-water pile-driving activities to exceed these levels, resulting in behavioral changes and injury to aquatic resources. Therefore, **we recommend that:**

<u>Prior to the start of in-water pile driving activities</u>, DWLNG should file with the Secretary, for review and written approval by the Director of OEP, an In-Water Pile Driving Plan, developed in consultation with the NMFS. This plan should identify mitigation measures that when implemented would reduce in-water peak noise levels associated with vibratory and hammer pile driving below 206 dB (re: 1 µPa).

With the development of an In-water Pile Driving Plan, noise levels associated with pile driving activities would be minimized to a level that would not cause significant impacts on aquatic resources.

Hydrostatic Testing

Prior to being placed into service, the LNG storage tanks would be hydrostatically tested with surface water to ensure their integrity. Water to be used for testing of the LNG storage tanks would be withdrawn from the Calcasieu Ship Channel, as described in section 2.5.2.16. The withdrawal would occur once for each tank (total of three times).

The water withdrawal process could entrain fish eggs and juvenile fish present near the intake structures within the Calcasieu Ship Channel. In accordance with the Driftwood Procedures, DWLNG would screen intake hoses to limit the entrainment of larvae and pre-juvenile fish and invertebrates during water withdrawal and place screened intake structures at the lowest possible elevation to reduce the impingement of biological organisms and debris on intake screens. With the implementation of these measures, impacts on aquatic resources due to water intake would be temporary and negligible.

Vessel Traffic

During construction and operation of the LNG Facility, barges, support vessels, and LNG carriers would call on the LNG Facility, increasing ship traffic within the Calcasieu Ship Channel, ICW, and Gulf of Mexico. Potential impacts on aquatic marine mammals resulting from vessel strikes are discussed in section 4.8. Potential impacts on other aquatic resources from increased vessel traffic include shoreline erosion and resuspension of sediments, ballast water discharges, cooling water intake and discharge, and increased noise levels are discussed below.

<u>Shoreline Erosion and Resuspension of Sediments</u>

Vessel traffic (discussed in section 2.6.2 of this final EIS) within and adjacent to the Marine Facility, MOF, and Pioneer Docks would have the potential to increase shoreline erosion and suspended solid concentrations due to increased wave activity.

The Calcasieu Ship Channel and ICW were specifically created to provide deepwater access for maritime commerce and are maintained by regular dredging as discussed above (COE, 2015). Similarly, LNG carriers transiting the Gulf of Mexico would use established shipping routes. As such, use of the waterways by LNG carriers, barges, and support vessels during construction and operation of the LNG Facility would be consistent with the planned purpose and use of these active shipping routes. As discussed in section 4.3.3.2, the increase in shoreline erosion attributable to this Project would be minimal, which would result in negligible impacts on aquatic wildlife resources.

Ballast Water Discharge

The effects of ballast water discharges on four ambient water quality parameters (salinity, temperature, pH, and dissolved oxygen) are described in section 4.3.3.2. Ballast water temperature would not deviate substantially from ambient water temperature, and the pH of ballast water would be similar to ambient water within the Calcasieu River; they would not be outside the tolerance range of resident species. Therefore, we have determined that changes in temperature and pH from ballast water discharges would be temporary and not likely to adversely affect aquatic resources.

We received comments on the draft EIS regarding the potential for ballast water to affect aquatic organisms due to the estimated frequency and volume of discharges. Estuarine salinities can naturally range from freshwater (<0.5 ppt), near the source of freshwater input, to full seawater (30 to 40 ppt) (Patillo et al., 1995). Salinity levels within the Calcasieu River naturally vary within this range dependent upon tidal regime and rainfall. During and immediately following ballast water discharges, benthic aquatic species may be affected by higher salinity levels because the higher salinity ballast water would sink to the lower portion of the Calcasieu River due to its higher specific gravity relative to the ambient water. However, ships moving into and out of the Calcasieu Ship Channel and berthing area would displace water, circulating it into, around, and out of the berthing area, and tidal flow and river current would provide additional mixing of the water. Therefore, any increased salinity levels resulting from ballast water discharges would be temporary. Resident species within the Calcasieu Ship Channel are euryhaline (able to live in waters with a wide range of salinity). As the maximum range anticipated for salinity of ballast water would be from freshwater to seawater, it would be well within their tolerance range. Therefore, we have determined that changes in salinity from ballast water discharges would be temporary and not likely to adversely affect aquatic resources.

Dissolved oxygen levels below 4 mg/L are generally considered unhealthy for aquatic life, and levels below 2 mg/L are considered hypoxic and inadequate to support most aquatic life. Ballast water typically has low dissolved oxygen levels and could decrease dissolved oxygen levels near the discharge point. Depending on the oxygen levels present in both the ballast and ambient water at the time of discharge, aquatic resources present near the discharge point could be exposed to dissolved oxygen levels considered unhealthy for aquatic life. The adaptability of resident species within the Calcasieu River to natural spatiotemporal variation in oxygen levels and the ability to move over a short distance to more suitable conditions, would minimize adverse impacts associated with the short-term exposures anticipated from ballast water discharges. Given that the amount of ballast water discharged into the Calcasieu River during each LNG carrier visit to the LNG Facility would make up less than about 0.5 percent of the volume of water within the Calcasieu River, we have determined that impacts on aquatic resources would be temporary and minor.

Living marine organisms may be entrained in ballast water. The larger macroorganisms that may be collected would likely die during transit; however, some of the smaller planktonic organisms could survive. Loaded with water from the surrounding ports and coastal waters throughout the world, vessels can carry a diverse assemblage of marine organisms in ballast water that may be foreign and exotic to the ship's port of destination. An environmental concern associated with ballast water discharge includes the risk of introducing exotic species into marine and estuarine ecosystems. Aquatic nuisance species threaten to outcompete and exclude native species and the overall health of an ecosystem, potentially affecting trophic structure, causing algal blooms, and creating hypoxic conditions.

As discussed in section 2.6.2.2, Driftwood would comply with U.S. regulations regarding management of ballast water, and LNG carriers discharging ballast water at the Marine Facilities would treat ballast water using a USCG-approved BWMS such that the discharge meets the applicable BWDS. USCG regulations define a BWMS as “any system that processes ballast water to kill, render harmless, or remove organisms.” The BWDS are numerical limits on the number or concentration of organisms that may be discharged with ballast water. There are currently six USCG-approved BWMS (USCG, 2018). Each of the approved systems involve a filtration step to physically remove organisms and a biological disinfection step to kill or render harmless organisms that pass through the filters. Disinfection processes used in the USCG-approved BWMS include treatments using ultraviolet light, electrolysis, electrodialysis, and chemical injection (chlorine dioxide). Included in the USCG approval criteria is a requirement that the “ballast water discharge, preparation, active substance, or relevant chemicals are not found to be persistent, bioaccumulative, or toxic when discharged.” The approval process includes performance of whole-effluent toxicity testing on a representative discharge from the BWMS. Driftwood has stated that it would ensure that any visiting vessels possess documentation to demonstrate their compliance with ballast water regulations and BMPs prior to allowing any ballast water to be discharged into the berthing area. With the implementation of the mandatory practices required by the USCG, we conclude that the impacts on aquatic resources from ballast water discharges would be temporary and minor.

Cooling Water Intake and Discharge

LNG carriers use water to cool boilers and/or main and auxiliary equipment. The cooling water would be withdrawn and discharged along the vessel transit routes in the Gulf of Mexico, from the Calcasieu Ship Channel, and within the Marine Berth. Typical cooling-water rates and volumes for LNG carriers are noted in table 4.3-6. Intake of water can also result in the impingement and entrainment of aquatic resources. Early life stages (ichthyoplankton) and other small organisms that use the Calcasieu Ship Channel for nursery habitat would be most susceptible to impingement and entrainment impacts.

We received comments on the draft EIS regarding the potential of cooling water withdrawal or discharge to affect ichthyoplankton. Driftwood anticipates that the majority of LNG carriers calling on the LNG Facility during operation would have intake screens with a mesh size of 5 millimeters, which should prevent entrainment of larger larvae and fish (Hartman, 2017a); however, some older LNG carriers could have intake screens with a mesh size of 10 millimeters. Mitigation measures that would require changes to the design or protective equipment on LNG carriers are beyond the scope of this Project (FERC, 2015a). Overall, impacts on ichthyoplankton associated with the cooling-water intake of about 365 LNG carriers visiting the LNG Facility per year within the Calcasieu Ship Channel would represent a long-term, moderate incremental increase to the existing effects of marine traffic in the region. Although the volume of cooling water intake that occurs varies greatly depending on the size and type of vessel, in general, the Project would result in a less than 20 percent increase in cargo-vessel traffic when in operation, and presumably the impacts on ichthyoplankton would increase by a similar rate (Hartman 2017a,b).

To quantify Project impacts on ichthyoplankton as a result of LNG carrier cooling-water intake, Driftwood conducted a 48-hour sampling and analysis effort in October 2017 to measure ichthyoplankton density and abundance at two sampling locations: within the existing berth at the LNG Facility site and within the Calcasieu Ship Channel. Although ichthyoplankton abundance varies seasonally (e.g., Hernandez, et al., 2010), this sampling effort provides Project-specific support of the estimates of ichthyoplankton impacts. Eight stratified sample tows were conducted at water’s surface and at mid-depth to document ichthyoplankton throughout the water column. In the laboratory, ichthyoplankton were identified to the lowest taxonomic level possible under a digital stereomicroscope and categorized as fishes, shrimp, and other. In the fish category, 14 species were identified, with Atlantic croaker and bay anchovy comprising the majority. In the shrimp category, three species were identified; opossum shrimp (mysid shrimp) comprised over 99 percent of the individuals. The “other” category was not identified to species; 95 percent were copepods, with amphipods and crabs making up the majority of the remaining individuals. Based on the results of the samples Driftwood collected in the Calcasieu Ship Channel (which had higher fish densities, thus resulting in a more conservative estimate), fish species had a density of 522.25 per 1,000 m^3 and white and brown shrimp (excluding opossum shrimp, for which EFH has not been defined) had a density of 91.54 per 1,000 m^3. The estuarine portion of the Calcasieu Ship Channel (i.e., not including the Calcasieu River or adjacent estuarine wetlands) contains over 80 million cubic meters of water, so, based on Driftwood’s density estimates, it would contain over 50 million ichthyoplankton individuals (fish and shrimp species).

Based on the anticipated volumes of cooling water for LNG carriers (table 4.3-6), about 19,500 fish and shrimp eggs/larvae would be entrained by each visit for a DFDE LNG carrier and 23,500 fish and shrimp eggs/larvae would be entrained by each visit for a steam turbine LNG carrier. This constitutes less than one-tenth of one percent of the ichthyoplankton population in the Calcasieu Ship Channel. Depending on the mix of DFDE and steam turbine LNG carriers, between 7 million and 8.5 million fish and shrimp eggs/larvae would be affected per year by LNG carrier cooling water intake. Compared to the high abundance of fish and shrimp in estuarine waters, we conclude that these impacts would not be significant.

Water used for engine cooling would be discharged at a temperature between 2.7 °F and 7.2 °F warmer than the ambient water temperature. Fish and invertebrates near the LNG carrier could be temporarily affected by this increase in temperature; however, many of the species present are mobile and would relocate to more suitable conditions during discharges. Given the volume of cooling water discharged relative to the total volume of water within the Marine Facility, and the mobility of resident species, which could relocate to cooler surrounding waters if necessary, we have determined that impacts on aquatic resources would be intermittent and not significant.

Increased Noise Levels

Engine-noise produced by LNG vessels would result in temporary increases in underwater noise levels near the transiting ships (see additional discussion in section 4.12.2.3). Noise generated by LNG vessels is generally omni-directional, emitting from all sides of the vessel (Whale and Dolphin Conservation Society, 2004), but are greatest on the sides of the ship and weakest on the front and rear of the ship. Impacts on aquatic resources due to increased noise levels would vary by species; however, the aquatic resources present within the LNG carrier routes are likely accustomed to regular fluctuations in noise levels from ongoing industrial and commercial shipping activities. Additionally, as described above, many of the species present within the LNG carrier routes are mobile and would be able to move out of areas of noise that would startle or stress aquatic resources present. Due to the existing shipping activities within the LNG vessel transit routes and the mobility of resident species, we have determined that impacts on aquatic resources associated engine-noise produced by LNG carriers during operation of the LNG Facility would be intermittent and minor.

Stormwater Runoff

Construction activities at the LNG Facility would remove vegetation cover at the site and expose the underlying soils to the effects of wind and rain, which increases the potential for soil erosion and sedimentation of aquatic habitat. Similarly, during operation of the LNG Facility, most of the site would be converted to impervious or semi-pervious surfaces associated with aboveground facilities and plant roads, which would increase stormwater runoff into adjacent vegetated and open water habitats. Potential impacts on water quality from stormwater runoff include increased turbidity and suspended solid levels, which would result in similar effect to aquatic resources as described for dredging, discussed above (see section 4.3.3.1, *Dredging*).

To minimize impacts on aquatic resources due to stormwater runoff, Driftwood would conduct land-disturbing activities according to its ESCP; Driftwood Plan and Procedures. The ESCP describes Driftwood's erosion and sedimentation control strategy, which includes construction entrances, silt fence, straw-bale barriers, drainage swales, sediment catch basins, and vegetative control measures to minimize the offsite transport of sediment.

Lighting

Temporary lighting would be installed and used during construction of the LNG Facility for construction activities during evening hours and meet applicable safety requirements. Construction of the Marine Facilities, MOF, and Pioneer Docks and associated dredging would require additional overwater lighting during the construction period. The work areas, dredges, smaller work boats associated with dredging operations, and floating portion of the temporary dredge transport pipeline would be well-lighted during construction activities to promote safety. Lighting associated with in-water activities would have the greatest potential to affect aquatic resources. To minimize potential impacts on aquatic resources, Driftwood would direct all nighttime lighting towards the construction activity being conducted. During operation of the LNG Facility, lighting would be installed and used to meet safety and security requirements. Permanent LNG Facility lighting would be chosen to minimize the horizontal emission of light away from intended areas, and over-water lighting would be limited to the extent necessary to carry out operations and maintenance, and would be shielded.

Illumination of surface waters near the LNG Facility could cause artificially induced aggregations of small organisms that rely on sun or moonlight to determine movement patterns, resulting in increased predation by larger species. Generally, impacts on aquatic species would be minor as these species may change their feeding habits over time. Due to the industrial nature of the area surrounding the LNG Facility, aquatic species within the Calcasieu Ship Channel are likely acclimated to ambient light from surrounding industrial sources. Based on the existing light conditions within the Calcasieu Ship Channel and the likelihood that aquatic resources would acclimate over time to increased lighting at the LNG Facility, we have determined that impacts on aquatic resources from increased lighting during construction, operation, and maintenance of the LNG Facility would not be significant.

LNG Storage Tank Deluge System

During operation of the LNG Facility, an LNG storage tank deluge system would be used to distribute water over the LNG storage tank's outer surfaces for cooling in the event of a fire on the adjacent tank. The deluge system would be operated in a fire emergency as well as periodically for system maintenance and testing. When in operation, two pumps near the LNG loading platform would appropriate water from the Calcasieu Ship Channel at a rate of up to 6,300 gpm. Intake structures would be screened to minimize entrapment of aquatic resources and prevent debris from entering the system. Water used for deluge purposes would be directed into two holding basins before being discharged back into the Calcasieu Ship Channel. Because of the infrequent operation of the system and use of screening to minimize entrapment of aquatic resources, we conclude that the LNG storage tank deluge system would have intermittent and minor impacts on aquatic resources.

Inadvertent Spills and Leaks

During construction and operation, hazardous materials resulting from spills or leaks entering the Calcasieu Ship Channel could have adverse impacts on aquatic resources. These impacts would depend on the depth and volume of the spill, as well as the properties of the material spilled. DWLNG would follow its *SPCC Plan* during construction as described in section 4.2.6.1 of this final EIS and would develop and follow an SPCC Plan during operation, as described in section 2.5 of this final EIS. Given the impact minimization and mitigation measures described above, we conclude that the probability of a spill of hazardous materials is small and any resulting impacts on aquatic resources would be temporary and minor.

4.4.3.2 Pipeline

Short-term impacts on surface waterbodies could result from Pipeline construction by temporarily increasing the suspended solids in the water column during active in-stream work. Driftwood would follow the Driftwood Procedures (see appendix C) to minimize construction-related impacts on fisheries encountered along the Pipeline route. The following provides a description of potential impacts on aquatic resources due to Pipeline construction and operation and the measures that Driftwood would implement to minimize or avoid such impacts.

Waterbody Crossings

In most instances, Driftwood would use the open-cut crossing method to construct across waterbodies (see table 4.4-4 in appendix A). The open-cut method has the potential for impacts on fisheries. Typical impacts associated with the open-cut method include temporary increases in turbidity and permanent alteration of the stream bed and stream banks.

Turbidity resulting from suspension of sediments during in-stream construction could reduce light penetration and photosynthetic oxygen production. Additionally, re-suspension of organic and inorganic materials can cause an increase in biochemical oxygen demand, resulting in a decrease of dissolved oxygen. Re-suspension of such sediment could result in localized depletion of oxygen throughout the water column, which could temporarily displace aquatic species from the affected area. Standard open-cut techniques could lead to elevated concentrations of suspended solids for brief periods downstream of the crossing. Increased suspended sediment concentrations during construction could increase invertebrate drift, impair fish feeding activities, and lead to sediment deposition in downstream habitats. Turbidity, decreases in dissolved oxygen concentrations, or other impacts on water quality would be restricted to the period of construction at the crossing and would return to background levels soon after construction is completed.

Driftwood would adhere to all federal and state regulations required for working in or near surface waters of the state. All instream activities would be conducted in a manner that reduces sediment loading of the waterway and limits the extent of downstream impacts, as outlined in the Driftwood and Procedures, which includes the following measures to avoid or minimize impacts on aquatic resources caused by open-cut crossings:

- Complete all in-stream construction activities within 24 hours for minor perennial waterbodies and within 48 hours for minor intermittent/ephemeral waterbodies and all intermediate waterbodies[15], unless otherwise approved by FERC;
- Limit extra work area sizes to what is needed to construct the stream crossing;
- Ensure all established erosion and sediment control measures are implemented prior to construction and across the work areas;
- Place all spoil from minor and intermediate waterbody crossings and upland spoil from major waterbody crossings within the construction right-of-way at least 10 feet from the edge of the water or in extra work areas. ATWS, staging areas and additional spoil storage areas would be at least 50 feet away from the edge of the water. Driftwood has identified workspace areas which cannot achieve a 50-foot setback in table 2.2-2 in appendix A. Use the applicable BMPs and erosion control measures such as silt fencing, mulching, and rock armoring in the appropriate locations to minimize soil erosion and sedimentation from these locations during and after construction;
- Construct berms or other sediment barriers to prevent saturated soils on banks from flowing back into the waterbody. If working at a dry crossing, berms would not likely be required unless groundwater and saturated soils are encountered; and
- Minimize the use of grading in stream banks.

Driftwood would use HDD technology to cross 15 waterbodies. By using the HDD crossing method at these locations, Driftwood would avoid impacts on fisheries and aquatic resources. In the event of an inadvertent release of drilling mud during an HDD installation beneath a wetland or waterbody, Driftwood would implement its HDD Plan, as described in section 4.1.1. Given the construction methods and impact minimization and mitigation measures described above, we conclude that impacts on aquatic resources from Pipeline waterbody crossings would be small and any resulting impacts would be temporary and minor.

Increased Noise Levels

Noise impacts on aquatic resources would occur due to in-stream construction activities such as trenching, placement of the pipe, backfilling, and installation of erosion control materials along the waterbody banks. Noise would be generated by the use of heavy equipment such as backhoes, cranes, and large trucks. It is anticipated that mobile species would disperse and avoid the areas during construction, and would return to the area upon completion of construction. Therefore, noise-related impacts on aquatic resources would be temporary and minor in nature.

[15] "Minor waterbody" includes all waterbodies less than or equal to 10 feet at the water's edge at the time of construction. "Intermediate waterbody" includes all waterbodies greater than 10 feet wide but less than or equal to 100 feet at the water's edge at the time of construction.

Stormwater

In addition to potential sedimentation and turbidity impacts from waterbody crossings, impacts may result from clearing, grading, and trenching activities in uplands adjacent to waterbodies. Surface drainage patterns and hydrology could be temporarily altered and could increase the potential for the trench to act as a drainage channel. Disturbance of adjacent wetlands could also affect the capacity to control erosion and flooding. Prior to and during construction, Driftwood would implement the mitigation measures contained in the Driftwood Plan and Procedures, and stormwater impacts would not be significant.

Inadvertent Spills and Leaks

During construction, inadvertent spills or leaks of hazardous materials pose a potential risk of contamination of surface water resources. Spill-related impacts from construction are typically associated with fuel storage, equipment refueling, small quantity chemical storage, and equipment maintenance.

To prevent inadvertent spills, all equipment would be properly maintained and inspected on a regular basis, and all refueling activities and equipment maintenance would be conducted according to Driftwood's SPCC Plan. As part of its SPCC Plan, Driftwood would coordinate with the construction contractors to ensure that adequate supplies of absorbent material and any other spill response supplies and equipment necessary for the immediate containment and cleanup of spills would be available in all construction areas. Disposal of spent spill response waste materials would adhere to federal, state, and local regulations.

Implementation of the various spill prevention, containment, and cleanup measures of the Driftwood SPCC Plan (as described in section 4.2.6.1 of this final EIS) should avoid or minimize potential impacts on surface waters due to spills of fuels and hazardous materials.

Hydrostatic Test Water Withdrawal and Discharge

Hydrostatic testing of the completed Pipeline and piping associated with the aboveground facilities would occur before final restoration and placing the Pipeline into service. Hydrostatic test water would be obtained from nearby surface water sources, and discharged according to the LPDES Permit for Discharge of Hydrostatic Test Water. Hydrostatic test water uptake locations include the West Fork Calcasieu River, Bayou Nezpique, and Bayou des Cannes.

The water withdrawal process could entrain fish eggs and juvenile fish present near the intake structures. In accordance with the Driftwood Procedures, Driftwood would screen intake hoses to limit the entrainment of larvae and pre-juvenile fish and invertebrates during water withdrawal. Erosion control measures may include discharge to energy dissipation structures constructed of straw bales, filter bags, and splash blocks to minimize erosion and sedimentation. The rate of flow would be continuously monitored and controlled to prevent flooding of adjacent properties and/or roadways. In addition, Driftwood would adhere to the terms and conditions of the applicable discharge permits. Based on implementation of the aforementioned mitigation measures, we conclude that impacts on fisheries resources from hydrostatic testing would be minimal.

4.4.3.3 Aboveground Pipeline Facilities

Driftwood has sited the aboveground pipeline facilities to avoid direct impacts on surface waterbodies. Therefore, no direct impacts on surface waterbodies containing aquatic resources are anticipated from construction and operation of aboveground facilities. Driftwood would use appropriate erosion controls as specified in the Driftwood Plan and Procedures to reduce the potential for erosion and sediment migration to any nearby resources.

4.4.4 Essential Fish Habitat

EFH is present at the LNG Facility and along the marine transit routes. It is not present along the Pipeline alignment.

4.4.4.1 Regulatory Background

The MSFCMA (Public Law 94-265 as amended through October 11, 1996) was established, along with other goals, to promote the protection of EFH during the review of projects to be conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. EFH is defined in the MSFCMA as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Federal agencies that authorize, fund, or undertake activities that may adversely affect EFH must consult with NMFS. Although absolute criteria have not been established for conducting EFH consultations, NMFS recommends consolidated EFH consultations with interagency coordination procedures required by other statutes, such as NEPA, the Fish and Wildlife Coordination Act, and the ESA, to reduce duplication and improve efficiency (50 CFR 600.920(e)). Generally, the EFH consultation process includes the following steps:

- **Notification**: the action agency should clearly state the process being used for EFH consultations (e.g., incorporating EFH consultation into an EIS).
- **EFH Assessment**: the action agency should prepare an EFH Assessment that includes both identification of affected EFH and an assessment of impacts. Specifically, the EFH Assessment should include:
    - a description of the proposed action;
    - an analysis of the effects (including cumulative effects) of the proposed action on EFH, managed fish species, and major prey species;
    - the federal agency's views regarding the effects of the action on EFH; and
    - proposed mitigation, if applicable.
- **EFH Conservation Recommendations**: after reviewing the EFH Assessment, NMFS should provide recommendations to the action agency regarding measures that can be taken by that agency to conserve EFH.
- **Agency Response**: within 30 days of receiving the recommendations, the action agency must respond to NMFS. The action agency may notify NMFS that a full response to the conservation recommendations would be provided by a specified completion date agreeable to all parties. The response must include a description of measures proposed by the agency to avoid, mitigate, or offset the impact of the activity on EFH. For any conservation recommendation that is not adopted, the action agency must explain its reason to NMFS for not following the recommendation.

As a non-federal party assisting FERC in meeting its obligations under the MSFCMA, Driftwood submitted a Project introduction letter, and associated Project location map and Project fact sheet to NMFS on May 4, 2016 (NMFS, 2016a). On May 9, 2016, NMFS acknowledged receipt of the Project introduction package (NMFS, 2016b). On June 27, 2016, Driftwood and NMFS discussed the presence of EFH for three species: white shrimp, brown shrimp, and red drum (NMFS, 2016c). On June 30, 2016, Driftwood and NMFS discussed the development of the BUDM Plan (NMFS, 2016d). On July 21, 2017, Driftwood submitted a letter outlining their assessment of federally protected fish and marine species (NMFS, 2016e). On November 7, 2016, NMFS submitted comments to FERC on fisheries and aquatic resource concerns including EFH (NMFS, 2016f). On November 9, 2016, a Joint Evaluation meeting was held; participants included FERC, Driftwood, USFWS, NMFS, LDWF, and others. On August 21, 2017, Driftwood submitted a request for concurrence pursuant to the MSFCMA (Driftwood, 2017).

The NMFS, in its October 3, 2017, letter (NMFS, 2018b) concluded that construction of the LNG Facility, in combination with wetland mitigation and BUDM, would not result in significant adverse impacts on EFH. The NMFS, in an email on October 23, 2018, indicated that no further consultation on EFH is necessary. We conclude that EFH consultation under the MSFCMA is complete.

4.4.4.2 Essential Fish Habitat within the Project Area

Between 1979 and 1987, the Gulf of Mexico Fishery Management Council (GMFMC) prepared fishery management plans for seven marine groups within the Gulf of Mexico: reef fish, migratory pelagic fish, red drum, shrimp, spiny lobster (*Panulirus argus*), stone crab (*Menippe adina* and *M. mercenaria*), and corals. Each fishery management plan has been amended several times since then. One important amendment that applied to all seven fishery management plans was implemented in 1998 and involved the identification of EFH for each group. All estuarine systems of the Gulf (e.g., Calcasieu River estuary) are considered EFH, which is managed by the GMFMC (GMFMC, 2010).

The GMFMC (2005) designated the Calcasieu River estuary and surrounding waters as EFH for four groups of finfish and shellfish: red drum, shrimp, reef fish, and coastal migratory pelagics. Life stage occurrences for several species within these groups found near the LNG Facility are presented in table 4.7-4. Driftwood's ichthyoplankton survey, discussed in more detail in section 4.4.3.1, identified eggs and larvae of the following species with EFH in the Calcasieu River in October 2017: brown shrimp (0.96 individuals/1,000 m^3) and white shrimp (77.40 individuals/1,000 m^3).

Table 4.4-4

Life Stage Occurrence for Species with EFH Designated Near the LNG Facility

Species	Life Stage	Zone	Essential Fish Habitat	Seasons
Brown Shrimp	Larvae / Neonate	Marine/Estuarine	0-269 feet; planktonic, sand/shell/soft bottoms, submerged aquatic vegetation (SAV), emergent marsh, oyster reef	Year Round/October through July
	Juvenile	Estuarine	0-59 feet; sand/shell/soft bottoms, SAV, emergent marsh, oyster reef	March through July
White Shrimp	Larvae / Neonate	Marine/Estuarine	1-269 feet; soft bottoms, emergent marsh	Year Round/June through September
	Juvenile	Estuarine	1-98 feet; soft bottoms	September through June
Red Drum	Eggs	Marine	Coastal waters frequently near tidal inlets	August through October
	Larvae / Neonate	Estuarine	emergent marsh Planktonic, sand/shell bottoms, SAV, soft bottoms, emergent marshes	October through January
	Juvenile	Estuarine/Marine	0-16 feet; emergent marshes, SAV, soft bottoms, hard bottoms, sand/shell bottoms	Year Round
	Adult	Estuarine/Marine	1-230 feet; hard bottoms, pelagic, emergent marshes, sand/shell bottoms, SAV, soft bottoms	Year Round
Lane Snapper	Juvenile	Estuarine	0-60 feet; grass flats, soft bottoms, back reefs	Late Summer/Early Fall
Gray Snapper	Adult	Marine, Estuarine, Riverine	0-540 feet; hard and soft bottoms, sand, rubble, rock	Year Round

The areas classified as EFH within the areas affected by the LNG Facility are the Calcasieu Ship Channel (including the E2 wetland along portions of the shoreline and the western and southern boundaries of the LNG Facility) and associated waterbodies along the marine transit route including the Calcasieu River, ICW, and Gulf of Mexico. Three categories of EFH are present within the Calcasieu Ship Channel: estuarine wetlands, mud substrates, and estuarine water column. Estuarine and marine water column is also present within the Calcasieu River, ICW, and Gulf of Mexico along the marine transit routes.

The E2 wetland within the existing recessed berth areas currently provides nursery, shelter, and feeding habitat for many fish and invertebrate species. The mud substrates in and near the Calcasieu Ship Channel are composed of sub-tidal unconsolidated sediments. This EFH type serves as important nursery and feeding habitat for many fish and the invertebrates they feed on (e.g., worms and mollusks living on and in the sediments). Estuarine and marine water column habitat serves as EFH for several species and their prey at various life stages by providing suitable habitat for spawning, breeding, and foraging. The community composition of both the mud substrates and estuarine water column within the Calcasieu Ship Channel exists in an early successional stage due to maintenance dredging, propeller wash from passing vessels, and natural sedimentation.

In addition to being designated as EFH, wetlands near the LNG Facility provide nursery and foraging habitats supportive of a variety of economically important marine fishery species, including striped mullet, Atlantic croaker, gulf menhaden, spotted and sand seatrout, southern flounder, and blue crab (as discussed in more detail in section 4.7.2.1). Some of these species serve as prey for other fish species managed under the MSFCMA by the GMFMC (e.g., mackerels, snappers, and groupers) and highly migratory species managed by NMFS (e.g., billfishes and sharks). These wetlands also produce nutrients and detritus, important components of the aquatic food web, which contribute to the overall productivity of the Calcasieu Lake estuary.

Based on review of the NMFS EFH Mapper (NMFS, 2018a), we have determined that EFH is not present in the waters associated with the Pipeline in Calcasieu, Jefferson Davis, Acadia, and Evangeline parishes. Based on this evaluation, no EFH would be crossed by the Pipeline; therefore, no impacts on EFH from construction and operation of the Pipeline are anticipated.

4.4.4.3 Impacts and Mitigation

Impacts on EFH during construction and operation of the LNG Facility would be similar to those described above for aquatic resources (see section 4.7.3.1). Potential impacts on EFH (estuarine wetland, mud substrates, and estuarine water column habitat) and Driftwood's proposed mitigation are described below.

Estuarine Wetland

Construction of the LNG Facility, construction laydown, other facilities, and roads would permanently convert 126.2 acres of E2 wetland habitat to industrial land use.

Driftwood proposes to use material dredged from the ship berthing area to restore historical emergent wetlands along the ICW at up to 10 locations, ranging from 1.8 to 8.5 miles southwest of the LNG Facility. Driftwood is designing the BUDM sites in coordination with the COE, NMFS-Habitat Conservation Division, LDNR OCM, and other agencies. As a result, the final *Beneficial Use of Dredge Material Plan* is expected to meet the requirements of each agency and to address impacts on EFH and other aquatic resources.

Due to the relatively small amount of estuarine wetland that would be affected by the LNG Facility compared to the extent of this abundant habitat in the region, its location adjacent to the existing Calcasieu Ship Channel with regular industrial vessel traffic, and the proposed re-creation of historical emergent wetlands, we have determined that the LNG Facility would not have a significant adverse impact on estuarine wetland habitat.

Mud Substrates

Dredging to create the Turning Basin and allow access to the Pioneer Docks, MOF, and Marine Berth would result in the removal of the existing mud substrates (which would remove the existing benthic community) and the creation of new mud substrates. In addition, sediments resuspended in the water column during dredging and other construction activities would be redeposited on nearby substrates, potentially smothering immobile fish eggs and larvae as well as benthic invertebrates. Dredging activities could also cause mortality of egg, larval, or neonate shrimp and fish species near the cutterhead of the dredge for the Marine Berth. Dredging would be conducted year-round for about 30 months, so avoidance of the period of peak larval abundance in early spring or summer is not feasible.

Driftwood estimates that the marine berths and MOF would require maintenance dredging about every three years; however, the volume and frequency of the required dredging would be assessed during the detailed design phase. Maintenance dredging would have impacts on mud substrates similar to those described above for dredging during construction; however, impacts would be shorter in duration due to the reduced amount of material being removed from the Marine Facility and MOF.

As described above, mud substrates within the Calcasieu Ship Channel remain in an early successional stage due to maintenance dredging of the Calcasieu Ship Channel. Given that impacts on mud substrates would generally be limited to the period during and immediately following construction and maintenance dredging, we have determined that dredging would not have a significant adverse impact on mud substrate habitat.

Estuarine Water Column

Construction of the LNG Facility would increase noise, artificial lighting, turbidity, and suspended solid levels within the estuarine water column near the LNG Facility. Impacts on the estuarine water column would be greatest during dredging and pile driving activities, but would occur throughout construction of the LNG Facility. During operation of the LNG Facility, increased noise and artificial lighting, stormwater runoff, LNG carrier ballast-water discharge and cooling water uptake, and vessel traffic could affect estuarine water column habitat near the LNG Facility. Impacts would be greatest near the Marine Facility and MOF; however, some impacts (e.g., noise and suspended solids) may extend beyond these facilities (e.g., to the marine transit routes), although the impact would decrease with distance. Potential impacts on fisheries present within the estuarine water column due to project-related changes in water quality and increased noise and artificial lighting could include decreased survival of juvenile fish, foraging success, and suitability of spawning habitat (see additional discussion in section 4.7.3.1).

Construction of the LNG loading and berthing areas would convert about 77.6 acres of land to estuarine water column habitat. Dock facilities and rock armor placed along the sheet piling for protection against scour would create a hard substrate for the growth of attached organisms as well as three-dimensional structures to be used by some species as refuge. Given the proposed creation of additional water column habitat, measures that Driftwood would implement to reduce impacts on aquatic resources, and the existing, similar industrial activity in the Calcasieu Ship Channel, we have determined that impacts on estuarine water column habitat would not be significant.

Increased ship traffic associated with construction and operation of the LNG Facility could affect estuarine and marine water column habitat within the Calcasieu Ship Channel, Calcasieu River, ICW, and Gulf of Mexico. Impacts on water quality may occur due to increased suspended solids, discharge of ballast water, and intake and discharge of cooling water. However, these waterways were specifically created to provide deepwater access for maritime commerce and support high levels of deep draft traffic; therefore, impacts due to the incremental increase in vessel traffic within these waterways during construction and operation of the LNG Facility would not have a significant adverse impact on estuarine water column habitat.

4.4.4.4 Conclusions

As described in the preceding sections, Driftwood would construct and operate the Project as described in the Driftwood Plan and Procedures, and SPCC Plans. The re-creation of emergent wetlands within the BUDM sites would offset adverse impacts on wetlands from construction and operation of the LNG Facility, resulting in long-term benefits to wetlands near the LNG Facility.

The existing recessed berthing area represents less than one-tenth of one percent of the total area of EFH within the Calcasieu Ship Channel. Due to the relatively small area affected within the Calcasieu Ship Channel, the increase in the amount of estuarine water column habitat created during construction of the berthing area, the proposed re-creation of emergent wetland via BUDM, and the record of consultation with NMFS, we have determined that the LNG Facility would not have adverse impacts on EFH.

4.5 WETLANDS

Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation (Environmental Laboratory, 1987). Wetlands can be a source of substantial biodiversity and serve a variety of functions that include providing wildlife habitat, recreational opportunities, flood control, and naturally improving water quality.

Wetlands are regulated under Section 404 of the CWA. Section 404 establishes standards to evaluate and reduce impacts on wetlands under the jurisdiction of the COE. Wetland impacts authorized under Section 404 also require state water quality certification under Section 401 of the CWA. Water quality certification was delegated to the state agencies (in the State of Louisiana, the LDEQ has jurisdiction over Section 401), with review by the EPA.

In addition, Louisiana defines coastal wetlands as wetlands less than 5 feet above mean sea level that occur within the designated coastal zone (Louisiana Revised Statute 49:214.2). Coastal wetlands are under the jurisdiction of the LDNR OCM, and impacts on coastal wetlands would require a CUP in addition to the COE's Section 404 permit. According to the revised Coastal Zone Inland Boundary (dated June 7, 2012), the LNG Facility site lies adjacent to but outside the designated coastal zone, the Pipeline lies outside the coastal zone, and the only portion of the Project within the coastal zone are the BUDM sites (LDNR, 2012), which are part of a separate established program as discussed in section 2.5.2.6. However, following removal of the temporary barrier and dredging the MOF and marine berth, the coastal zone management area would extend into the newly dredged areas.

4.5.1 Existing Wetland Resources

Driftwood conducted wetland delineations on potentially affected lands in 2016 and 2017. Wetland delineations were performed according to the COE's 1987 Wetland Delineation Manual (Environmental Laboratory, 1987) and the Atlantic and Gulf Coastal Plains Regional Supplement (COE, 2010a), which require the identification of wetlands based on the presence of three parameters: hydrophytic vegetation, hydric soils, and wetland hydrology. Wetlands identified within the Project area are shown in FERC eLibrary accession number 20170822-5131. In areas where land access was not granted, wetlands were interpreted using USFWS NWI maps, recent aerial photographs, and USGS topographic maps.

Wetland identified within the Project area include PEM, PSS, PFO, E2, and lacustrine wetlands (table 4.5-1). Palustrine wetlands are defined as non-tidal wetlands dominated by trees, shrubs, persistent emergent vegetation, emergent mosses, or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. Palustrine wetlands include features such as marshes, swamps, bogs, fens, and prairies, and may include small shallow permanent and intermittent waterbodies referred to as ponds. Estuarine wetlands are defined as tidal wetlands that are usually semi-enclosed by land, but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from land. E2 wetlands occur within the western and southern portions of the LNG Facility site, adjacent to Bayou Choupique and the ICW. These wetlands provide important ecological functions including water purification, shoreline stabilization, and flood protection as well as supporting essential habitat for various life stages of many fish and wildlife species. Lacustrine systems are defined by Cowardin as wetlands and deepwater habitats of 20+ acres, without significant vegetation, situated in a topographic depression or a dammed river channel (Cowardin et al., 1979).

Table 4.5-1

Wetlands Affected by the LNG Facility and Pipeline

Facility Area	NWI Classification [a]	Pipeline Crossing Length (miles) [b]	Acreage Affected During Construction [c, d, h]	Acreage Affected During Operation (Maintained ROW) [c]
LNG Facility [e]				
Marine Berths	PSS	N/A	1.9	1.9
MOF	PEM	N/A	1.2	1.2
Liquefaction Facility	E2	N/A	68.7	68.7
	PEM	N/A	4.8	4.8
	Mosaic/PFO	N/A	61.0	61.0
	PEM/PSS	N/A	10.3	10.3
	PSS/PFO	N/A	3.3	3.3
Other Facilities [f]	E2	N/A	53.0	53.0
	PEM	N/A	10.2	10.2
	Mosaic/PFO	N/A	26.2	26.2
	PEM/PSS	N/A	3.9	3.9
	PFO	N/A	0.2	0.2
	PSS	N/A	0.9	0.9
	PSS/PFO	N/A	3.9	3.9
Construction Laydown and Storage Areas	E2	N/A	3.4	3.4
	PEM	N/A	20.5	20.5
	Mosaic/PFO	N/A	26.1	26.1
	PFO	N/A	1.6	1.6
	PSS	N/A	3.9	3.9
Roads	E2	N/A	1.1	1.1
	PEM	N/A	1.1	1.1
	Mosaic/PFO	N/A	11.7	11.7
	PEM/PSS	N/A	0.1	0.1
	PFO	N/A	0.3	0.3
Subtotal			*319.3*	*319.3*
Pipeline				
Pipeline [g, h]	PEM	5.5	85.3	0.0
	PFO	24.6	318.9	76.6
	PSS	0.9	12.8	1.1
	L2UB	0.0	0.2	0.0
Compressor Stations[i]	PFO	N/A	0.2	0.2

Table 4.5-1

Wetlands Affected by the LNG Facility and Pipeline

Facility Area	NWI Classification [a]	Pipeline Crossing Length (miles) [b]	Acreage Affected During Construction [c, d, h]	Acreage Affected During Operation (Maintained ROW) [c]
Meter Stations[j]	PEM	N/A	4.1	3.1
	PSS	N/A	0.1	<0.1
Access Roads	PEM	N/A	2.9	<0.1
	PFO	N/A	1.1	<0.1
	PSS	N/A	0.1	<0.1
Staging Areas	PFO	N/A	0.2	0.0
Subtotal			*425.9*	*81.0*
Total			*745.2*	*400.3*

Note: Construction and operation acres in impact tables calculate the impact acreages based on the area of concern for each resource, and may not be the same for each resource. Footnotes in each table describe the areas of concern used for each resource table.

[a] PEM – Palustrine emergent; PSS – Palustrine Scrub/Shrub; PFO – Palustrine forested; E2 – Estuarine emergent intertidal; L2UB - Lacustrine, Littoral Unconsolidated Bottom.

[b] Crossing length includes wetlands crossed by HDD.

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

[d] Includes ATWS.

[e] No wetlands would be affected by the Temporary Offsite Construction Areas.

[f] All areas outside of the berm.

[g] Includes mainline valves.

[h] Construction and operation acreage excludes areas between HDD entry and exit locations, as these areas would not be maintained during operation or cleared during construction, with the exception of two small, 10-foot-wide temporary access paths associated with the Calcasieu River HDD. Impacts associated with those paths are captured in this table. Operation impacts reflect only those areas that would be routinely maintained during operation as outlined in the Driftwood Plan and Procedures and would result in a change in cover type (excludes PEM wetlands). For PSS wetlands this includes a 10-foot-wide corridor and for PFO wetlands this includes a 30-foot-wide corridor.

[i] Acreage impacts for MS-06 are accounted for in the Compressor Stations total, as CS-01 and MS-06 are collocated.

[j] Includes interconnects.

4.5.1.1 LNG Facility

A total of 24 wetland features were identified within the LNG Facility site. Wetland types identified include PEM, PSS, PFO, and E2 or mixed wetlands comprised of multiple wetland types (see table 4.5-1). Mosaic/PFO and E2 wetlands are the most common wetland type within the LNG Facility. Dominant vegetation species observed in each wetland community are presented in section 4.6.1.1.

4.5.1.2 Pipeline

A total of 165 wetland features, including 52 PEM wetlands, 15 PSS wetlands, 96 PFO wetlands, and 2 L2UB wetlands have been identified along the Pipeline route (see table 4.5-1). Dominant vegetation species observed in each wetland community are presented in section 4.6.1.2.

4.5.2 Wetland Impacts and Mitigation

4.5.2.1 LNG Facility

Construction and operation of the LNG Facility, including the temporary offsite construction areas, would result in the permanent loss of wetlands (see table 4.5-1). Of the wetlands affected, about 99 percent would be converted to industrial land use and the remaining 1 percent would be converted to open water associated with the marine berth and MOF or filled for shoreline stabilization. No wetlands would be affected by the temporary offsite construction areas.

During operation, increased vessel traffic within the Calcasieu Ship Channel could result in increased shoreline erosion due to increased wave activity, potentially affecting the remaining estuarine wetland fringe south of the pioneer docks. As discussed in section 2.5.1, Driftwood would install rock armoring to provide scour protection. Because the Calcasieu Ship Channel is an existing ship channel, authorized for and subject to heavy commercial marine traffic, we have determined that the minor incremental increase in vessel traffic within the Calcasieu Ship Channel would not cause a significant increase in erosion of the estuarine wetland fringe.

4.5.2.2 Pipeline

The wetland acreage affected during construction of the Pipeline is shown in table 4.5-1. Constructing and operating the Pipeline would temporarily and permanently impact wetlands. Construction activities would temporarily and permanently impact wetland vegetation and habitats, and could temporarily impact wetland soils characteristics, hydrology, and water quality. The effects on wetland vegetation would be greatest during and immediately following construction. In general, wetland vegetation would eventually transition back into a community similar to that of the wetland before construction. Emergent wetlands would recover to their pre-existing vegetative conditions in a relatively short period (typically within 1 to 2 years). Scrub-shrub wetlands could take about 4 years to regain a structure similar to pre-construction conditions depending on the age and complexity of the system. In forested wetlands, the impact of construction would be much longer due to the time needed to regenerate a forest community. Given the species that dominate the forested wetlands crossed by the Pipeline, regeneration to pre-construction conditions may take 30 years or longer. Impacts on the vegetative communities may also include changes in the density, type, and biodiversity of vegetation, including invasive species. Impacts on habitats may occur due to fragmentation, loss of riparian vegetation, and microclimate changes associated with gaps in canopy.

Wetland soils would be restored to their original profile to the extent possible. During construction, failure to segregate topsoil could result in the mixing of the topsoil with the subsoil. This disturbance could result in reduced biological productivity or modify chemical conditions in wetland soils that could affect the reestablishment and natural recruitment of native wetland vegetation. In addition, inadvertent compaction and rutting of soils during construction could result from the movement of heavy machinery and the transportation of pipe sections. The resulting alteration of the natural hydrologic patterns of the wetlands could inhibit seed germination and regeneration of vegetative species. The discharge of stormwater, trench water, or hydrostatic test water could also increase the potential for sediment-laden water to enter wetlands and cover native soils and vegetation. Finally, construction clearing activities and disturbance of wetland vegetation could also temporarily affect the wetland's capacity to buffer flood flows and/or control erosion. Wetland hydrology would be maintained by installation of trench breakers at the wetland/upland boundary and by restoring wetlands to original contours without adding new drainage features that were not present prior to construction.

Secondary and indirect effects are impacts on adjacent or other nearby environmental resources, such as the sedimentation of water resources down-gradient of disturbed areas or habitat loss due to microclimate changes following clearing of forested vegetation that could result from the principal pipeline construction activities. Driftwood proposed measures in their Procedures and restoration plans to prevent secondary and indirect impacts on adjacent wetland areas. These include such measures as minimizing the length of open trench at any given time, using HDD installation methods in sensitive areas, installing trench breakers to maintain hydrology, employing erosion and sediment control measures to prevent discharge of sediment into adjacent wetlands and waterbodies, and limiting refueling and storage of hazardous materials. In addition, where secondary and indirect effects cannot be avoided or minimized, they would be mitigated as part of applicable COE wetland impact mitigation requirements (section 4.5.3).

Driftwood would adhere to all federal and state regulations required for working in or near wetlands. As described in the Driftwood Procedures, DWPL would adopt the following measures to avoid or minimize wetland impacts:

- Route the pipeline to avoid wetland areas to the maximum extent possible.
- Limit the width of the construction right-of-way in wetlands to 75 feet or less, except where topographic conditions or soil limitations require that the construction right-of-way width be expanded beyond 75 feet. Identify site-specific areas were wider rights-of-way would be required (see table 2.2-2).
- Clearly mark wetland boundaries and buffers in the field with signs and/or highly visible flagging under construction-related ground disturbing activities are complete.
- Do not locate aboveground facilities in wetlands, except where the location of such facilities outside of wetlands would prohibit compliance with DOT regulations (see table 2.2-2).
- Locate ATWS at least 50 feet away from wetland boundaries, except where the adjacent upland consists of cultivated or rotated cropland or other disturbed land.
- Minimize the length of time that topsoil is segregated and the trench is open. Do not trench the wetland until the pipeline is assembled and ready for lowering in.
- Segregate the top one foot of topsoil from the area disturbed by trenching, except in areas where standing water is present or soils are saturated. Immediately after backfilling is compete, restore the segregated topsoil to its original location.
- Install sediment barriers immediately after initial disturbance of the wetland or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary, such as after backfilling of the trench. Maintain sediment barriers until replaced by permanent erosion controls or restoration of adjacent upland areas is complete.

As described previously, Driftwood would use the HDD method to cross the Calcasieu River and the associated PFO wetland complex (WJEB009F). However, according to its site-specific crossing plan, Driftwood would place the HDD exit location and additional temporary workspace within the wetland complex. The boundary of the wetland complex is about 500 feet to the west of the exit location. Therefore, to avoid and further minimize impacts on this wetland complex, **we recommend that:**

> **Prior to construction, DWPL should file with the Secretary, for review and approval by the Director of OEP, a revised crossing plan for the Calcasieu River HDD that relocates the exit location and associated workspace to the adjacent upland area, outside of the PFO wetland complex (WJEB009F).**

Following construction, 344.9 acres of wetlands within the temporary right-of-way, ATWS, staging areas, and other work areas would be restored according to the Driftwood Procedures and allowed to revegetate naturally. Within one to two years, we expect that a similar vegetation community would establish within areas of PEM and PSS wetlands. Areas of PFO wetlands would require substantial additional time to recover. To minimize the spread and introduction of invasive plant species within the Project area, Driftwood would implement management and control measures as outlined in the Revegetation and Invasive Species Management Plan (FERC eLibrary accession number 20170621-5139) and further discussed in section 4.5.2 of this final EIS.

Operating the Pipeline would result in the permanent conversion of 77.9 acres of PFO and PSS wetlands to PEM wetlands, as shown in table 4.5-1.

Aboveground Facilities

A total of about 4.4 acres of wetlands would be affected by construction of the Pipeline aboveground facilities (see table 4.5-1). Following construction, about 1.0 acre of wetlands within the temporary work space would be restored according to the Driftwood Procedures and allowed to revegetate naturally. The remaining 3.4 acres of wetland would be permanently filled for operation of the aboveground facilities. Temporary impacts on wetlands caused by construction activities would be similar to those discussed for the Pipeline. Within one to two years, the area would transition back into a community with a function similar to that of the wetland prior to construction. To minimize the spread and introduction of invasive plant species within the Project area, Driftwood would enact various management and control measures as outlined in the Revegetation and Invasive Species Management Plan.

4.5.2.3 Exceptions to FERC Procedures

Section 2.5.1 identifies alternative measures to our Plan and Procedures. These alternative measures include a construction right-of-way through wetlands greater than 75 feet (Section V1.A.3 of FERC's Procedures). According to DWPL, a larger right-of-way is necessary to facilitate safe and efficient construction of the Pipeline. Additionally, DWPL would install CS-01/MS-06 and MS-02 partially within wetlands (Section VI.A.6 of FERC's Procedures) to meet engineering requirements and DOT regulations. As noted in Section 2.5.1, we conclude that a 110-foot-wide construction right-of-way within wetlands for 48-inch-diameter pipeline and for 42-inch-pipeline when crossing wetlands greater than 500 feet long is acceptable. Additionally, we find a 130-foot-wide construction right-of-way acceptable for crossing wetlands where the 36-inch-diameter lateral would parallel the 48-inch mainline between MS-05 and CS-01 also is acceptable.

4.5.3 Compensatory Wetland Mitigation

The COE has a goal of "no net loss" of wetlands. This means that unavoidable wetland impacts must be offset by the creation, restoration, enhancement, or preservation of at least an equal amount of wetlands, referred to as compensatory mitigation. Driftwood would contribute dredged material to Louisiana's BUDM Program to build and restore degraded coastal wetlands, which would offset the majority of the wetland impacts at the LNG Facility site (section 2.5.1).

To mitigate remaining impacts on PFO wetlands at the LNG Facility site and to PEM, PSS, and PFO wetlands (including longleaf pine savannas) along the Pipeline alignment, Driftwood would purchase mitigation credits according to mitigation guidelines established by the Louisiana Wetland Rapid Assessment Method (LRAM) and prescribed by the COE New Orleans District Wetland Mitigation Plan. Final compensatory mitigation requirements would be subject to review and approval by the COE New Orleans District as part of the Section 404/10 permit process.

We received comments on the draft EIS requesting the final Driftwood Compensatory Mitigation Plan (FERC eLibrary accession number 20170822-5131). It is the responsibility of the COE to determine the appropriate amount and type of mitigation for the various impacts on Waters of the U.S., including wetlands, from construction and operation of the LNG Facility and Pipeline. FERC requires that Driftwood have all federal authorizations, including the COE permit, prior to construction. Driftwood's Compensatory Mitigation Plan would be developed during the COE's review process and approved prior to construction. Further, FERC would monitor the Pipeline construction right-of-way until restoration is successful, and DWPL would be required to file wetland monitoring reports and, if necessary, develop a remedial revegetation and monitoring plan if wetlands do not meet prescribed restoration criteria within three years of construction.

We agree that impacts on forested wetlands represent a temporal impact and concluded in the EIS that impacts on wetlands would be would temporary and permanent. Section 4.5.2.2 states that in forested wetlands, the impact of construction would be much longer due to the time needed to regenerate a forest community. Given the species that dominate the forested wetlands crossed by the Pipeline, regeneration to pre-construction conditions may take 30 years or longer.

4.6 VEGETATION

4.6.1 Existing Vegetation Resources

4.6.1.1 LNG Facility

The LNG Facility would be located within the Western Gulf Coastal Plain Ecoregion. The principal distinguishing characteristics of the Western Gulf Coastal Plain Ecoregion are its relatively flat coastal plain topography and mainly grassland natural vegetation. Inland portions of this region are older, more irregular, and have mostly forest or savanna-type vegetation (EPA, 2013).

Field surveys conducted by Driftwood identified agriculture, herbaceous, scrub-shrub, wooded/forested, and wetland vegetation within the LNG Facility site and the temporary offsite construction areas (table 4.6-1). Currently disturbed areas are considered to be developed land use in Section 4.9. No aquatic vegetation was identified within the LNG Facility site. If present, emergent and submerged, saline-tolerant aquatic vegetation would be limited to the Calcasieu River, Calcasieu Ship Channel, and Bayou Choupique.

Agriculture

The Chennault Airport temporary offsite construction area contains agriculture vegetation (hay), occupying about one quarter of the 80-acre site.

Herbaceous

Herbaceous vegetation present within the LNG Facility has been directly or indirectly disturbed as a result of previous industrial facility land use. Dominant plant species observed within the upland herbaceous vegetation community included tall fescue (*Festuca arundinacea)*, creeping buttercup *(Ranunculus repens)*, dallisgrass (*Paspalum dilatatum*), bermudagrass (*Cynodon dactylon*), smut grass (*Sporobolus indicus)*, Virginia springbeauty (*Claytonia virginica)*, white clover (*Trifolium repens)*, curly dock (*Rumex crispus*), common dandelion (*Taraxacum officinale*), common evening-primrose (*Oenothera biennis*), annual ragweed (*Ambrosia artemisifolia*), broomsedge bluestem (*Andropogon virginicus*), common vetch (*Vicia sativa*), Johnsongrass (*Sorghum halepense*), sawtooth blackberry, St. Augustine grass (*Stenotaphrum secundatum*), Virginia creeper (*Parthenocissus quinquefolia*), saw greenbrier (*Smilax bona-nox*), trumpet vine (*Campsis radicans*), bushy bluestem (*Andropogon glomeratus*), wax myrtle (*Morella cerifera*), Santa Maria feverfew (*Parthenium hysterophorus*), and fall witchgrass (*Digitaria cognata*).

Scrub-shrub

Dominant plant species observed within the upland scrub-shrub vegetation community included yaupon (*Ilex vomitoria*), Chinese tallow (*Triadica sebifera*), eastern baccharis (*Baccharis halimifolia*), and wax myrtle.

Wooded/Forested

Dominant plant species observed within the upland wooded/forested vegetation community included small stands of sparse, immature live oak (*Quercus virginiana*), Chinese tallow, American sweetgum (*Liquidambar styraciflua*), water oak (*Quercus nigra*), and loblolly pine (*Pinus taeda*).

Wetlands

The wetland communities within the LNG Facility site consist of PEM, PSS, PFO, and E2 wetlands, further discussed in section 4.4 of this final EIS. No wetlands are present in the temporary offsite construction areas.

<u>Palustrine Emergent</u>

Dominant plant species observed within PEM wetland communities included blunt spikerush (*Eleocharis obtusa*), common rush (*Juncus effusus*), narrowleaf cattail (*Typha angustifolia*), common spikerush (*Eleocharis palustris*), saltmeadow cordgrass (*Spartina patens*), green flat sedge (*Cyperus virens*), alligator weed (*Alternanthera philoxeroides*), jointed flat sedge (*Cyperus articulatus*), Carolina wolfberry (*Lycium carolinianum*), torpedo grass (*Panicum repens*), gulf cordgrass (*Spartina spartinae*), sturdy bulrush (*Bolboschoenus robustus*), and eastern baccharis.

Palustrine Scrub-shrub

Dominant plant species observed within PSS wetland community included Chinese tallow, wax myrtle, sawtooth blackberry (*Rubus argutus*), annual marsh elder (*Iva annua*), eastern baccharis, water oak, yaupon, common plantain (*Plantago major*), common spikerush, saltmeadow cordgrass, gulf cordgrass, and narrowleaf cattail.

Palustrine Forested

Dominant plant species observed within PFO wetland community included Chinese tallow, water oak, green flat sedge, alligator weed, live oak, black willow (*Salix nigra*), sawtooth blackberry, blunt spikerush, common rush, and poison ivy (*Toxicodendron radicans*).

Estuarine Emergent

Dominant plant species observed within the E2 wetland community included eastern baccharis, wax myrtle, black needle rush (*Juncus roemerianus*), narrow leaf cattail, saltgrass (*Distichlis spicata*), common reed (*Phragmites australis*), saltmeadow cordgrass, sturdy bulrush, and chairmaker's bulrush (*Schoenoplectus americanus*).

4.6.1.2 Pipeline

The Pipeline from MP 0.0 to 16.0 and MP 39.5 to 95.9 is within the Western Gulf Coastal Plain Ecoregion. The Pipeline from MP 16.0 to 39.5 is within the South Central Plains Ecoregion. Locally termed the "piney woods," the South Central Plains Ecoregion is characterized by mostly irregular plains, representing the western edge of the southern coniferous forest belt. Once blanketed by a mix of pine and hardwood forests, much of the South Central Plains Ecoregion is now in loblolly and shortleaf pine (*Pinus echinata*) plantations. Only about one sixth of the region is in cropland, primarily within the Red River floodplain, while about two thirds of the region is in forests and woodland.

Field surveys conducted by Driftwood identified the presence of agriculture, herbaceous, scrub-shrub, wooded/forested, and wetland vegetation communities along the Pipeline route (see table 4.6-1). No aquatic vegetation was identified along the Pipeline route.

Agriculture

Crops cultivated along the Pipeline route include rice (*Oryza sativa*) and soybean (*Glycine max*). Pasture lands that would be crossed by the pipeline typically consisted of maintained natural herbaceous vegetation cover or were seeded with non-native grasses predominantly consisting of bermudagrass or bahiagrass (*Paspalum notatum*) for hay production.

Herbaceous

Dominant plant species observed within the upland herbaceous vegetation community included Saint Augustine grass, bermudagrass, and white clover.

Scrub-shrub

Dominant plant species observed within the upland scrub-shrub vegetation community included loblolly pine, American sweetgum, red maple (*Acer rubrum*), Chinese privet (*Ligustrum sinense*), yaupon, bushy bluestem, eastern baccharis, slender woodoats (*Chasmanthium laxum*), southern arrowwood (*Viburnum dentatum*), and Japanese climbing fern (*Lygodium japonicum*).

Wooded/Forested

Dominant plant species observed within the upland wooded/forested vegetation community included loblolly pine, Chinese tallow, water oak, white oak (*Quercus alba*), American sweetgum, red maple, American holly (*Ilex opaca*), southern arrowwood, yaupon, southern bayberry (*Morella caroliniensis*), slender woodoats, sawtooth blackberry, Japanese climbing fern, roundleaf greenbrier (*Smilax rotundifolia*), and peppervine (*Ampelopsis arborea*).

The majority of managed tree plantations along the Pipeline are dominated by varying age stands of loblolly pine and are exclusively used for timber production. Most pine plantations are mixed coniferous-hardwood communities such as mixed hardwood-loblolly pine forest and shortleaf pine-oak-hickory forest or pine-dominated communities such as western upland longleaf pine forest. Pine plantations have a varied understory and ground cover depending on the native habitat type present prior to conversion and the frequency and intensity of periodic maintenance activities. One managed tree plantation comprised of eucalyptus trees (*Eucalyptus* sp.) was documented along the Pipeline alignment between MP 54.5-57.0.

Wetlands

The wetland communities along the Pipeline consist of PEM, PSS, and PFO wetlands, further discussed in section 4.4 of this final EIS.

<u>Palustrine Emergent</u>

Dominant plant species observed within the PEM wetland community included Virginia buttonweed (*Diodia virginiana*), Vasey's grass (*Paspalum urvillei*), Chinese tallow, purpletop vervain (*Verbena bonariensis*), southern crabgrass (*Digitaria ciliaris*), common rush, dallisgrass, bermudagrass, leathery rush (*Juncus coriaceus*), and flatsedge (*Cyperus echinatus*).

<u>Palustrine Scrub-Shrub</u>

Dominant plant species observed within the PSS wetland community included Chinese tallow, loblolly pine, yaupon, peppervine, water oak, green hawthorn (*Crataegus viridis*), American holly, southern dewberry (*Rubus trivialis*), slash pine (*Pinus elliottii*), American elm (*Ulmus americana*), common rush, and American sweetgum.

<u>Palustrine Forested</u>

Dominant plant species observed within the PFO wetland community included Chinese tallow, water oak, loblolly pine, American sweetgum, yaupon, poison ivy, roundleaf greenbrier, wax myrtle, and trumpet creeper (*Campsis radicans*).

4.6.1.3 Invasive Plant Species

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. Many invasive species (non-native plants) are considered to pose a threat to native vegetation by displacing native plants and creating monocultures that reduce habitat biodiversity (Pimentel et al., 2005).

According to the Plant Protection Act of 2000 (7 USC 7701), 13 plants have been federally designated as noxious weeds that could occur in Louisiana, and one plant (Chinese tallow) has been designated as a noxious weed by the state of Louisiana (Louisiana Revised Statutes Title 3 Part 1791).

Invasive plant species observed at the LNG Facility site include Chinese tallow and alligator weed. Invasive terrestrial plant species observed along the Pipeline right-of-way include Chinese tallow, Chinese privet, bermudagrass, Johnson grass, Vasey's grass, little quaking grass (*Briza minor*), bahiagrass, and Japanese privet (*Ligustrum japonicum*). Invasive (aquatic) plant species observed along the Pipeline include giant salvinia (*Salvinia molesta*), common salvinia (*Salvinia minima*), alligator weed, water hyacinth (*Eichhornia crassipes*), and hydrilla (*Hydrilla verticillata*).

4.6.1.4 Vegetation Communities of Special Concern

Vegetation communities of special concern may include ecologically important natural communities or other rare or imperiled plant assemblages in need of special protection or minimal disturbance. In consultation with the LDWF and Louisiana Natural Heritage Program (LNHP), the two vegetation communities of special concern were identified as potentially occurring within the Project area: coastal prairie and longleaf pine savanna. Field surveys confirmed that the only vegetation community of special concern present within the Project area is longleaf pine savanna. Table 4.6-1 summarizes the location and spatial extent of these vegetation communities within the Project area.

Table 4.6-1

Vegetative Communities of Special Concern

MP Entry	MP Exit	Crossing Length (miles)	Crossing Width (feet)	Construction Acreages	Operation Acreages
Longleaf Pine Savanna					
20.8	21.1	0.3	110	3.8	1.7
21.3	21.6	0.3	130	4.3	1.6

Longleaf Pine Savanna

Longleaf pine savannas are fire-maintained herbaceous-dominated wetlands with an open-to-sparse canopy of longleaf pine as the dominant tree species. These habitats are subject to a highly fluctuating water table, surface saturation in late fall, winter, and early spring followed by dry conditions in the growing season. Longleaf pine savannas were reduced by 95 to 99 percent of their original extent due to construction activities, conversion to managed plantations, and residential and commercial developments. They are dominated by herbaceous species including broomsedges (*Andropogon* sp.), little bluestem (*Schizachyrium scoparium*), slender bluestem (*S. tenerum*), and panic grasses (*Panicum* sp.). Common forb species include gerardias (*Agalinis* sp.), lobelias (*Lobelia* sp.), meadow beauties (*Rhexia* sp.), and bog thistle (*Eryngium integrifolium*). In addition to longleaf pine, common woody species include black gum (*Nyssa sylvatica*), sweet bay (*Magnolia virginiana*), and blackjack oak (*Quercus marilandica*) (LDWF, 2017b).

Based on a field assessment, two longleaf pine savanna assemblages, totaling about 0.6 linear mile, were identified along the Pipeline alignment. No longleaf pine savannas were identified within the LNG Facility site.

4.6.2 Impacts and Mitigation

As identified in table 4.6-2 and described below, constructing and operating the LNG Facility and Pipeline would temporarily and permanently affect vegetation.

A total of 2,440.3 acres of vegetation would be cleared during construction of the Project. Following construction, about 637.5 acres would be permanently converted to industrial use associated with operation of the LNG Facility and the Pipeline aboveground facilities. An additional 557.5 acres within the permanent pipeline easement would be allowed revegetate. Forested communities in the permanent easement would be permanently converted to upland herbaceous or PEM wetland communities, and the remaining acreage would return to pre-construction vegetated conditions.

Table 4.6-2

Project Facilities and Their Associated Vegetation Impact Acreages

Facilities	Upland								Wetland									
	Agricultural [a]		Herbaceous		Scrub-Shrub		Forest [b]		PEM [c]		PSS [d]		PFO [e]		E2		Total [f, g]	
	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.
LNG Facility																		
Liquefaction Facility	0.0	0.0	71.5	71.5	2.4	2.4	5.4	5.4	15.1	15.1	3.3	3.3	61.0	61.0	68.7	68.7	227.4	227.4
Marine Berths	0.0	0.0	7.3	7.3	18.0	18.0	8.2	8.2	0.0	0.0	1.9	1.9	0.0	0.0	0.0	0.0	35.4	35.4
MOF	0.0	0.0	3.7	3.7	0.0	0.0	0.0	0.0	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	4.9	4.9
Construction Laydown (incl. temporary facilities)	0.0	0.0	8.6	8.6	22.6	22.6	14.5	14.5	20.5	20.5	3.9	3.9	27.7	27.7	3.4	3.4	101.2	101.2
Other Facilities (outside the berm)	0.0	0.0	22.9	22.9	13.7	13.7	24.4	24.4	14.1	14.1	4.8	4.8	26.4	26.4	53.0	53.0	159.3	159.3
Roads	0.0	0.0	7.0	7.0	0.0	0.0	1.8	1.8	1.2	1.2	0.0	0.0	12.0	12.0	1.1	1.1	23.1	23.1
Subtotal Within the LNG Facility Site	0.0	0.0	121.0	121.0	56.7	56.7	54.3	54.3	52.1	52.1	13.9	13.9	127.1	127.1	126.2	126.2	551.3	551.3
Outside LNG Facility Site																		
Subtotal for Temporary Offsite Construction Areas [h]	22.8	0.0	109.2	0.0	3.2	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	137.7	0.0
Total for the LNG Facility	22.8	0.0	230.2	121.0	59.9	56.7	56.8	54.3	52.1	52.1	13.9	13.9	127.1	127.1	126.2	126.2	689.0	551.3
Pipeline																		
Pipeline ROW	556.6	225.1	115.0	47.7	72.9	29.0	131.6	53.5	75.7	34.4	11.2	5.1	291.1	151.0	0.0	0.0	1,254.0	545.8
Pipeline ATWS	64.6	0.0	16.7	0.0	12.8	0.0	23.1	0.0	12.5	0.0	1.6	0.0	49.1	0.0	0.0	0.0	180.3	0.0
Pipe and Contractor Yards	98.8	0.0	18.5	0.0	2.5	0.0	5.9	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	125.9	0.0
Access Roads	18.1	4.7	5.5	0.4	21.4	5.8	14.3	0.8	2.9	<0.1	0.1	0.0	1.1	0.0	0.0	0.0	63.5	11.7
Subtotal Pipeline	738.1	229.8	155.7	48.1	109.6	34.8	174.9	54.3	91.0	34.4	12.9	5.2	341.5	151.0	0.0	0.0	1,623.7	557.5

Table 4.6-2

Project Facilities and Their Associated Vegetation Impact Acreages

	Upland								Wetland									
	Agricultural [a]		Herbaceous		Scrub-Shrub		Forest [b]		PEM [c]		PSS [d]		PFO [e]		E2		Total [f, g]	
Facilities	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.	Const.	Oper.
Aboveground Facilities																		
CS-01 and MS-06	0.0	0.0	0.0	0.0	1.4	0.9	29.3	17.3	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	30.9	18.4
CS-02	20.4	8.9	0.0	0.0	0.4	0.4	21.5	19.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.4	28.7
CS-03 and MS-14	17.8	9.3	1.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.0	10.0
Meter Stations [i]	24.4	21.3	0.0	0.0	1.2	0.6	5.6	4.2	4.1	3.0	0.1	0.0	0.0	0.0	0.0	0.0	35.4	26.9
Subtotal Aboveground Facilities	62.6	39.5	1.2	0.7	3.0	1.8	56.4	40.9	4.1	3.0	0.1	0.0	0.2	0.2	0.0	0.0	127.6	86.2
Total for Pipeline Facilities	800.7	269.3	156.9	48.8	112.6	36.7	231.3	95.2	95.1	37.4	12.9	5.2	341.7	151.2	0.0	0.0	1,751.3	643.7
Total for the Project	823.5	269.3	387.1	169.8	172.5	93.4	288.1	149.5	147.2	89.5	26.8	19.1	468.8	278.3	126.2	126.2	2,440.3	1,195.0

Note: Construction and operation acres in impact tables calculate the impact acreages based on the area of concern for each resource, and may not be the same for each resource. Footnotes in each table describe the areas of concern used for each resource table.

[a] Agricultural vegetation includes upland crops (e.g., rice and soy). Following construction, all upland agriculture would be allowed to revegetate to pre-construction conditions, and therefore, would be considered minor and temporary in nature.

[b] Upland forest vegetation includes tree plantations. Impacts on forested areas within a 30-foot-wide corridor centered on the permanent easement would be maintained in an herbaceous-dominated state; therefore, impacts would be considered permanent.

[c] PEM wetlands include emergent/ scrub shrub wetlands.

[d] PSS wetlands include scrub shrub/ forested wetlands.

[e] PFO wetlands include mosaic wetlands.

[f] Open water and developed lands are not included, as these areas typically are unvegetated or sparsely vegetated Acreage includes areas between HDDs that would be retained as permanent easement but would not be disturbed during construction or operation. Operation acreage assumes full 50-foot-wide permanent ROW and does not reflect the routine maintenance that would be conducted within a 10-foot (PEM and PSS wetlands) and 30-foot corridor (PFO wetlands) in wetlands during operation.

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

[h] Temporary Offsite Construction Areas would be permanently converted to industrial land use and returned to the landowners in their developed condition following construction.

MS-01 and MS-03 are accounted for in the LNG Facility footprint.

[i] Meter stations 01-05, 07-13, and 15.

4.6.2.1 LNG Facility

In total, about 689.0 acres of vegetation would be cleared for construction of the LNG Facility, including areas temporarily used for equipment laydown, parking, and staging during construction. Operating the LNG Facility would result in the permanent loss of the vegetated areas within the LNG Facility (551.3 acres), which includes 232.0 acres of upland vegetation and 319.3 acres of palustrine and estuarine wetland vegetation (see table 4.6-2). Wetlands impacts and mitigation are addressed in section 4.5. The temporary offsite construction areas, including park-and-rides (about 137.7 acres) would be returned to their owners in their developed condition.

To minimize impacts on adjacent vegetation resources, Driftwood would implement measures described in the Driftwood Plan and Procedures, which require the use of temporary and permanent erosion control measures. We determined that impacts on vegetation from construction and operation of the LNG Facility would be permanent, but because of the abundant similar vegetation resources in the region, the overall effect on this habitat would not be significant.

4.6.2.2 Pipeline

Construction of the Pipeline, and its associated temporary use areas for equipment laydown, parking, and staging, and operation of the Pipeline would result in impacts on vegetation (see table 4.6-2).

Driftwood would construct the Pipeline within a right-of-way that varies from 75 to 150 (typically 110) feet wide. During construction, Driftwood would remove surface vegetation and grade the construction right-of-way as necessary for pipeline installation and to allow for safe operation of equipment. Additional areas would be temporarily cleared of vegetation to allow for equipment laydown, parking, and staging during construction. Construction impacts would be temporary to permanent depending on the type of vegetation cover affected and the operational use of the land. The degree of construction impacts would depend on the type and amount of vegetation affected and the rate at which the vegetation would regenerate after construction.

Construction would disturb about 984.8 acres of non-wooded vegetation, of which about 312.3 acres would be within the permanent right-of-way (see table 4.6-2). Construction activities would result in the short-term alteration and loss of vegetation, and could result in increased soil erosion and changes to surface water flow and infiltration. In general, the disturbance of non-wooded/forested areas within temporary workspaces would be considered short-term because vegetation would be capable of recovering within 1 to 2 years for PEM wetlands and about 4 years for PSS wetlands after restoration and revegetation.

We received a comment on the draft EIS that the potential impacts of forest fragmentation were not sufficiently disclosed. The Pipeline would parallel or be collocated with existing disturbed corridors (pipelines, utilities, power lines, public and private roads, and other infrastructure) for about 68 miles, or 70 percent of the entire length of the Pipeline, which reduces the amount of forest fragmentation.

Construction would disturb about 638.9 acres of wooded vegetation (upland and wetland) as shown in table 4.6-2. Removal of wooded/forested vegetation could result in forest habitat fragmentation, edge effects, and an increased potential for invasive species establishment. The removal of mature trees could also result in secondary impacts such as increased erosion, increased light penetration, change in air temperature, and loss of soil moisture. The clearing of wooded/forested vegetation in temporary workspace that is then revegetated would result in a long-term decrease in the quality of wildlife habitat, due to the timeframe for a tree species to reach maturity. In addition to the permanent loss of vegetation at aboveground facility sites, wooded/forested vegetation within the permanent right-of-way would be permanently converted to an herbaceous vegetation community through revegetation following construction and maintained in this state during pipeline operations.

Following construction, DWPL would restore the construction workspaces to pre-construction conditions and contours according to the Driftwood Plan and Procedures. All vegetation communities within temporary construction use areas would be allowed to revegetate following construction. Revegetation rate would depend on conditions such as local climate, soil types, and land use. Impacts on agriculture, herbaceous, and PEM wetland vegetation would be minor and short-term because these areas would revegetate to a cover similar to pre-construction conditions within a few growing seasons. Wooded/forested areas cleared from the temporary construction work areas would be allowed to revert back to forest cover; however, complete recovery of mature forest systems would take decades and may not recover to a similar system.

The Driftwood Plan and Procedures, which require the use of temporary and permanent erosion control measures, topsoil segregation in agricultural and residential uplands and unsaturated wetlands, testing and mitigation for soil compaction, and limited routine vegetation maintenance would minimize impacts on vegetation. Disturbed areas would be routinely monitored until restoration and revegetation are successful. The Driftwood Procedures, which require adequate restoration of wetlands and waterbodies following construction, would also minimize impacts on vegetation.

Based on the use of the Driftwood Plan and Procedures to minimize impacts of the Pipeline, we conclude that impacts on vegetation from construction and operation of the Pipeline would range from temporary to permanent, but would not be significant.

4.6.2.3 Pipeline Aboveground Facilities

Construction and operation of the aboveground facilities associated with the Pipeline would result in impacts on vegetation (see table 4.6-2).

Driftwood would implement the measures described in the Driftwood Plan and Procedures, which require the use of temporary and permanent erosion control measures, topsoil segregation in agricultural and residential uplands and unsaturated wetlands, testing and mitigation for soil compaction, post-construction monitoring, and limited routine vegetation maintenance. Driftwood would also implement the measures described in the Driftwood Procedures, which require adequate restoration of wetlands following construction. With the implementation of the measures described above, we conclude that impacts on vegetation from construction and operation of the aboveground facilities associated with the Pipeline would range from temporary to permanent, but would not be significant.

4.6.2.4 Invasive Plant Species

Disturbance related to construction and maintenance activities would have the potential to introduce and increase the spread of invasive plant species, particularly in areas where vegetation is cleared. Activities in disturbed areas can spread invasive plant species rapidly due to the species' ability to establish more quickly and effectively than native species. Once spread or newly established, invasive species infestations can become permanent if left uncontrolled.

To minimize the spread and introduction of invasive plant species, Driftwood would implement control measures as outlined in the Revegetation and Invasive Species Management Plan (FERC eLibrary accession number 20170621-5139). Such measures include, but are not limited to, the following:

- restricting access of construction equipment and materials to only areas where required;
- ensuring that all equipment has been cleaned and is free of vegetation and debris prior to entering and exiting the Project area;
- segregating topsoil in wetland construction areas where conditions allow to maintain the existing seed bank;
- using erosion control devices that are certified weed-free; and
- monitoring the construction corridor and other disturbed areas following construction to verify that revegetation has been successful and that invasive plant species have not become widely established.

Because the LNG Facility site would be an industrial site with little vegetation, there is little risk of invasive plant species proliferating on the site, and no mitigation measures are proposed. Temporary offsite construction areas, which would be converted to industrial land use, would be returned to the original landowners for future use and maintenance in the converted state.

4.6.2.5 Vegetation Communities of Special Concern

As stated in section 4.6.1.4, there are two longleaf pine savanna habitat communities (totaling 8.1 acres) identified by LDWF that would be affected by Pipeline construction. LDWF recommended that a mitigation plan for impacts on these communities be developed. These communities occur primarily within wetlands, and impacts on these communities would be mitigated through the Project's compensatory wetland mitigation plan under COE jurisdiction, as discussed in section 4.5.2.4. The final compensatory mitigation plan would incorporate offsets for impacts on the longleaf pine savanna habitat.

No vegetation communities of special concern were identified within an aboveground facility footprint; therefore, no impacts on vegetation communities of special concern are anticipated due to construction and operation of the aboveground facilities.

4.7 WILDLIFE RESOURCES

Wildlife species occurring within and near the Project area are characteristic of the habitats provided by the vegetation communities that occur in these areas, which are described in detail in section 4.6.1. Habitat types were identified based on aerial photography and field surveys. Aquatic resources and special status wildlife species are discussed in sections 4.3 and 4.8, respectively.

4.7.1 Existing Wildlife Habitats

The wildlife habitat types present within the Project area include wetlands, forest, open water, open land, and agricultural land. Typical wildlife occurring within these habitat types are described below.

Wetlands

Wetland habitats are abundant throughout southern Louisiana. Wetland types within the LNG Facility site include PEM, PSS, PFO, and E2 wetlands. The Pipeline alignment contains palustrine (PEM, PSS, and PFO) and lacustrine (L2UB) wetlands. Wetlands typically support a diverse ecosystem that provides nutrients, cover, shelter, and water for a variety of terrestrial and aquatic wildlife species, including waterfowl, wading birds, raptors, mammals, reptiles, and amphibians.

Representative wildlife species associated with palustrine wetlands include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), river otter (*Lutra canadensis*), rice rat (*Oryzomys palustris*), swamp rabbit (*Sylvilagus aquaticus*), wood duck (*Aix sponsa*), least bittern (*Ixobrychus exilis*), green heron (*Butorides striatus*), red-winged blackbird (*Agelains phoeniceus*), southern leopard frog (*Rana utricularia*), bullfrog (*Rana catesbeiana*), cottonmouth (*Agkistrodon piscivorus*), and mud snake (*Farancia abacura*).

Representative wildlife species associated with estuarine wetlands include raccoon, rice rat, nutria (*Myocastor coypus*), brown pelican (*Pelecanus occidentalis*), great blue heron (*Ardea herodias*), green heron, fiddler crab (*Uca rapax*), and salt marsh snake (*Nerodia clarkia*). Reptiles and amphibians such as the American alligator *(Alligator mississippiensis)*, cottonmouth, Texas blind snake *(Leptotyphlops dulcis)*, Gulf Coast toad *(Incilius valliceps)*, and diamondback terrapin *(Malaclemys terrapin*) are associated with the wetland areas (LDWF, 2014a; COE, 2013a).

Wooded/Forested

Upland forest habitat is present in the northwestern portion of the LNG Facility site and many locations along the Pipeline alignment. Tree and shrub layers provide shelter and foraging habitat for various bird species and larger mammals. Organic material on the forest floor provides habitat for invertebrates, reptiles, smaller mammals, and amphibians. Representative wildlife species associated with upland forests include white-tailed deer, gray fox (*Urocyon cinereoargenteus*), gray squirrel (*Sciurus carolinensis*), cotton mouse (*Sigmodon hispidus*), opossum *(Didelphis virginiana*), and striped skunk (*Mephitis mephitis*). Typical bird species include the prothonotary warbler (*Protonotaria citrea*), wood thrush (*Hylocichla mustelina*), red-shouldered hawk (*Buteo lineatus*), Carolina chickadee (*Parus carolinensis*), loggerhead shrike (*Lanius ludovicianus*), eastern kingbird (*Tyrannus tyrannus*), brown-headed nuthatch (*Sitta pusilla*), pine warbler (*Dendroica pinus*), Northern bobwhite (*Colinus virginianus*), and tufted titmouse (*Parus bicolor*). Amphibians and reptiles include the green tree frog (*Hyla cinerea*), garter snake (*Thamnophis sirtalis sirtalis*), racer (*Coluber constrictor*), and pygmy rattlesnake (*Sistrurus miliarius*) (LDWF, 2014a; COE, 2013a).

Open Water

Open water is defined in this section as wildlife habitat associated with perennial, intermittent, and ephemeral waterbodies, ponds, lakes, and drainage ditches. Representative wildlife species associated with open water habitat includes wading birds, waterfowl, beavers, otters, nutria, snakes, and other wildlife species dependent on an aquatic environment. Aquatic resources are discussed in section 4.3.

Open Lands

Open lands are defined in this section as wildlife habitat consisting of uplands dominated by grasses, forbs, and shrubs. Representative wildlife species associated with open lands include white-tailed deer, striped skunk, spotted skunk (*Spilogale putorius*), cotton mouse, armadillo (*Dasypus novemcinctus*), raccoon, and eastern harvest mouse (*Reithrodontomys humulis*). Bird species include common yellowthroat (*Geothlypis trichas*), northern bobwhite, eastern bluebird (*Sialia sialis*), dickcissel (*Spiza americana*), rusty blackbird (*Euphagus carolinus*), red-tailed hawk (*Buteo jamaicensus*), northern harrier (*Circus cyaneus*), American robin (*Turdus migratorius*), cattle egret (*Bubulcus ibis*), and red-winged blackbird. Typical reptiles and amphibians include chorus frog (*Pseudacris* sp.), western rat snake (*Pantherophis obsoletus*), and garter snake (LDWF, 2014a; COE, 2013a).

Agricultural

Agricultural lands consist of areas used for cultivated crops, including rice production and crawfish farming, and managed tree plantations. No agricultural lands are present within the LNG Facility site; however, the Chennault Airport temporary offsite construction area contains some agricultural land and the Pipeline alignment traverses extensive agricultural lands. Due to low diversity of plant species and frequent disturbance, agricultural lands do not provide high-quality habitat for cover or nesting, but do provide foraging opportunities for several species. Irrigation ditches, ponds, and flooded fields provide habitat for shorebirds, wading birds, and waterfowl. Many species capable of inhabiting open lands would also use agricultural lands. Representative wildlife species that forage in agricultural lands near the Pipeline include white-tailed deer, striped skunk, eastern spotted skunk, cotton mouse, armadillo, raccoon, and eastern harvest mouse. Bird species occurring within agricultural lands include cattle egret, red-tailed hawk, northern harrier, American robin, red-winged black bird, and mourning dove. Typical amphibians and reptiles include rat snake, garter snake, and chorus frog (LDWF, 2014a; USGS, 2013). Although managed tree plantations have relatively low plant species diversity and are periodically disturbed, they provide cover, nesting, and foraging habitats for various mammal, bird, amphibian, and reptile species; representative species which may occur within managed tree plantations would be similar to those present in upland forested habitat.

4.7.2 Impacts and Mitigation

Wildlife habitat would be affected by construction of the Project. Overall, the greatest impacts would occur on agricultural land, upland and wetland forested habitat, and upland and wetland herbaceous habitat (see table 4.6-2).

4.7.2.1 LNG Facility

Impacts on wildlife from construction of the LNG Facility would include displacement, stress, and direct mortality or injury caused by construction machinery and vehicles. Vegetation clearing would 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., reptiles and amphibians) could be inadvertently injured or killed by construction equipment. The permanent reduction in available habitat within the LNG 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.

Construction and operation of the LNG Facility would also result in the permanent loss of wetlands. Compensatory mitigation for wetlands are discussed in detail in section 4.5.3. The wetland and saltmarsh mitigation would also serve to mitigate impacts on wildlife that are dependent on wetland habitats.

Operation of the LNG Facility would result in increased noise, lighting, and human activity that could disturb wildlife in the area. However, due to the LNG Facility's prior use as an industrial site and current industrial activities at other facilities along the Calcasieu Ship Channel, 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, Driftwood would implement its ESCP and construction SPCC Plan during construction, and would develop and implement an SPCC Plan during operation (see additional discussion in section 2.5).

Based on the relatively low habitat value of the LNG Facility site in its current condition, abundant similar habitat for wildlife near the LNG Facility site, Driftwood's proposed mitigation measures, and Driftwood's commitment to use the Driftwood Plan and Procedures, and SPCC Plans, we have determined that construction and operation of the LNG Facility would have permanent but minor impacts on wildlife.

4.7.2.2 Pipeline

Construction and operation of the Pipeline would result in both temporary and permanent alteration of wildlife habitat (see table 4.6-2). Within the Pipeline right-of-way, temporary wildlife impacts would be those associated with the disturbance and disruption to habitats during the construction period (e.g., vegetation clearing, human activity, noise), whereas permanent impacts generally would be associated with the conversion of habitat to maintained right-of-way, in particular, conversion of forested habitat to early successional habitats due to the periodic maintenance of the permanent Pipeline right-of-way.

The overall impact on wildlife would be minimized by the short duration of the disturbance and because the Pipeline would be, to the extent feasible, parallel or adjacent to existing maintained rights-of-way. However, forest habitat within the construction right-of-way would be modified to a different vegetation type (forest to scrub-shrub or herbaceous). Therefore, species that depend upon trees for food, refuge, or nesting would be displaced to nearby forest habitat.

Following construction, areas within the permanent right-of-way would be maintained in an herbaceous state, while temporary construction work areas would be restored to pre-construction conditions and revegetated by adhering to the Driftwood Plan and Procedures, and the Revegetation and Invasive Species Management Plan. In wetlands, vegetation would be maintained in an herbaceous state within a 10-foot-wide corridor centered on the Pipeline. Trees that are within 15 feet of the pipeline and have roots that could compromise the integrity of the pipeline coating would be selectively cut and removed from the permanent right-of-way, as described in the Driftwood Procedures.

The duration of impacts on terrestrial wildlife habitat would depend on the rate at which vegetation regenerates after construction. Agricultural lands would be available for replanting during the growing season immediately following construction. Emergent wetland habitat would start to revegetate during the next growing season after construction is completed. Open water habitats would revert to pre-construction condition shortly after the completion of in-water work (see section 4.7 for further discussion of impacts on aquatic resources). Forested habitat cleared from the temporary construction work areas would be allowed to revert back to forest cover, but complete recovery of mature forest systems are would take decades and may not recover to a similar system.

To minimize and mitigate impacts on wildlife species and their associated habitats, Driftwood would follow the Driftwood Plan and Procedures, ESCP, and Revegetation and Invasive Species Management Plan. Such impact minimization measures include, but are not limited to, the following: the use of temporary and permanent erosion control measures; topsoil segregation in agricultural and residential uplands and unsaturated wetlands; reducing construction right-of-way width in wetlands; testing and mitigation for soil compaction; and post-construction monitoring for revegetation success and invasive-species control. Although individuals of some wildlife species would be affected by construction and operation of the Pipeline, most impacts on wildlife would be temporary or short-term. With the implementation of these measures, and because abundant similar habitat is available for wildlife adjacent to the affected areas, we conclude that construction and operation of the Pipeline would have minor impacts on local wildlife populations and habitat.

4.7.2.3 Aboveground Pipeline Facilities

The impacts of aboveground facility construction on terrestrial wildlife and wildlife habitats would vary depending on the type of habitat affected, requirements of each species, timing of construction, and types of construction techniques used. The greatest effect on wildlife habitat would result from cutting, clearing, and/or removal of existing vegetation, which would reduce the amount of available wildlife habitat in the area and may result in direct mortality of less mobile wildlife (e.g., small mammals and reptiles). Larger or more mobile wildlife, such as birds and large mammals, would relocate to adjacent similar habitats. Noise and human disturbance during construction would generally result in wildlife avoiding areas of active construction.

Following construction, 86.2 acres of wildlife habitat (primarily agricultural lands and upland forest) would be permanently converted to industrial land use associated with the operation of the aboveground facilities. The remaining 41.4 acres would be allowed to revert to pre-construction conditions and would be revegetated according to the Driftwood Plan and Procedures, NRCS recommendations, other agency requirements and permit conditions, and landowner requests.

During operation, the aboveground facilities would be fenced for safety and security. The fencing would also limit the use of habitat by larger wildlife species, particularly mammals. In addition, increased noise levels near the compressor stations may result in wildlife avoiding the area unless/until they become acclimated to the noise increase.

Although individuals of some wildlife species would be affected by construction and operation of the aboveground facilities, most impacts on wildlife would be temporary or short-term. With the use of these measures, and because abundant similar habitat is available for wildlife adjacent to the affected areas, we conclude that construction and operation of the aboveground facilities would have permanent but minor impacts on local wildlife populations and habitat.

4.7.3 Unique and Sensitive Wildlife

Unique, sensitive, or significant habitats, such as breeding, rearing, nesting, or calving areas; migration routes; or high-quality cover or forage areas (e.g., large tracts of contiguous forest, mature cypress swamps, and established wildlife movement corridors) were evaluated within the Project area via desktop analyses and field surveys. In consultation with the LDWF and LNHP, longleaf pine savanna and coastal prairie habitats were identified as occurring in or near the Project area. Wildlife species occurring in and near the Project area are characteristic of the habitats provided by the plant communities that occur in these areas. Section 4.6.1 provides detailed information on the vegetation communities present within the aforementioned habitats. Table 4.6-1 summarizes the location and spatial extent of these habitats within the Project area. Representative wildlife species associated with longleaf pine savanna and coastal prairie habitats would be consistent with those described in section 4.6.1, in the open land and upland and wetland forest habitats.

Migratory birds, including colonial waterbirds, may be present near the Project area. Species protected under the Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA) are discussed in the following section. Special status wildlife species, including federal and state-listed threatened and endangered species and state species of concern, are discussed separately in section 4.8.

4.7.3.1 Migratory Birds

The MBTA of 1918 (16 USC §§ 703-712) uses various treaties and conventions between the U.S. and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. The MBTA (16 USC 703-711) as amended, implements protection of many native migratory game and non-game birds, with exceptions for the control of species that cause damage to agricultural or other interests. The MBTA prohibits the take of any migratory bird or their parts, nests, and eggs, where "take" means to "pursue, hunt, shoot, wound, kill, trap, capture, or collect."

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

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

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are afforded additional protection under the BGEPA, which prohibits the take, possession, sale, purchase, barter, offer to sell, purchase or barter, transport, export or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16 USC 668(a); 50 CFR 22). "Take," under the BGEPA is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." "Disturb" means "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." The bald eagle, while federally de-listed from protection by the ESA, continues to receive federal protection under the BGEPA and MBTA, and additionally affords state protection by the LDWF.

To accurately identify bird species with the greatest conservation priority and stimulate action by federal/state agencies and private parties, the USFWS Migratory Bird Office issued a report describing the Birds of Conservation Concern (USFWS, 2008). The report identifies priority bird species at national, regional, and Bird Conservation Region levels. Bird Conservation Regions are regions that encompass landscapes with similar bird communities, habitats, and resource management issues (North American Bird Conservation Initiative, 2018). Bird Conservation Regions were established to facilitate a regional approach to bird conservation and to identify overlapping or conflicting conservation priorities. The Project area is within Bird Conservation Regions 37 and 25 – Gulf Coastal Prairie and West Gulf Coastal Plain/Ouachitas, respectively (North American Bird Conservation Initiative, 2018). Table 4.7-1 identifies Birds of Conservation Concern with potential to occur in or near the Project area, indicates which species breed within the region and identifies the nesting habitat of the breeding species. Potential impacts on migratory birds that are also federally listed as threatened or endangered are described in section 4.8.1

Table 4.7-1

Birds of Conservation Concern Potentially Occurring Near the Project

Common Name	Scientific Name	Seasonal Occurrence	Occurrence Within the Project Area [a]	Colonial Waterbird	Breeds in Region [b]	Nesting Habitat [c]		
						Ground	Shrub	Tree
American bittern	*Botaurus lentiginosus*	Wintering	r	X				
American kestrel	*Falco sparverius paulus*	Year-round	u		B			X
American oystercatcher	*Haematopus palliatus*	Year-round	u	X				
Bachman's sparrow	*Aimophila aestivalis*	Year-round	c					
Bald eagle	*Haliaeetus leucocephalus*	Year-round	u		B			X
Black rail	*Laterallus jamaicensis*	Year-round	r					
Black skimmer	*Rynchops niger*	Year-round	u	X				
Brown-headed nuthatch	*Sitta pusilla*	Year-round	u		B			X
Chuck-will'-widow	*Caprimulgus carolinensis*	Summer	o		B			
Dickcissel	*Spiza americana*	Migrating	u		B		X	
Fox sparrow	*Passerella iliaca*	Wintering	o					
Gull-billed tern	*Gelochelidon nilotica*	Year-round	u	X				
Henslow's sparrow	*Ammodramus henslowii*	Wintering	u					
Hudsonian godwit	*Limosa haemastica*	Migrating	r					
Kentucky warbler	*Oporornis formosus*	Year-round	c		B	X		
Least bittern	*Ixobrychus exilis*	Summer	c	X	B	X		
LeConte's sparrow	*Ammodramus leconteii*	Wintering	o					
Lesser yellowlegs	*Tringa flavipes*	Summer	c					
Little blue heron	*Egretta caerulea*	Summer	c	X	B			
Loggerhead shrike	*Lanius ludovicianus*	Summer	u					
Long-billed curlew	*Numenius americanus*	Wintering	o					
Louisiana waterthrush	*Parkesia motacilla*	Summer	o		B			
Marbled godwit	*Limosa fedoa*	Wintering	o					
Mississippi kite	*Ictinia mississippiensis*	Summer	r		B			
Nelson's sharp-tailed	*Ammodramus nelsoni*	Wintering	u					
Orchard oriole	*Icterus spurius*	Summer	c		B			
Painted bunting	*Passerina ciris*	Summer	u		B		X	
Peregrine falcon	*Falco peregrinus*	Wintering	o					
Prothonotary warbler	*Protonotaria citrea*	Summer	c		B			X
Red knot (rufa ssp.)	*Calidris canutus rufa*	Wintering	r					
Red-headed woodpecker	*Melanerpes*	Year-round	o					
Reddish egret	*Egretta rufescens*	Year-round	r	X				X
Rusty blackbird	*Euphagus carolinus*	Wintering	r					

Table 4.7-1

Birds of Conservation Concern Potentially Occurring Near the Project

Common Name	Scientific Name	Seasonal Occurrence	Occurrence Within the Project Area [a]	Colonial Waterbird	Breeds in Region [b]	Nesting Habitat [c] Ground	Shrub	Tree
Sedge wren	*Cistothorus platensis*	Wintering	u					
Short-billed dowitcher	*Limnodromus griseus*	Wintering	c					
Short-eared owl	*Asio flammeus*	Wintering	r					
Snowy plover	*Charadrius alexandrinus*	Wintering	u					
Swainson's warbler	*Limnothlypis swainsonii*	Summer	u		B		X	
Swallow-tailed kite	*Elanoides forficatus*	Summer	r		B			X
Whimbrel	*Numenius phaeopus*	Wintering	o, r					
Wilson's plover	*Charadrius wilsonia*	Year-round	r					
Wood thrush	*Hylocichla mustelina*	Summer	u		B			
Worm eating warbler	*Helmitheros vermivorum*	Migrating	o		B			
Yellow rail	*Coturnicops noveboracensis*	Wintering	o	X				

[a] USFWS Southwest Louisiana NWR Complex Bird List Seasonal Abundance Classifications:
[b] = Breeding
[c] X = Nesting habitat type is only provided for those species that breed in Bird Conservation Region 37.
a = abundant (a common species which is very numerous);
c = common (certain to be seen in suitable habitat);
u = uncommon (present but not certain to be seen);
o = occasional (seen only a few times within a season);
r = rare (seen at intervals of 2 to 5 years).

Sources: USFWS, 2017a; Wiedenfeld and Swan, 2000.

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 (USFWS, 2002). Colonial waterbirds demonstrate nest fidelity, meaning that they return to the same rookery year after year. Rookeries are typically established in marshes or near the shores of ponds or streams. Although some colonial waterbirds (e.g., least terns) will 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 U.S. 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. The Project area is within the Mississippi Flyway, which ends at the Gulf Coast and is bordered by the Central Flyway to the west (National Audubon Society, 2016). Of the 650 species of birds known to occur in the U.S., nearly 400 species occur along the Gulf Coast (Esslinger and Wilson, 2001). The Gulf Coast provides wintering and migration habitat for large numbers of continental duck and goose populations that use the Mississippi Flyway. The coastal marshes of Louisiana, Alabama, and Mississippi regularly hold half of the wintering duck population of the Mississippi Flyway (Esslinger and Wilson, 2001). For the reasons listed above, the Gulf Coast is considered one of the most important waterfowl areas in North America.

Impacts and Mitigation

The vegetation communities within the Project area provide suitable habitat for migratory birds, including songbirds, waterbirds, and raptors. During field surveys conducted in 2016 and 2017, a total of 41 migratory bird species were observed within the LNG Facility area and 71 migratory bird species were observed along the Pipeline alignment. However, no colonies or rookeries associated with wading birds (including herons, egrets, night herons, ibis, and roseate spoonbill), anhingas, or cormorants were documented within the Project area. Although bird nests (active or inactive) may be present within the Project area, these species typically construct new nests each year, and survey results conducted in 2016 and 2017 would not be applicable at the time of construction.

The increased presence of humans, noise, and vibrations associated with project activities would likely cause sensory disturbances of migratory birds. The resulting negative effects are expected to be intermittent and short-term, occurring during work hours and ceasing after construction activities have moved from a given area. Displacement and avoidance of the area are direct responses to sensory disturbances. Birds may be injured or suffer mortality as an indirect effect of fleeing an area of disturbance. Sensory disturbances to adults could also result in nest abandonment, affecting egg-laying and potentially causing the mortality of young. In most cases, project activities would be short-term and episodic. As such, sensory disturbance effects associated with these activities may affect individuals but would not likely have notable effects on any local populations of migratory birds. Permanent aboveground structures, such as compressor stations, would create potential localized sensory disturbances for the operational life of the project, and thus would have more permanent effects. Impacts on migratory birds and their habitat due to construction and operation of the Project would be similar to impacts on general wildlife resources (see section 4.7.1).

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. Lighted vertical structures have the potential to result in avian mortality due to strikes. These strikes have been shown to occur most frequently involving migratory birds striking towers using steady burning, red obstruction lights during low-visibility conditions, such as night, fog, and inclement weather (Patterson, 2012). Lighting on stacks and flares would be performed according to applicable FAA requirements. Driftwood would follow the National Bald Eagle Management Guidelines for the LNG Facility and would continue to consult with the USFWS and LDWF to ensure compliance under the MBTA and establish avoidance and mitigation measures, as necessary.

Driftwood anticipates that flaring from the LNG Facility’s 350-foot flares would occur for about five days during startup of the LNG Facility. During operation of the LNG Facility, use of the emergency and marine flares would only occur during process upset conditions, which Driftwood anticipates would be no more than 12 hours during the first year of operation and no more than 6 hours in each subsequent year (each flaring event is expected to occur for between 15 and 60 minutes). Therefore, we have determined that the temporary flaring during construction and the occasional flaring during operation would not substantially affect migratory birds.

The LNG Facility and compressor stations would require adequate lighting for operations, security, and safety. During construction, Driftwood would direct all nighttime lighting towards construction activity and use the minimum light level necessary to ensure site safety and security. While the final *Facility Lighting Plan* for operation of the LNG Facility is in development, Driftwood has stated the plan would include down-facing lights with shielding needed to meet regulatory standards and minimize illumination specifications. LNG Facility lighting would be chosen to minimize the horizontal emission of light away from intended areas, and shielding would help minimize impacts on birds and other wildlife while providing the illumination needed to ensure safe operation.

Driftwood conducted visual simulations depicting anticipated nighttime lighting conditions at the LNG Facility (see detailed discussion in section 4.9.2.10). Based on the factors described above, we conclude that impacts on migratory birds as a result of construction lighting, would be temporary and localized. Given Driftwood's commitments to the mitigation measures noted above and the location of the facility in relation to similar industrial facilities, we conclude that impacts on migratory birds as a result of operational lighting would be permanent but minor. Similarly, to minimize the effects of artificial lighting on migratory birds, outdoor lighting at the compressor stations would be shielded and downward-facing and limited to that required for security only, unless active maintenance required nighttime work.

We conclude that impacts on migratory birds would primarily occur during construction and would not be significant.

Driftwood developed a preliminary set of mitigation measures that included conducting pre-construction clearing outside of the breeding season, before annual nests are established, to the extent practicable; conducting field surveys for nesting colonies no more than two weeks prior to clearing of migratory bird habitat during the nesting season, if required; coordinating with USFWS if protected species are encountered; and implementing a construction plan in accordance with respective guidelines. However, in their comments on the draft EIS, Driftwood indicated that it would only attempt to observe the clearing windows it had previously agreed to observe, based on the December 22, 2017, memorandum by the USFWS, clarifying the agency's interpretation of the MBTA to not prohibit incidental take (USFWS, 2017e). We acknowledge the change in the regulatory interpretation but maintain that Driftwood should consult with the USFWS to determine whether prudent measures can and should be employed to minimize impacts on migratory birds. Therefore, **we recommend that:**

> **<u>Prior to construction</u>, Driftwood should consult with the USFWS and file with the Secretary a final set of mitigation measures for migratory birds and evidence of consultation with the USFWS.**

4.8 SPECIAL STATUS SPECIES

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are species listed or proposed to be listed as threatened or endangered under the ESA; species that are currently candidates for federal listing under the ESA; state-listed threatened or endangered species; and species otherwise granted special status at the state or federal level (e.g., protected under the Marine Mammal Protection Act of 1972 [MMPA]). In addition to these species with federal and state protection, consultation with the LDWF identified seven "species of concern" as potentially occurring within the Project area (LDWF, 2017c). These species of concern are considered special status species for the purposes of this analysis; however, they are not afforded protection under federal or state law.

Federal agencies are required, under Section 7 of the ESA, to ensure that any actions authorized, funded, or carried out by the agency would not jeopardize the continued existence of a federally listed threatened or endangered species or result in the destruction or adverse modification of the designated critical habitat of a federally listed species. As the lead federal agency, FERC is required to coordinate with the USFWS and NMFS to determine whether federally listed threatened or endangered species or designated critical habitat are found near the project and to analyze potential effects on those species and critical habitats.

For actions involving major construction activities with the potential to affect listed species or designated critical habitat, Section 7 of the ESA requires the lead federal agency to prepare and submit a biological assessment to the USFWS and/or NMFS. If the action is determined likely to adversely affect a listed species, the federal agency must also submit a request for formal consultation. In response, the USFWS and/or NMFS would issue a Biological Opinion if the federal action would likely jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Our findings of effect for the federally listed species are found in table 4.8-1. Our species determinations consisted of either *no effect*, or *may affect, not likely to adversely affect*; therefore, no formal consultation or biological assessment is required.

To aid in compliance with Section 7 of the ESA, Driftwood, acting as FERC’s non-federal representative for the Project, initiated informal consultation with the USFWS Louisiana Ecological Services Field Office (USFWS, 2016a), NMFS (NMFS, 2016a), and LDWF (LDWF, 2016b) regarding federally and state-listed and other special status species or habitat with the potential to be affected by construction and operation of the Project.

The NMFS, in its February 14, 2018, letter (NMFS, 2018b) concluded that the proposed action is not likely to adversely affect listed species or critical habitat under NMFS's purview and that consultation under the ESA was complete.

The USFWS, in its March 31, 2017, letter (USFWS, 2017b) confirmed that red-cockaded woodpecker is the only federally listed species under the jurisdiction of the USFWS with potential to occur in the Project area and that the Project is not likely to adversely affect this resource. Thus, consultation with the USFWS is complete. One additional species, the eastern black rail, was proposed for listing as threatened by the USFWS on October 9, 2018, after issuance of the draft EIS, and could be present in the Project area.

Based on a review of publicly available information and agency correspondence, a total of 48 special status species may occur within the Project area and/or along the marine transit route in Cameron Parish (i.e., where material barges would transit during construction and LNG carriers would transit during operation). One area designated as critical habitat for the federally and state-listed threatened piping plover was identified in Cameron Parish along the shoreline of the Gulf Coast. Federally and state-listed species and species of concern potentially occurring within the Project area are identified in table 4.8-1 and discussed in sections 4.8.1, 4.8.2, and 4.8.3 below.

Table 4.8-1

Special Status Species Potentially Occurring in the Project Area

Common Name	Scientific Name	Status [a]	Parish	Project Component	Agency	ESA Determination of Effect
Birds						
Bald eagle	*Haliaeetus leucocephalus*	SE	Calcasieu	Pipeline	USFWS (MBTA), LDWF	Determination not required
Brown pelican [b]	*Pelecanus occidentalis*	SE	Cameron	Marine Transit	USFWS (MBTA), LDWF	Determination not required
Crested caracara [c]	*Caracara cheriway*	S1	Calcasieu, Cameron	LNG Facility, Pipeline	USFWS (MBTA), LDWF	Determination not required
Interior least tern [b]	*Sternula antillarum athalassos*	SE	Cameron	Marine Transit	USFWS (MBTA), LDWF	Determination not required
Piping plover [b]	*Charadrius melodus*	FT, ST	Cameron	Marine Transit	USFWS, LDWF	No effect
Red knot [b]	*Calidris canutus rufa*	FT	Cameron	Marine Transit	USFWS	No effect
Red-cockaded woodpecker	*Picoides borealis*	FE, SE	Calcasieu, Evangeline	Pipeline	USFWS, LDWF	May affect, not likely to adversely affect
Eastern black rail	*Laterallus jamaicensis*	Proposed	Evangeline, Acadia, Jefferson Davis, Calcasieu	LNG Facility, Pipeline	USFWS	May affect, not likely to adversely affect
Fish						
Atlantic sturgeon [b]	*Acipenser oxyrhynchus desotoi*	FT	Cameron	Marine Transit	NMFS	No effect
Smalltooth sawfish	*Pristis pectinata*	FE	Cameron	Marine Transit	NMFS	No effect
Invertebrates						
Calcasieu painted crawfish [c]	*Orconectes blacki*	S1	Calcasieu	LNG Facility, Pipeline	LDWF	Determination not required
Old prairie crawfish [c]	*Fallicambarus macneesei*	S2	Calcasieu, Jefferson Davis, Acadia	LNG Facility, Pipeline	LDWF	Determination not required
Mammals						
Fin whale [b]	*Balaenoptera physalus*	FE	Cameron	Marine Transit	NMFS	May affect, not likely to adversely affect
Humpback whale [b]	*Megaptera novaeangliae*	FE	Cameron	Marine Transit	NMFS	May affect, not likely to adversely affect
Sei whale [b]	*Balaenoptera borealis*	FE	Cameron	Marine Transit	NMFS	May affect, not likely to adversely affect
Sperm whale [b]	*Physeter macrocephalus*	FE	Cameron	Marine Transit	NMFS	May affect, not likely to adversely affect
West Indian manatee [b]	*Trichechus manatus*	FE, SE	Cameron	Marine Transit	USFWS, NMFS	May affect, not likely to adversely affect
Reptiles						
Green sea turtle [b]	*Chelonia mydas*	FT	Cameron	Marine Transit	NMFS	May affect, not likely to adversely affect

Table 4.8-1

Special Status Species Potentially Occurring in the Project Area

Common Name	Scientific Name	Status [a]	Parish	Project Component	Agency	ESA Determination of Effect
Hawksbill sea turtle [b]	*Eretmochelys imbricata*	FE	Cameron	Marine Transit	NMFS	May affect, not likely to adversely affect
Kemp's Ridley sea turtle [b]	*Lepidochelys kempii*	FE	Cameron	Marine Transit	NMFS	May affect, not likely to adversely affect
Leatherback sea turtle [b]	*Dermochelys coriacea*	FE	Cameron	Marine Transit	NMFS	May affect, not likely to adversely affect
Loggerhead sea turtle [b]	*Caretta*	FT	Cameron	Marine Transit	NMFS	May affect, not likely to adversely affect
Plants						
American chaffseed	*Schwalbea americana*	FE	Calcasieu, Jefferson Davis	LNG Facility, Pipeline	USFWS	No effect
Grapefruit primrose willow [c]	*Ludwigia sphaerocarpa*	S2	Calcasieu	LNG Facility, Pipeline	LDWF	Determination not required
Green milkweed [c]	*Asclepias hirtella*	S1	Calcasieu, Jefferson Davis	LNG Facility, Pipeline	LDWF	Determination not required
Long-sepaled false dragon-head [c]	*Physostegia longisepala*	S2S3	Calcasieu, Jefferson Davis, Acadia	LNG Facility, Pipeline	LDWF	Determination not required
Small-fruited water-willow [c]	*Ludwigia microcarpa*	S1	Calcasieu	LNG Facility, Pipeline	LDWF	Determination not required

[a] FE = Federal Endangered; FT = Federal Threatened; SE = State Endangered; ST = State Threatened; S1 = Critically imperiled in Louisiana because of extreme rarity (5 or fewer known extant populations) or because of some factor(s) making it especially vulnerable to extirpation; S2 = Imperiled in Louisiana because of rarity (6 to 20 known extant populations) or because of some factor(s) making it very vulnerable to extirpation; S3 = Rare and local throughout the state or found locally (even abundantly at some of its locations) in a restricted region of the state, or because of other circumstances making it vulnerable to extirpation (21 to 100 known extant populations).

[b] Species are federally or state-listed within Cameron Parish along marine transit routes. These species are not listed within Calcasieu Parish where the LNG Facility and Pipeline are located.

[c] Based on consultation with the LDWF, these state species of concern may be present within the Project area and are included in the analysis herein, but are not afforded legal protection.

4.8.1 Federally Listed Species

Based on information obtained from the USFWS and NMFS, 16 federally listed species may occur within the parishes affected by the Project. Of these, 12 are marine species (five sea turtle species, four whale species, two fish species, and the West Indian manatee) that may occur in the Calcasieu Ship Channel in Cameron Parish, Louisiana, or off the Gulf Coast. Therefore, potentially suitable habitat for these species is limited to the portion of the marine transit in Cameron Parish and the Gulf of Mexico.

4.8.1.1 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 are listed as threatened or endangered under the ESA and are under the shared jurisdiction of the USFWS and NMFS. The major threats to sea turtle populations are overharvesting, fisheries by-catch, disease, pollution, and coastal development of nesting beaches. Five species of federally listed sea turtles could occur along the portion of the marine transit routes in Cameron Parish and the Gulf of Mexico, which are further described below.

Green Sea Turtle

The green sea turtle (*Chelonia mydas*) is currently federally listed as threatened. On March 23, 2015, the USFWS and NMFS found that the green sea turtle population is composed of 11 distinct population segments that qualify as unique species for the purposes of listing under the ESA (Federal Register 15271–15337). As a result, the green sea turtles occurring off the coast of Louisiana are part of the North Atlantic distinct population segment. This species occurs within coastal and offshore waters off of Louisiana, but is rarely documented off the western portion of the state (Fuller et al., 1987).

Green sea turtles are generally found in shallow water inside bays, inlets, and reefs with an abundance of seagrass and algae. They use coral reefs and rocky outcrops near feeding areas to rest, and they feed on marine plants, mollusks, sponges, crustaceans, and jellyfish. As one of the more coastal species of sea turtle, adult green sea turtles forage primarily on seagrass and marine algae. Hatchlings feed on a variety of plants and animals and have been observed using brown algae (*Sargassum*) mats for food and refuge. Green sea turtles can exhibit high nesting site fidelity, which can lead to common migratory routes between feeding grounds and nesting beaches. Green sea turtles nest on open, sloping beaches with minimal disturbance (USFWS, 2012a; NMFS, 2013a). Suitable nesting habitat is not present along the marine transit routes; however, adult green sea turtles could potentially use these areas for transit and juveniles could potentially use these areas for foraging.

Hawksbill Sea Turtle

The hawksbill sea turtle (*Eretmochelys imbricata*) is federally listed as endangered. This species is widely distributed throughout the Caribbean Sea and western Atlantic Ocean. The hawksbill sea turtle is not commonly known to occur in either inshore or offshore waters of Louisiana and is one of the most infrequently encountered sea turtles in offshore Louisiana (COE, 2013a). However, a hawksbill was reported near Calcasieu Lake in 1986 (Fuller et al., 1987). The species occurs in shallow coastal areas, rocky areas, and coral reefs, and near oceanic islands (USFWS, 2012b). Hawksbill sea turtles feed on sponges, other invertebrates, and algae (NMFS, 2013b). Young hawksbills are found foraging in association with *Sargassum* mats in the open ocean; as they mature, hawksbill sea turtles commonly forage over coral reefs and hard bottom substrates. The species nests in low densities on scattered undisturbed deep-sand beaches in the tropics (USFWS, 2012b). Suitable nesting habitat is not present along the marine transit routes; however, adult hawksbill sea turtles could potentially use these areas for transit and juveniles could potentially use these areas for foraging.

Kemp's Ridley Sea Turtle

The Kemp's Ridley sea turtle (*Lepidochelys kempii*) is federally listed as endangered. This species is the smallest marine turtle in the world and has been documented off the coast of Louisiana more than other sea turtles (Fuller et al., 1987). This species has been documented within Calcasieu Lake, though very rarely (Fuller et al., 1987). Juvenile Kemp's Ridley sea turtles are generally found in Louisiana's coastal waters from May through October, and adults are generally found during the spring and summer near the mouth of the Mississippi River. During the winter months, Kemp's Ridley sea turtles typically move offshore to deeper, warmer waters, but some of the deepwater channels and estuaries in Louisiana could provide thermal refuge (COE, 2013a). Kemp's Ridley sea turtles feed primarily on crabs, but are also known to feed on fish, jellyfish, and mollusks (USFWS, 2012c; NMFS, 2013c). This species is not known to nest on the Louisiana coast; however, it could also use the estuarine and offshore waters along the marine transit routes for foraging and transit during the non-nesting season.

Leatherback Sea Turtle

The leatherback sea turtle (*Dermochelys coriacea*) is federally listed as endangered. The leatherback is the largest sea turtle and spends more of its life in the open ocean environment than other sea turtles. Because it spends most of its life in the open ocean, the leatherback sea turtle is rarely documented, and not commonly known to occur in either inshore or offshore waters of Louisiana (Fuller et al., 1987). Leatherback sea turtles occur globally and range farther north and south than other sea turtles, likely due to their ability to maintain warmer body temperatures. Leatherback sea turtles feed primarily on soft-bodied animals such as jellyfish and sea squirts; however, they are also known to consume sea urchins, crustaceans, fish, and floating seaweed. Females require sandy beaches with deepwater approach for nesting habitat (USFWS, 2012d; NMFS, 2013d). The largest nesting assemblages are found in northern South America and West Africa; however, within the U.S., southeast Florida, the U.S. Virgin Islands, and Puerto Rico are their primary nesting locations (NMFS, 2013d). Suitable nesting habitat is not present along the marine transit routes; however, leatherback sea turtles could potentially use these areas for transit and foraging.

Loggerhead Sea Turtle

The loggerhead sea turtle (*Caretta caretta*) is federally listed as threatened. This species occurs throughout the world in temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. The loggerhead sea turtle is occasionally documented off the coast of Louisiana, although the majority of the sightings occur east of the Vermillion River (over 70 miles east of the marine transit route through Cameron Parish) (Fuller et al., 1987). The loggerhead sea turtle can migrate significant distances between foraging areas, breeding areas, and nesting locations. They can be found in inshore areas such as bays, ship channels, large river mouths, and salt marshes as well as hundreds of miles offshore. Loggerhead sea turtles feed on mollusks, crustaceans, fish, conchs, and other marine animals (USFWS, 2012e; NMFS, 2013e).

Critical habitat for the loggerhead sea turtle (LOGG-S-2) occurs in the Gulf of Mexico off the coast of Louisiana and consists of the following primary constituent elements: (i) *Sargassum* in concentrations that support adequate prey abundance and cover, and (ii) 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 (NMFS, 2018a).

Young loggerheads occur in the open ocean and are often found in association with *Sargassum* mats, while juveniles and adults reside in coastal areas in between reproductive migrations where females return to their natal beach to nest. In the U.S., loggerheads can be found nesting from Texas to Virginia, though the major nesting concentrations occur in Florida, Georgia, South Carolina, and North Carolina (USFWS, 2012e). Suitable nesting habitat is not present along the marine transit routes; however, loggerhead sea turtles could potentially use inshore and offshore areas for transit and foraging.

Sea Turtle Impacts and Mitigation

No suitable nesting habitat for sea turtles is present along the marine transit routes; however, foraging and transit habitat for these species is present within these areas. The increased traffic within the Calcasieu Ship Channel and Gulf of Mexico due to barges during construction and LNG carriers during operation could pose an increased risk to sea turtles from carrier strikes. Barges and LNG carriers would use established, well-traveled shipping lanes. During operation, LNG carriers would make up to 365 trips to the LNG Facility per year (one round trip per day). Vulnerability to collisions would be greatest while sea turtles feed, swim, and rest near the surface of the water. However, LNG carriers push a considerable bow wave when underway on the open ocean because of their design and large displacement tonnage. This bow wave pushes water, flotsam, and other small objects (such as sea turtles) away from the carrier. To further minimize the potential for carrier strikes, Driftwood would provide LNG carrier captains with the NMFS-issued document *Vessel Strike Avoidance Measures and Reporting for Mariners* (NMFS, 2008), which outlines collision-avoidance measures.

Impacts on loggerhead sea turtle critical habitat (LOGG-S-2) would occur as a result of LNG carrier traffic which may drive through and disrupt the *Sargassum* mats. However, the vessel tracks resulting from these activities are not anticipated to scatter *Sargassum* mats or harm organisms in the *Sargassum* to the point of affecting the functionality of the loggerhead critical habitat primary constituent elements. The wakes and surface water disruption associated with these vessels may temporarily disturb a *Sargassum* mat (for a few minutes up to a few hours); however, any potential disturbance would be insignificant, as it would not be expected to result in adverse effects to the distribution, size, or composition of mats or their ability to support loggerheads or their prey resources (NMFS, 2018a).

Based on the sea turtle's characteristics and habitat requirements and the aforementioned minimization measures, we have determined that the LNG Facility *may affect, but is not likely to adversely affect* sea turtles. On February 14, 2018, the NMFS provided a determination of effect letter indicating concurrence with our determination (NMFS, 2018b).

4.8.1.2 West Indian Manatee

The West Indian manatee (*Trichechus manatus*) is federally listed and state-listed as endangered. This species is an herbivorous marine mammal most commonly found in coastal estuaries and rivers in Florida and Georgia, but has been documented from Texas to Massachusetts. Manatees are a sub-tropical species that are not cold-tolerant and reside in the warm waters of peninsular Florida during the winter; however, they may disperse great distances during warmer months (USFWS, 2007). They feed on aquatic plants such as seagrass, water hyacinths, hydrilla, and eelgrass. Mating can occur at any time of year with adults usually giving birth to a calf every two to five years. Calves may be present throughout the year and usually remain with their mother for up to two years. The greatest threats to the manatee are collisions with boats and loss of warm water habitat. They often rest suspended just below the water's surface, making them highly vulnerable to being hit by vessels, including barges and LNG carriers.

The manatee has been documented within the Calcasieu River Basin and could occur along the portions of the marine transit routes in Cameron Parish and the Gulf of Mexico (USFWS, 2014); however, given the level of industrial activity and lack of foraging habitat within the Calcasieu Ship Channel, their presence within this area is unlikely. Due to the LNG Facility's location several miles north of Calcasieu Lake within the Calcasieu Ship Channel, the likelihood of manatees occurring near the recessed berthing area is discountable.

Increased traffic within the Calcasieu Ship Channel due to marine transit to and from the LNG Facility could pose an increased risk to manatees from vessel strikes. In areas of intense marine traffic, manatees can experience propeller or collision injuries; however, most of these injuries are caused by small, fast-moving vessels. As described in section 4.8.4, Driftwood proposes to provide LNG carrier captains with a NMFS-issued guidance document that outlines collision-avoidance measures to reduce potential for impacts from carrier strikes. Based on the manatee's characteristics and habitat requirements, the lack of foraging habitat along the marine transit routes, and the aforementioned risk-minimization measures, we have determined that the LNG Facility *may affect, but is not likely to adversely affect* the West Indian manatee.

4.8.1.3 Whales

Sperm Whale

The sperm whale (*Physeter microcephalus*) 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. Migrations are not as distinct as other species and are thought to primarily follow food resources (NMFS, 2010a). Sperm whales are present in the northern Gulf of Mexico in all seasons, but are more common during the summer months (NMFS, 2014a). The sperm whale is the only federally listed whale that is known to commonly occur in the Gulf of Mexico (NMFS, 2012) and the only whale with a measureable injury rate due to vessel strikes in the Gulf of Mexico (NMFS, 2018a).

Humpback Whale

The humpback whale (*Megaptera novaeangliae*) is a baleen whale that is distributed throughout the world's oceans. They generally spend winter months in lower temperate and tropical waters then migrate to higher latitudes during the summer months to feed in areas of high productivity. They winter in tropical waters near deeper water. Calving occurs primarily during the winter months; the only breeding ground in U.S. waters is near Puerto Rico (NMFS, 1991). Although humpback whales have been documented within the Gulf of Mexico, no population estimates are available for this area, as sightings are uncommon (NMFS, 2012).

Other Baleen Whales

Other baleen whales, including the fin whale (*Balaenoptera physalus*) and sei whale (*Balaenoptera borealis*), are listed by NMFS as occurring within the southeast region. Like the humpback, these whales are not commonly found in the Gulf of Mexico, but could occur within the area during migrations or other movements (NMFS, 2012). 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 (NMFS, 1998, 2010b, 2011). Calving and breeding grounds have not been identified for these species in the Gulf of Mexico.

Whale Impacts and Mitigation

Whales could be vulnerable to vessel strikes during construction and operation of the LNG Facility. Vulnerability to collision with barges during construction and LNG carriers during operation would be greatest while these animals feed, swim, and rest near the surface of the water. In areas of intense vessel traffic, whales can experience propeller or collision injuries; however, most of these injuries are caused by small, fast-moving vessels. In addition, barges and carriers would use established and well-traveled shipping lanes. As described in section 4.8.4, Driftwood would provide LNG carrier captains with a NMFS-issued guidance document that outlines collision-avoidance measures to be used to minimize the likelihood of a vessel strike. Based on the whales' characteristics and habitat requirements and the aforementioned minimization measures, we have determined that the LNG Facility *may affect, but is not likely to adversely affect* federally listed whales. On February 14, 2018, the NMFS provided a determination of effect letter indicating concurrence with our determination (NMFS, 2018b).

4.8.1.4 Piping Plover

The piping plover (*Charadrius melodus*) is a federally and state-listed threatened bird species. Critical habitat for the piping plover has been designated along the shores of the Gulf Coast including Cameron Parish, Louisiana. The species' breeding range includes the U.S. and Canadian Great Plains, extending from Nebraska to Alberta and Manitoba, and the beaches of the Great Lakes and Atlantic seashore from North Carolina to Newfoundland. The species' winter distribution includes the southern Atlantic and Gulf coasts and several Caribbean islands. In Louisiana, the species is known to occur as a non-breeding resident in Cameron Parish (USFWS, 2017d). Non-breeding habitat for the species consists primarily of beaches and mudflats of barrier islands (LDWF, 2017d). Where the piping plover may occur in Cameron Parish, Project activities would not include shoreline or near-shore disturbance; activities would be limited to marine traffic. Barges and LNG carriers would use established and well-traveled shipping lanes and would not affect the piping plover, its habitat, or its designated critical habitat. Based on the species characteristics and habitat requirements, we have determined that the LNG Facility would have *no effect* on the piping plover.

4.8.1.5 Red Knot

The red knot (*Calidris canutus rufa*) is a federally listed threatened bird species. Although the species breeds on the high arctic tundra, the red knot is almost exclusively coastal in the winter. During the winter, the species forages on bivalves, small snails, and crustaceans on soft sands and tidal estuaries and along coastlines. In Louisiana, the species is known to occur as a non-breeding resident in Cameron Parish (Audubon Louisiana, 2013). Where the red knot may occur in Cameron Parish, Project activities would not include shoreline or near-shore disturbance and activities would be limited to marine traffic. Barges and LNG carriers would use established and well-traveled shipping lanes and would not affect the red knot or its habitat. Based on the species characteristics and habitat requirements, we have determined that the LNG Facility would have *no effect* on the red knot.

4.8.1.6 Red-cockaded Woodpecker

The red-cockaded woodpecker (*Picoides borealis*) is a federally and state-listed threatened species. Habitat for the red-cockaded woodpecker is very specific, consisting of longleaf pine forests or mixed pine-upland hardwood forests with little or no hardwood mid-story. The average cavity trees range in age from 60 to 126 years for longleaf pine, 70 to 90 years for loblolly pine, and 75 to 149 years for shortleaf pine (LNHP, 2016). This species historically ranged throughout much of the southeast U.S., but now is virtually extirpated. Estimates from the USFWS indicate about 14,000 red-cockaded woodpeckers remain across 11 states (USFWS, 2003).

Driftwood performed field studies between August and September 2016 and in January 2017 to evaluate the presence/absence of suitable habitat within the LNG Facility site and along the Pipeline alignment. Based on field observations, no individuals or suitable habitat were identified within the LNG Facility site. Potentially suitable habitat (longleaf pine savanna) was identified along the Pipeline from MP 20.8 to 21.1 and from MP 21.3 to MP 21.6 (FERC eLibrary accession number 20170331-5058); however, based on further observation, it was determined that these areas exhibited evidence of active management such as mechanical clearing, and were dominated by young trees and a dense understory consistent with low-quality habitat.

The results of the field surveys were provided to the USFWS on August 2, 2016 (USFWS, 2016f). Based on the information provided, the USFWS determined that the Pipeline *may affect, but is not likely to adversely affect* the red-cockaded woodpecker (USFWS, 2017b). We are in agreement with that determination.

4.8.1.7 Eastern Black Rail

On October 9, 2018, the USFWS proposed the eastern black rail for listing as threatened under the ESA, with a final rule anticipated no later than October 2019 (83 FR 50610). Under the ESA, federal agencies are required to confer with the USFWS on agency actions that may be likely to jeopardize a proposed species. The USFWS would typically finalize or withdraw the listing about 12 months after the proposal depending on comments received; ESA protections become effective 30 days after the final listing rule is published.

The eastern black rail is found in a variety of salt, brackish, and freshwater marsh habitats that can be tidally or non-tidally influenced. Within these habitats, the birds occupy relatively high elevations along heavily vegetated wetland gradients, with soils that are moist or flooded to a shallow depth (83 FR 50610). The eastern black rail requires dense vegetation cover that allows movement underneath the canopy. Plant structure is considered more important than plant species composition in predicting habitat suitability for the eastern black rail (83 FR 50610). Occupied habitat tends to be primarily composed of fine-stemmed emergent plants (rushes, grasses, and sedges) with high stem densities and dense canopy cover (83 FR 50610). However, when shrub densities become too high, the habitat becomes less suitable for the eastern black rail. Soils are moist to saturated (occasionally dry) and interspersed with or adjacent to very shallow water (1 to 6 centimeters) (83 FR 50610).

Louisiana is not currently known to support a breeding black rail population (Watts, 2016). There are no confirmed breeding records, and historic observations during the breeding season are rare. Most historic and recent records are from the Broussard Beach area of Cameron Parish (Watts, 2016), which is approximately 22 miles from the Driftwood LNG Facility site and the nearest point of the Pipeline.

Primary threats to the eastern black rail include habitat loss due to continued alteration and loss of wetland habitats, land management practices that result in fire suppression (or inappropriately timed fire application that may cause direct mortalities), grazing, haying and mowing, and impounding of wetlands (USFWS, 2018b). In addition, projected sea level rise and associated tidal flooding, increased temperatures, decreased precipitation, increased drought and severe weather events producing flooding or changes in wildfire frequency and intensity are all likely to have significant impacts on eastern black rail populations and their habitat (USFWS, 2018b).

The eastern black rail is proposed for listing as federally threatened and may become listed prior to or during construction. Should the eastern black rail be listed, the Project would be required to complete any necessary Section 7 consultation. Because previous consultation with the USFWS did not include consideration of the eastern black rail, **we recommend:**

<u>Driftwood should not begin construction activities until</u>:

a. Driftwood consults with the USFWS to determine whether proposed Project activities could affect the eastern black rail or its habitat and files copies of all correspondence with the Secretary;

b. FERC staff completes its conference with the USFWS, if required; and

c. Driftwood has received written notification from the Director of OEP that construction may begin.

4.8.1.8 Atlantic Sturgeon

The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is a federally listed threatened fish species. The Atlantic sturgeon is an anadromous fish that spawns in large, free-flowing, freshwater rivers with hard substrates composed of sand, rock, or rubble in spring; forages in lower rivers during summer months; and returns to coastal waters of the Gulf of Mexico during the winter. The western extent of the species' present range is Lake Pontchartrain, which is over 125 miles east of the Project (USFWS, 2009). Based on the known range and distribution, we have determined that the LNG Facility would have *no effect* on the Atlantic sturgeon.

4.8.1.9 Smalltooth Sawfish

The smalltooth sawfish (*Pristis pectinata*) is a federally listed endangered fish species known to inhabit shallow coastal waters of tropical seas and estuaries throughout the world. The species is usually found in shallow waters (less than 32 feet), very close to shore over muddy and sandy bottoms, and are often found in sheltered bays, on shallow banks, in estuaries or river mouths, and are known to ascend inland in river systems. Although historically common throughout the Gulf of Mexico from Texas to Florida, the species' current range in the U.S. is limited to the peninsula of Florida, and it is common only in the Everglades region. Based on the known range and distribution, we have determined that the LNG Facility would have *no effect* on the smalltooth sawfish.

4.8.1.10 American Chaffseed

The American chaffseed (*Schwalbea americana*) is a federally listed endangered plant species. The species is known to inhabit pimple mounds (i.e., a low, flattened, roughly circular dome consisting of sandy loam that is entirely distinct from the surrounding soil specific to southwestern Louisiana) in longleaf pine flatwood savannas on acidic, sandy, or peaty soils. In Louisiana, the species is known to occur in Calcasieu, Allen, and Rapides parishes (LDWF, 2017d). Field studies were performed by Driftwood between August and September 2016 and in January 2017 to evaluate the presence/absence of suitable habitat within the LNG Facility site and along the Pipeline alignment. Based on field surveys, no individuals, populations, or suitable habitat was identified within the LNG Facility or along the Pipeline alignment. As such, we have determined that the Project would have *no effect* on the American chaffseed.

4.8.2 State-listed Species

Based on information obtained from the LDWF, six state-listed threatened or endangered species are listed within the parishes that would be affected by the Project (LDWF, 2017d). Three of the six state-listed species (piping plover, red-cockaded woodpecker, and West Indian manatee) are also federally listed as threatened or endangered, as indicated in table 4.8-1 and discussed above. The remaining three state-listed species are discussed below.

4.8.2.1 Bald Eagle

The bald eagle is state-listed as endangered and may occur in Calcasieu Parish. Although the bald eagle is federally delisted, the species is still afforded protection under the MBTA and BGEPA, which prohibits the "taking" of bald eagles, including their parts, nests, or eggs (see section 4.6.3.1). In Louisiana, the species typically nests in mature trees (e.g., bald cypress, sycamore, willow), in or near cypress/tupelo swamps, fresh to intermediate marshes, or open water in the southeastern coastal parishes and occasionally on large lakes in northern and central parishes. Bald eagles nest in Louisiana from October through mid-May. The species feeds in open lakes on fish, either self-caught or robbed from other birds (especially ospreys), as well as carrion, waterfowl, coots, muskrats, and nutria (LDWF, 2017d).

Driftwood performed field studies between August and September 2016 and in January 2017 to evaluate the presence/absence of suitable habitat within the LNG Facility site and along the Pipeline alignment. Based on field surveys, no suitable nesting habitat or nests were identified within one mile of the LNG Facility site. Suitable nesting habitat was identified along the Pipeline alignment in Calcasieu Parish; however, no nests were identified. If a bald eagle nest is observed prior to or during construction, Driftwood would adhere to the guidance provided in the USFWS National Bald Eagle Management Guidelines. To minimize impacts on bald eagles during construction and operation of the Project, Driftwood has committed to survey protocols and various impact minimization practices as outlined in section 4.6.3.1.

4.8.2.2 Brown Pelican

The brown pelican (*Pelecanus occidentalis*) is listed by Louisiana as endangered and may occur within Cameron Parish. Although the brown pelican is federally delisted, the species still affords protection under the MBTA, which prohibits intentional "taking" of brown pelicans, including their parts, nests, or eggs (see section 4.6.3.1). In Louisiana, the brown pelican occurs along the coasts in bays and tidal estuaries; nesting occurs primarily in southeastern coastal areas on barrier islands within dune shrub thickets. This species commonly occurs within the Sabine National Wildlife Refuge (NWR), which is about 12 miles south-southwest of the LNG Facility on the west side of the Calcasieu Ship Channel (Audubon, 2014). Brown pelicans primarily forage on fish and some marine invertebrates. Current threats to this species include loss of nesting habitat due to barrier island erosion, loss of coastal land, and the illegal take of eggs (LDWF, 2014d).

While no suitable nesting habitat is present along the marine transit routes, the Calcasieu Ship Channel and coastal waters of the Gulf of Mexico may provide foraging habitat for the brown pelican. In Cameron Parish, where the brown pelican may occur, Project activities would be limited to barge traffic during construction and LNG carrier traffic during operations, which would not affect a healthy brown pelican or brown pelican habitat. Based on the species characteristics and habitat requirements, we have determined that construction and operation of the LNG Facility would not likely impact the brown pelican.

4.8.2.3 Interior Least Tern

The interior least tern (*Sternula antillarum athalassos*) is listed by Louisiana as endangered and may occur within Cameron Parish. Although not a federally listed species under the ESA in the State of Louisiana, the interior least tern affords protection under the MBTA, which prohibits intentional "taking" of interior least terns, including their parts, nests, or eggs (see section 4.6.3.1). The interior least tern is the inland reproductive population of least tern that nests on or adjacent to the major rivers of the Great Plains and the Lower Mississippi Valley. The species' range is defined as the Mississippi River and tributaries north of Baton Rouge, Louisiana, which are used for nesting and foraging during the spring/summer reproductive season (May to August). The species nests in areas remote from trees or other vegetation that may hide or support predators, and may also nest on anthropogenic sites near waterbodies with appropriate fish species and abundance including industrial sites, dredged-material deposition sites, sand pits, created habitats, and rooftops (USFWS, 2013).

Although suitable nesting and foraging habitat may be present along the banks of the Calcasieu Ship Channel in Cameron Parish, where the interior least tern may occur, suitable habitat is very limited within the Project boundary. Project activities would be limited to barge traffic during construction and LNG carrier traffic during operation, which would not affect the interior least tern or its habitat. Based on the species characteristics and habitat requirements, we have determined that construction and operation of the LNG Facility would not likely impact the interior least tern.

4.8.3 Species of Concern

In consultation with the LDWF, seven species of concern, including one bird (crested caracara), two invertebrates (Calcasieu painted crawfish and old prairie crawfish), and four plant species (grapefruit primrose willow, green milkweed, long-sepaled false dragon-head, and small-fruited water-willow), were identified as having the potential to occur within the Project area (LDWF, 2017c). These species are presented in table 4.8-1 and discussed below.

4.8.3.1 Crested Caracara

The crested caracara (*Caracara cheriway*) is an S1 state-ranked bird species known to occur in Calcasieu and Cameron parishes. S1 species are defined by the LDWF as critically imperiled in Louisiana because of extreme rarity (5 or fewer known extant populations) or because of some factor(s) making it especially vulnerable to extirpation. This medium-sized raptor typically inhabits mixed coastal prairie and marsh habitats, where it feeds on carrion and small animals including rabbits, ground squirrels, frogs, and snakes (LDWF, 2017d). In the U.S., the species' range includes Florida, central and southern Texas, southern Arizona, and southwestern Louisiana. In Louisiana, the species is restricted to the extreme southwest portion of the state, specifically Calcasieu and Cameron parishes (LNHP, 2017).

A species-specific habitat assessment was conducted in the spring and summer of 2016 within the LNG Facility site and along the Pipeline alignment. Based on these efforts, one individual was observed within the LNG Facility site; however, suitable habitat was not identified along the Pipeline alignment. To minimize potential impacts on the species during construction of the LNG Facility, Driftwood would conduct nesting surveys no more than two weeks prior to the commencement of vegetation clearing or other construction activities. These surveys would be conducted by experienced biologists to identify bird activity and active nests. If bird nesting activity is observed, the biologist would document the location using a GPS device and collect pertinent data, including, but not limited to, species and number of eggs and/or young identified. An avoidance buffer would be established around each active nest; the buffer size and avoidance parameters would be established by the LDWF. Biologists would monitor and document nest activity daily or as appropriate. Based on the implementation of the aforementioned minimization measures, we have determined that construction and operation of the Project would result in no significant adverse impact on the species.

4.8.3.2 Calcasieu Painted Crawfish

The Calcasieu painted crawfish (*Orconectes blacki*) is an S1 state-ranked species known to occur in Calcasieu Parish. An olive to brown crawfish with crimson highlights, the Calcasieu painted crawfish is found in moderately-flowing, small to medium-sized streams with detritus. Its diet includes plants, detritus, small live animals, and carrion (LDWF, 2017d). The species is endemic to Louisiana and has a range of about 2,200 square miles.

A species-specific habitat assessment was conducted in the spring and summer of 2016 within the LNG Facility site and along the Pipeline alignment. Based on these efforts, no species were observed; however, suitable habitat was identified within the LNG Facility site and along the Pipeline alignment. To minimize disturbance within wetlands and waterbodies, limit the potential for erosion and sedimentation, and reduce the potential for impacts on the species and its habitat, Driftwood would follow its ESCP and the Driftwood Plan and Procedures. Based on the species characteristics, habitat requirement, and implementation of the aforementioned minimization measures, we have determined that construction and operation of the Project would result in minor adverse impacts on the species.

4.8.3.3 Old Prairie Crawfish

The old prairie crawfish (*Fallicambarus macneesei*) is an S2 state-ranked species known to occur in Calcasieu, Jefferson Davis, and Acadia parishes, Louisiana, and parts of Texas. A S2 species is defined by the LDWF as critically imperiled in Louisiana because of extreme rarity (5 or fewer known extant populations) or because of some factor(s) making it especially vulnerable to extirpation. The species typically resides in wet meadow habitats including ditches flooded by heavy rains or in complex burrows carved into sandy-clay soils of roadside ditches (LDWF, 2017d).

A species-specific habitat assessment was conducted in the spring and summer of 2016 within the LNG Facility site and along the Pipeline alignment. Based on these efforts, no individuals of this species were observed; however, suitable habitat was identified within the LNG Facility site and along the Pipeline alignment. To minimize disturbance within wetlands and waterbodies, limit the potential for erosion and sedimentation, and reduce the potential for impacts on the species and its habitat, Driftwood would follow its ESCP, Driftwood Plan and Procedures. Based on the species characteristics, habitat requirement, and implementation of the aforementioned minimization measures, we have determined that construction and operation of the Project would result in minor adverse impacts on the species.

4.8.3.4 Grapefruit Primrose Willow

The grapefruit primrose willow (*Ludwigia sphaerocarpa*) is an S2 state-ranked species known to occur in Cameron Parish. This perennial wetland species is known to occur in freshwater marshes (LDWF, 2017d). A species-specific habitat assessment was conducted in the spring and summer of 2016 within the LNG Facility site and along the Pipeline alignment. Based on these efforts, no individuals, populations, or suitable habitat were identified within the LNG Facility site. Suitable habitat was observed along the Pipeline alignment; however, no individuals or populations were identified. To minimize disturbance within wetlands and waterbodies, limit the potential for erosion and sedimentation, and reduce the potential for on the species and its habitat, Driftwood would follow the Driftwood Plan and Procedures. Based on the species characteristics, habitat requirement, and implementation of the aforementioned minimization measures, we have determined that construction and operation of the Project would result in no significant adverse impact on the species, and that construction and operation of the Pipeline would result in minor, yet temporary impacts on the species' habitat.

4.8.3.5 Green Milkweed

The green milkweed (*Asclepias hirtella*) is an S1 state-ranked species known to occur in Calcasieu and Jefferson Davis parishes. The species inhabits upland prairies, hay meadows, roadsides, and sometimes wetter areas (Xerxes Society for Invertebrate Conservation, 2013). A species-specific habitat assessment was conducted in the spring and summer of 2016 within the LNG Facility site and along the Pipeline alignment. Based on these efforts, no individuals, populations, or suitable habitat were identified within the LNG Facility site. Suitable habitat was observed along the Pipeline alignment; however, no individuals or populations were identified. To minimize disturbance within wetlands and waterbodies, limit the potential for erosion and sedimentation, and reduce the potential for impacts on the species and its habitat, Driftwood would follow the Driftwood Plan and Procedures. Based on the species characteristics, habitat requirement, and implementation of the aforementioned minimization measures, we have determined that construction and operation of the Project would result in no significant adverse impact on the species, and that construction and operation of the Pipeline would result in minor, yet temporary impacts on the species' habitat.

4.8.3.6 Long-sepaled False Dragon-head

The long-sepaled false dragon-head (*Physostegia longisepala*) is an S2S3 state-ranked species known to occur in Calcasieu, Acadia, and Jefferson Davis parishes. A S2S3 species is defined by the LDWF as a combination of an S2 and S3 status. S3 species are defined as rare and local throughout the state or found locally (even abundantly at some of its locations) in a restricted region of the state, or because of other circumstances making it vulnerable to extirpation (21 to 100 known extant populations). The species inhabits partly shaded bottomland hardwood forests along streams and freshwater marshes in flat terrain. In southwest Louisiana, associated plant species may include, but are not limited to, laurel oak (*Quercus laurifolia*), sweet bay, and green ash (*Fraxinus pennsylvanica*) (LDWF, 2017d). A species-specific habitat assessment was conducted in the spring and summer of 2016 within the LNG Facility site and along the Pipeline alignment. Based on these efforts, no individuals, populations, or suitable habitat were identified within the LNG Facility site. Suitable habitat was observed along the Pipeline alignment; however, no individuals or populations were identified. To minimize disturbance within wetlands and waterbodies, and limit the potential for erosion and sedimentation and reduce the potential for impacts on the species and its habitat, Driftwood would follow the Driftwood Plan and Procedures. Based on the species characteristics, habitat requirement, and implementation of the aforementioned minimization measures, we have determined that construction and operation of the Project would result in no significant adverse impact on the species, and that construction and operation of the Pipeline would result in both temporary and permanent impacts on the species' habitat due to the potential loss of associated plant species.

4.8.3.7 Small-fruited Water-willow

The small-fruited water-willow (*Ludwigia microcarpa*) is an S1 state-ranked species known to occur in Calcasieu Parish. The species inhabits wet areas such as stream banks, pond edges, and freshwater wetlands. In Louisiana, this species can be found along roadsides within wetland pine savannas. Associated plant species may include beaksedge species (*Rhynchospora* spp.), nutrush species (*Scleria* spp.), saltmarsh umbrella sedge (*Fuirena breviseta*), spadeleaf (*Centella asiatica*), and rosy camphorweed (*Pluchea rosea*) (LDWF, 2017d). A species-specific habitat assessment was conducted in the spring and summer of 2016 within the LNG Facility site and along the Pipeline alignment. Based on these efforts, no individuals, populations, or suitable habitat were identified within the LNG Facility site. Suitable habitat was observed along the Pipeline alignment; however, no individuals or populations were identified. To minimize disturbance within wetlands and waterbodies, and limit the potential for erosion and sedimentation and reduce the potential for impacts on the species and its habitat, Driftwood would follow the Driftwood Plan and Procedures. Based on the species characteristics, habitat requirement, and implementation of the aforementioned minimization measures, we have determined that construction and operation of the Project would result in no significant adverse impact on the species, and that construction and operation of the Pipeline would result in minor, yet temporary impacts on the species' habitat.

4.8.3.8 Blue Water Lily

The blue water lily (*Nymphaea elegans*) is an S2/S4 state-ranked species known to occur in Calcasieu Parish. The species inhabits pools in freshwater marshes and can grow in water depths up to 1.2 m (4 feet). It is intolerant of salinities over 3 ppt and saltwater intrusion is considered a threat. In a comment on the draft EIS, LDWF noted that this floating-leaved aquatic plant is considered imperiled in Louisiana and requested Driftwood use caution while working near this habitat to avoid impacts on this species. To minimize disturbance within wetlands and waterbodies, and limit the potential for erosion and sedimentation and reduce the potential for impacts on the species and its habitat, Driftwood would follow the Driftwood Plan and Procedures. Based on the species characteristics, habitat requirement, and implementation of the aforementioned minimization measures, we have determined that construction and operation of the Project would result in no significant adverse impact on the species.

4.8.4 Marine Mammals

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 U.S. A total of 27 mammals protected under the MMPA may occur along the marine transit routes (NMFS, 2012). Five of these species are also listed under the ESA (four whales and the West Indian manatee) and are included in table 4.8-1 and discussed in sections 4.8.1.2 and 4.8.1.3 above. The remaining 22 whale and dolphin species and their potential area of occurrence along the marine transit routes are described in table 4.8-2 and discussed below.

Table 4.8-2

Marine Mammals Occurring in the Gulf of Mexico

Common Name	Scientific Name	Area Where Mammal May Occur
Dolphins		
Atlantic spotted dolphin	*Stenella frontalis*	Calcasieu Ship Channel and Gulf of Mexico
Bottlenose dolphin	*Tursiops truncatus*	Calcasieu Ship Channel and Gulf of Mexico

Table 4.8-2

Marine Mammals Occurring in the Gulf of Mexico

Common Name	Scientific Name	Area Where Mammal May Occur
Clymene dolphin	*Stenella clymene*	Gulf of Mexico
False killer whale	*Pseudorca crassidens*	Gulf of Mexico
Frasier's dolphin	*Lagenodelphis hosei*	Gulf of Mexico
Killer whale	*Orcinus orca*	Gulf of Mexico
Melon-headed whale	*Peponocephala electra*	Gulf of Mexico
Pantropical spotted dolphin	*Stenella attenuata*	Gulf of Mexico
Pygmy killer whale	*Feresa attenuata*	Gulf of Mexico
Risso's dolphin	*Grampus griseus*	Gulf of Mexico
Rough-toothed dolphin	*Steno bredanensis*	Gulf of Mexico
Short-finned pilot whale	*Globicephala macrorhynchus*	Gulf of Mexico
Spinner dolphin	*Stenella longirostris*	Gulf of Mexico
Striped dolphin	*Stenella coeruleoalba*	Gulf of Mexico
Whales		
Blainville's beaked whale	*Mesoplodon densirostris*	Gulf of Mexico
Bryde's whale	*Balaenoptera edeni*	Gulf of Mexico
Cuvier's beaked whale	*Ziphius cavirostris*	Gulf of Mexico
Dwarf sperm whale	*Kogia sima*	Gulf of Mexico
Gervais' beaked whale	*Mesoplodon europaeus*	Gulf of Mexico
Minke whale	*Balaenoptera acutorostrata*	Gulf of Mexico
Pygmy sperm whale	*Kogia breviceps*	Gulf of Mexico
Sowerby's beaked whale	*Mesoplodon bidens*	Gulf of Mexico

Source: Waring et al. 2016.

Two marine mammal species, the Atlantic spotted dolphin (*Stenella frontalis*) and bottlenose dolphin (*Tursiops truncatus*), exist within the Calcasieu Ship Channel. Atlantic spotted dolphins are widely distributed within warm tropical to temperate waters of the Atlantic Ocean, including the Gulf of Mexico. Their diet consists of small fish, squid, octopus, and benthic invertebrates. Bottlenose dolphins are found in tropical and temperate waters worldwide. Coastal populations commonly migrate into bays and estuaries while offshore populations reside along the continental shelf. The coastal populations feed on fish and benthic invertebrates while offshore populations feed on pelagic fish and squid. Bottlenose dolphins commonly occur in coastal waters of Louisiana and offshore waters within the Gulf of Mexico and could occur within the Calcasieu Ship Channel (NMFS, 2014b). Atlantic spotted dolphins could also occur within these areas (NMFS, 2014c).

The other species of marine mammals listed in table 4.8-2 are unlikely to occur in the Calcasieu Ship Channel but are found in the Gulf of Mexico and may occur along the marine transit routes (NMFS, 2017b).

Impacts on marine mammals occurring along the marine transit routes would be similar to those discussed in sections 4.8.4 regarding the federally listed West Indian manatee and whales. The primary threat to marine mammals would be vessel strikes from barges during construction and LNG carriers during operation. However, LNG carriers push a considerable bow wave when underway on the open ocean because of their design and large displacement tonnage. This bow wave pushes water, flotsam, and other small objects (e.g., dolphins) away from the carrier. LNG carriers would use established and well-traveled shipping lanes. As described in section 4.8.4, Driftwood proposes to provide LNG carrier captains with the NMFS-issued document *Vessel Strike Avoidance Measures and Reporting for Mariners* (NMFS, 2008), which outlines collision-avoidance measures.

Marine mammals may also be affected by underwater noise, primarily by pile driving and barge traffic during construction and LNG carrier transit during operations. For a discussion of underwater noise sources and intensity calculations, see section 4.12.2.3. Threshold for injury (i.e., permanent threshold shift or "hearing loss") for mid-frequency cetaceans, such as the bottlenose dolphin, is a peak sound pressure level of 230 dB re 1 µPa, as established by NMFS (2016b). The highest-intensity noise for in-water impact driving the steel piles would attenuate to <230 dB re 1 µPa less than 20 feet from the source (Caltrans, 2015). Dolphins outside of the 20-foot radius would not be expected to experience hearing loss. We have recommended in section 4.4.3.1 that DWLNG develop an In-Water Pile Driving Plan, in consultation with the NMFS to identify mitigation measures that when implemented would reduce in-water peak noise levels associated with vibratory and hammer pile driving below 206 dB (re: 1 µPa).

Behavior disruption from impulsive noise, such as pile driving, occurs at much lower intensities, estimated to be about 160 dB re 1 µPa by NMFS (2012). As mitigation for the potential injury to dolphins near the pile-driving source, Driftwood would begin in-water pile driving with "soft-start" procedures, that is, by a series of lower-power blows, which generate lower-intensity noise, slowly increasing to full power over several minutes to allow dolphins to vacate the area before potentially damaging sound intensity is generated. Based on the incorporation of these mitigation measures, we have determined that underwater noise emissions during construction would not significantly impact marine mammals.

Based on Driftwood's proposed use of existing, highly traveled shipping lanes and proposed mitigation measures during marine transit and during pile driving, we have determined that construction and operation of the LNG Facility would have no significant adverse impact on marine mammals.

4.8.5 Conclusions and Recommendations

Driftwood has proposed numerous measures to minimize impacts on federally listed threatened and endangered species and other special status species, including implementation of the Driftwood Plan Procedures, ESCP, and SPCC Plans, as well as providing NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners* (NMFS, 2008) to LNG carrier captains. Based on consultations with NMFS, we conclude that the Project would not adversely impact species under the jurisdiction of NMFS. In addition, based on consultations with USFWS, we conclude that the Project would not adversely affect federally listed species under the jurisdiction of USFWS. However, the Eastern black rail was proposed for listing as threatened after the draft EIS was issued; therefore we recommend Driftwood consult with USFWS regarding this species prior to construction.

4.9 LAND USE, RECREATION, AND VISUAL RESOURCES

4.9.1 Land Use

Land use near the Project is generally classified into the following categories: agricultural land, forest, tree plantation, open land, developed land, and open water. The definitions of each land use type are as follows:

- **Agricultural land**: includes active cropland and areas being used for hay production.
- **Forests**: includes both upland forests and forested wetlands.
- **Tree plantation**: includes planted tree land used for silviculture.
- **Open land**: includes non-forested open lands, such as: existing utility rights-of-way; grassland/rangeland; emergent and scrub-shrub wetlands and uplands.
- **Developed land**: includes both industrial land and residential land. Industrial land includes all developed areas, such as roads railroads, and industrial areas; residential land includes residential yards, subdivisions, and planned new residential developments.
- **Open water**: includes lakes, ponds, and major streams/rivers (greater than 100 feet wide).

4.9.1.1 LNG Facility

The LNG Facility would be on about 720 acres of a 790-acre site on the west bank of the Calcasieu River, about five miles south of the city of Carlyss, Louisiana. The LNG Facility site was previously classified as undeveloped land. Development activity within the LNG Facility site beginning in the mid-1990s resulted in the conversion of the property from undeveloped land to a mix of developed and undeveloped land. Land use in, adjacent to, and surrounding the LNG Facility consists of undeveloped lands, rural residential lands, and developed lands including other industrial facilities. Construction of the facilities would require about 883.1 acres (718.1 acres onsite, and 165.0 acres temporary offsite construction areas), including 482.3 acres of open land, 93.1 acres of open water, 101.0 acres of developed land, 183.9 acres of forested land, and 22.8 acres of agricultural land (table 4.9-1). Impacts associated with construction and operation of the LNG Facility would include those impacts associated with the liquefaction facility, marine berth, MOF, other facilities (administration building, warehouses, substation, metering station, etc.), and temporary offsite facilities. Additionally, one mile of the Pipeline and two meter stations would be located within the LNG Facility boundary. About 300 acres of the LNG Facility and 12 acres of maintenance buildings and warehouses would be surrounded with security fence.

Table 4.9-1

Land Uses Affected by Construction and Operation of the LNG Facility (acres) [a]

	Agricultural Land		Forest/Woodland [b]		Tree Plantations [g]		Open Land [c]		Developed Land		Open Water [d]		*Totals*	
Facilities	Const [e]	Oper [f]	Const [e]	Oper [f]	Const [e]	Oper [f]	Const [e]	Oper [f]	Const [e]	Oper [f]	Const [e]	Oper [f]	Const [e]	Oper [f]
Liquefaction Facility	0.0	0.0	66.4	66.4	0.0	0.0	161.0	161.0	34.9	34.9	15.2	15.2	*277.5*	*277.5*
Marine Berth	0.0	0.0	8.2	8.2	0.0	0.0	27.2	27.2	23.9	23.9	18.3	18.3	*77.6*	*77.6*
MOF	0.0	0.0	0.0	0.0	0.0	0.0	4.9	4.9	0.0	0.0	0.0	0.0	*4.9*	*4.9*
Construction Laydown (includes temporary facilities)	0.0	0.0	42.2	42.2	0.0	0.0	59.0	59.0	2.2	2.2	0.9	0.9	*104.3*	*104.3*
Other Facilities (outside berm)	0.0	0.0	50.8	50.8	0.0	0.0	108.5	108.5	12.2	12.2	58.6	58.6	*230.1*	*230.1*
Roads	0.0	0.0	13.8	13.8	0.0	0.0	9.3	9.3	0.5	0.5	0.1	0.1	*23.7*	*23.7*
Temporary Offsite Construction Areas	22.8	0.0	2.5	0.0	0.0	0.0	112.4	0.0	27.3	0.0	0.0	0.0	*165.0*	*0.0*
Totals	***22.8***	***0.0***	***183.9***	***181.4***	***0.0***	***0.0***	***482.3***	***369.9***	***101.0***	***73.7***	***93.1***	***93.1***	***883.1***	***718.1***

Note: Construction and operation acres in impact tables calculate the impact acreages based on the area of concern for each resource, and may not be the same for each resource. Footnotes in each table describe the areas of concern used for each resource table.

Const = Construction

Oper = Operation

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

[b] Forested acreages include upland forests and forested wetlands.

[c] Open Land acreages include emergent and scrub-shrub wetlands.

[d] Refers to existing waterbodies on the LNG Facility site.

[e] Construction – all construction acreages include operational acreages.

[f] Following construction, the temporary offsite construction areas would be returned to the landowner in their developed condition.

[g] Tree Plantations – zero acreage affected.

4.9.1.2 Pipeline

Acreage required for construction of the Pipeline, including area for the ATWSs, staging areas, aboveground facilities, and access roads, is shown in table 4.9-2. In general, the Pipeline would be constructed within a 100- or 130-foot-wide right-of-way in uplands and a 75- or 110-foot-wide right-of-way in wetlands and across waterbodies, and within a 150-foot-wide right-of-way between MP 36.5 and 39.9, where a lateral would be installed. The Pipeline would parallel or be collocated with existing disturbed corridors (pipelines, utilities, power lines, public and private roads, and other infrastructure) for about 68 miles, or 70 percent of the entire length of the Pipeline. Where the Pipeline route parallels existing foreign pipelines, DWPL would seek to maintain a minimum separation distance of 50 feet from foreign pipeline centerlines, unless approved otherwise. If operational or construction constraints arise, a lesser offset may be agreed upon with the existing pipeline operator. In these areas, the construction right-of-way would overlap the existing rights-of-way, with the width of the overlap dependent upon the configuration of the existing rights-of-way. ATWS would be required to accommodate construction at sensitive features, points of inflection, foreign pipeline crossings, road and railroad crossings, and for spoil storage and vehicular maneuvering. Following construction, the permanent right-of-way for the Pipeline would be 50 feet, with a 65-foot right-of-way between MP 36.5 and 39.9. The permanent easement would be maintained according to DOT requirements (49 CFR 192) and the Driftwood Plan and Procedures to allow for routine pipeline inspection and maintenance. DWPL would maintain about 684.4 acres during operation of the Pipeline.

Aboveground Facilities

DWPL would construct and operate three compressor stations along the Pipeline. CS-01 would be located at about MP 39.9 in Jefferson Davis Parish, and would require 34.8 acres and 20.9 acres of developed, forest, and open land for construction and operation, respectively. CS-02 would be at about MP 71.7 in Acadia Parish, and would require 44.3 acres and 30.1 acres of agricultural, developed, forested, and open land for construction and operation, respectively. CS-03 would be at about MP 84.6 in Evangeline Parish, and would require 21.7 acres and 12.1 acres of agricultural, developed, and open land for construction and operation, respectively. Lands permanently affected by the aboveground facilities would be permanently converted to industrial use.

At each location where the Pipeline intersects with third-party pipelines, a meter station, including interconnect valves and piping, would be installed. Up to fifteen meter stations would be installed along the Pipeline. Construction of the 11 meter stations that lie outside the LNG Facility site and outside the compressor station sites would require 39.3 acres of land, of which 32.0 acres would be retained during operation.

Pig launchers and receivers would be installed as part of the Pipeline design to allow for cleaning and inspection. A receiver would be located at MP 0.0, a launcher and receiver would be placed at both MP 74.0 and MP 84.6, and a launcher would be located at MP 95.9.

Table 4.9-2

Land Uses Affected by Construction and Operation of the Pipeline

Parish	Agricultural [b]		Forest/ Woodland [b]		Managed Tree Plantation [b]		Open Land [b]		Developed [b]		Open Water [b]		Total [b]	
	Const [a]	Oper	Const [a]	Oper	Const [a]	Oper	Const [a]	Oper	Const [a]	Oper	Const [a]	Oper	Const [a]	*Oper*
Pipeline ROW														
Calcasieu	16.7	6.3	248.2	122.7	24.1	9.7	198.0	80.9	28.1	13.3	2.9	2.2	518.0	235.0
Jefferson Davis	247.3	94.9	98.3	48.0	7.8	3.0	48.4	21.1	9.9	4.3	1.8	0.7	413.4	171.9
Acadia	67.0	25.0	24.9	11.0	<0.1	0.0	9.2	3.8	7.0	3.1	0.0	0.0	108.1	42.9
Evangeline	225.6	99.0	19.4	10.1	0.0	0.0	19.2	10.4	10.1	5.6	0.0	0.0	274.4	125.2
Subtotal	556.6	225.1	390.8	191.8	31.9	12.7	274.7	116.2	55.1	26.4	4.7	2.9	1,313.7	575.0
Pipeline ATWS														
Calcasieu	1.6	0.0	47.0	0.0	2.8	0.0	34.6	0.0	7.9	0.0	0.4	0.0	94.2	0.0
Jefferson Davis	25.5	0.0	14.9	0.0	0.6	0.0	3.8	0.0	1.5	0.0	0.0	0.0	46.3	0.0
Acadia	9.6	0.0	3.7	0.0	0.0	0.0	0.9	0.0	1.3	0.0	0.0	0.0	15.4	0.0
Evangeline	27.9	0.0	3.2	0.0	0.0	0.0	4.4	0.0	3.6	0.0	0.0	0.0	39.1	0.0
Subtotal	64.6	0.0	68.8	0.0	3.4	0.0	43.6	0.0	14.3	0.0	0.4	0.0	195.0	0.0
Staging Areas														
Pipe yard	64.9	0.0	0.0	0.0	0.0	0.0	18.5	0.0	6.6	0.0	0.0	0.0	90.0	0.0
Contractor yard 1	0.0	0.0	5.9	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	7.7	0.0
Contractor yard 3	33.9	0.0	0.2	0.0	0.0	0.0	0.7	0.0	0.1	0.0	0.0	0.0	34.9	0.0
Subtotal	98.8	0.0	6.1	0.0	0.0	0.0	21.0	0.0	6.7	0.0	0.0	0.0	132.6	0.0
Other Work Areas														
Access Roads	18.1	4.7	15.1	0.5	0.4	0.3	29.9	6.2	29.5	2.6	0.9	0.0	93.8	14.3
Subtotal	*18.1*	*4.7*	*15.1*	*0.0*	*0.0*	*0.0*	*29.9*	*6.2*	*29.5*	*2.6*	*0.9*	*0.0*	*93.8*	*14.3*
Pipeline Aboveground Facilities														
Meter Stations [d]	24.4	21.3	1.6	1.2	4	3	5.4	3.6	4	3	0	0	39.3	32
Compressor Stations	38.2	18.2	51.0	36.9	0.0	0.0	3.0	2.0	8.5	6.0	0.0	0.0	100.8	63.1
Mainline Valves [e]	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*
Subtotal	62.6	39.5	52.6	38.1	4.0	3.0	8.4	5.6	12.4	8.8	0.0	0.0	140.1	95.1
Pipeline Total	800.7	269.3	533.3	230.4	39.7	16.0	377.6	128.0	118.0	37.8	5.9	2.9	1,875.2	684.4

Note: Construction and operation acres in impact tables calculate the impact acreages based on the area of concern for each resource, and may not be the same for each resource. Footnotes in each table describe the areas of concern used for each resource table.

[a] Construction acreages for all land uses include operational acreages.

[b] All acreages are rounded. As a result the totals may not reflect the sum of the addends in all cases.

[c] Some Access Roads overlap with the Pipeline right-of-way workspaces. In these cases there has been no double-counting.

[d] MSs acreages include short laterals. Acreage for MS-01 and -03 are within the LNG Facility. Acreages for MS-06 and -14 are accounted for in CS-01 and CS-03, respectively.

[e] All MLV land use impacts would be accounted within the existing land use impacts created by the Pipeline right-of-way and/ or metering station footprints.

The four pig launchers and receivers and 17 MLVs would be constructed within the boundaries of other facilities discussed above and would not have independent land requirements.

Contractor and Storage Yards

The Pipeline would require temporary use of one pipe laydown yard, about 9.5 miles south of MP 46 along Highway 165, and two contractor yards for a total of 132.6 acres of predominantly agricultural and open land.

Additional Temporary Work Space/Staging Areas

DWPL would require 195.0 acres of ATWSs adjacent to the construction right-of-way. The majority of ATWSs would be within open land and agricultural land. If DWPL requires new ATWSs in some areas and for reasons approved by the Driftwood Plan (i.e., non-wetland areas to accommodate topsoil segregation or for truck turn-arounds where no reasonable alternative exists), they would be identified and approved by the EI prior to use by the construction workforce and identified in the construction status reports.

Access Roads

DWPL would use 97 public and private roads that intersect or parallel the Pipeline route to access the right-of-way during construction. No new access roads to the Pipeline right-of-way are proposed and the existing roadways would not require major modifications, such as widening; however, DWPL may require minor modifications to some of the existing access roads, such as grading and replacement of gravel.

4.9.2 Land Use Impacts and Mitigation

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

4.9.2.1 Managed Tree Plantations

Construction and operation of the LNG Facility would not affect managed tree plantations. Operation of the Pipeline would permanently affect 12.7 acres of managed tree plantations. DWPL would clear about 37.9 acres of tree plantation during construction of the Pipeline. After construction, 19.2 acres would be available for planting and use in timber production. This would be a long-term impact due to the relatively long growth period required for marketable timber of 25 to 60 years (Arbor Day Foundation, 2017). DWPL would prohibit timber production within the permanent right-of-way. DWPL would compensate the landowner for the loss of timber production according to the terms of individual easement negotiations. Given DWPL's commitment to compensation, impacts on managed tree plantations would not be significant.

4.9.2.2 Existing Rights-of-Way

An existing 6-inch-diameter pipeline and associated right-of-way crosses the LNG Facility site. This pipeline and right-of-way would be relocated during site preparation, as discussed in section 1.4.1.3.

The Pipeline would parallel or be collocated with existing disturbed corridors (pipelines, utilities, power lines, public and private roads, and other infrastructure) for about 68 miles (about 70 percent of the length of the Pipeline). Where the Pipeline route parallels existing foreign pipelines, DWPL would seek to maintain a minimum separation distance of 50 feet from foreign pipeline centerlines, unless approved otherwise. If that operational or construction constraints arise, a lesser offset may be agreed upon with the existing pipeline operator. In these areas, the construction right-of- way would overlap the existing rights-of-way, with the width of the overlap dependent upon the configuration of the existing rights-of-way.

There are no open cut crossings of railroad lines associated with the Pipeline. DWPL would cross railroad crossings and major roadway crossings using conventional jack and bore methodology. With this method, the Pipeline would pass under the railroad or roadway with little or no disturbance to traffic along the rail or roadway.

DWPL would cross lightly traveled paved and unimproved rural dirt or gravel roads using the open-cut installation method. Where open-cut construction is proposed on roads that provide access to private residences or businesses with no alternate entrance, DWPL would maintain passage during construction. In addition, DWPL would attempt to avoid peak traffic times during construction of roadway crossings that could temporarily close roads, use signage to minimize impacts, and follow local regulations regarding maintaining the flow of traffic. If open-cut road construction requires extensive construction time, DWPL would make provisions for detours or other measures to permit traffic flow during construction.

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

4.9.2.3 Open Water

LNG Facility

Construction of the LNG Facility would permanently affect about 93.1 acres of open water, including a 45-acre manmade lake within the LNG Facility that would be filled during site preparation. The remaining 48.0 acres of open water impacts (estuary wetlands) within the Calcasieu River, Calcasieu Ship Channel, Bayou Choupique, and ICW would experience indirect impacts during construction; however, to be conservative these are considered to be permanent impacts. Permanent impacts on COE jurisdictional wetlands would be permitted and compensated for by DWLNG through the beneficial use of dredge material and mitigation credits developed in coordination with the COE/LDNR Coastal Management Program permit.

Impacts from construction and operation of the LNG Facility would not be significant for several reasons. Open water adjacent to the site would remain as open water although public use of the water would be limited by security protocols. In addition, there is a large amount of open water in all directions from the LNG Facility site.

Pipeline

DWPL would cross each of the 317 waterbodies according to the Driftwood Procedures. DWPL would use the HDD method to cross 15 waterbodies, including Diversion Canal (twice), Houston River Canal, Houston River, West Fork Calcasieu River, Calcasieu River, Bayou Serpent, Bayou Des Cannes, and several associated tributaries and ditches and conventional bore to cross two waterbodies (two unnamed legs of the Houston River Canal), so that those waterbodies would not be affected by construction. All other waterbodies would be crossed using the standard upland construction techniques, provided there is no perceptible flow at the time of crossing and the environmental inspector verifies that water is unlikely to flow between the initial disturbance and final stabilization of the feature. If flow is present in the waterbody, all crossing activities would follow the guidelines for open cut-crossing methods for minor, intermediate and major waterbodies. Operation of the Pipeline would result in 2.9 acres of permanent impacts on open water (table 4.9-2). Impacts on surface waterbodies are discussed in more detail in section 4.3.3.

4.9.2.4 Agricultural Land

LNG Facility

The LNG Facility would temporarily affect 22.8 acres of agricultural lands during construction, which is limited to the Temporary Offsite Construction Areas and is comprised of areas being used for hay production.

In areas classified as agricultural, DWLNG would use topsoil segregation techniques to preserve soil productivity. DWLNG would also negotiate with and reimburse landowners for any damages or loss of production caused by the LNG Facility construction activities. The reimbursement would be based on the market prices for the specific products at the time of easement negotiations with each landowner.

Pipeline

DWPL would temporarily affect about 556.6 acres of agricultural lands within the Pipeline construction right-of-way, 181.5 acres within the ATWS and staging areas, and 62.6 acres within aboveground facility footprints. Predominant agricultural uses that would be affected are rice cultivation and crawfish production.

To minimize impacts on agricultural lands, DWPL would restore agricultural lands to pre-construction conditions as practicable to be used for future crop rotations. The topsoil would be managed according to the Driftwood Plan. DWPL would negotiate with and reimburse landowners for any damages or loss of production due to Pipeline construction activities. Following restoration, agricultural land within temporary workspaces would revert to the previous land use; however, land within the permanent easements would be subject to routine inspections for the Pipeline.

DWPL would implement the following measures to mitigate impacts on rice cultivation:

- Compensate farmers to suspend rice or plant soybeans or milo farming during the year of construction, which would allow the right-of-way to remain dry during construction.

- Alternatively, if farmers prefer to plant rice during the year of construction, the farmer could either levee off the right-of-way prior to Pipeline construction or the use of Low Ground Pressure equipment could establish levees on both sides of the right-of-way. If the right-of-way is leveed during construction, culverts would be installed to maintain water flow across sections of fields bisected by the right-of-way. Water would be pumped out of the right-of-way to allow for construction activities to progress. Restoration would use a field leveling contractor to re-establish rice field irrigation and drainage according to the farmer's plans.

The Pipeline would extend through about 85 miles of lands with soils classified as prime farmland; about 38 miles of soils classified as prime farmland to be crossed are characterized as agricultural land.

The aboveground facilities would affect about 134.8 acres of prime farmland during construction, and 92.5 acres during operation. DWPL would implement the Driftwood Plan, which includes mitigation measures to limit impacts, such as topsoil segregation and soil compaction mitigation in annually cultivated prime farmland, and maintain the permanent right-of-way in a manner that would not preclude current or future agricultural activities. Given the prevalence of prime farmland in the parishes crossed by the Project, the impact of construction and operation of the Pipeline on prime farmland would be temporary to short-term and would not be significant.

The Pipeline would temporarily affect about 800.7 acres of agricultural lands, with a loss of production during and shortly after construction is completed, and permanently affect 225.1 acres for permanent right-of-way and 39.5 acres for operation of aboveground facilities. After construction, DWPL would allow all cultivated agricultural land affected by the construction of the Pipeline to return to pre-construction conditions. The only permanent impacts on cultivated land by the Project would be those associated with aboveground facilities. As a result, we conclude the impact on cultivated agricultural land would be temporary to short-term and would not be significant.

4.9.2.5 Residential Land

LNG Facility

No residences occur within 50 feet of the of construction areas for the LNG Facility. The nearest residences are about 100-200 feet northeast of the LNG Facility site and also lie within 50 feet of Pipeline construction area at MP 0.9 and 1.0. Accordingly, they are discussed in relation to the Pipeline, below (see MP 0.9 and MP 1.0 in table 4.9.3). The nearest residential communities include the Driftwood Community (0.25 mile north of the LNG Facility) and a residential area 0.8 mile west of the LNG Facility.

Prior to the start of construction at the LNG Facility, DWLNG has committed to send a newsletter update to landowners in the area of the LNG Facility to let them know when construction is expected to start and what types of impacts and mitigation measures should be expected. Driftwood would place signage along Burton Shipyard Road at the property boundary, and make notice to mariners for dredging operations.

Based on this evaluation, we conclude that impacts on residential land resulting from construction and operation of the LNG Facility would not be significant.

Pipeline

In residential areas, the two impacts associated with construction and operation of natural gas facilities are disturbance during construction and hindrance of property future uses due to the presence of Project facilities. Temporary construction impacts on residential areas can include inconveniences caused by noise and dust generated by construction equipment, personnel, and trenching through roads or driveways; ground disturbance of lawns; removal of trees, landscaped shrubs, or other vegetative screening between residences and the right-of-way; potential damage to septic systems or wells; and removal of aboveground structures, such as sheds or trailers, from the right-of-way. Additionally, during typical overland pipeline construction, the trench is sometimes excavated before the pipe is strung and welded. This could result in open trenches for extended periods of time, which could pose a safety hazard to nearby residents.

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

- Work with local law enforcement, fire departments, and emergency medical services to coordinate access for effective emergency response during construction.
- Fence the boundary to the construction work area for a distance of 100 feet on either side of the residence to ensure construction equipment, materials, and spoil remain in the construction right-of-way.
- Notify local residents in advance of construction activities.
- Preserve mature trees and landscaping from within the edge of the construction work area unless necessary for the safe operation of construction equipment or as specified in landowner agreements.
- Use topsoil segregation procedures, as required, according to the Driftwood Plan.
- Ensure pipe is welded and installed as quickly as reasonably possible, consistent with prudent pipeline construction practices to minimize construction time affecting a neighborhood.
- Backfill the trench and complete cleanup as soon as the pipe is laid or temporarily steel plate the trench to minimize the hazard of open trenches.
- Complete cleanup (including grading) and installation of permanent erosion control measures within 20 days (10 days in residential areas) after the trench is backfilled, weather conditions permitting.
- Remove soil or mud tracked onto roadways as soon as practicable.
- Use measures to provide access during construction in residential areas in the event of an emergency.
- Restore lawns and landscaping immediately following final clean-up, or as specified in landowner agreements, weather conditions permitting.
- If weather conditions prevent immediate restoration of these areas, maintain and monitor temporary erosion controls until restoration is completed.

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

Table 4.9-3 lists the structures within 25 feet of the construction right-of-way and within 50 feet of the Pipeline centerline. Four residences would be within 25 feet of the construction right-of-way, one of which is currently owned by DWPL and one for which DWPL has executed an option to purchase; the two residences to be owned by DWPL would likely be demolished prior to construction. If not demolished, Driftwood has committed to ensure that the structures would not become residences in the future.

DWPL developed site-specific construction plans to mitigate potential impacts for residences and structures within 25 feet of construction areas. We reviewed these site-specific plans (section 2.5.3.1), and have concluded Driftwood's mitigation measures would lessen impacts on the affected residences. Comments on these site-specific plans may be submitted to FERC as described in the Letter to Interested Parties. Visual impacts on residential areas are discussed in section 4.9.2, transportation impacts are discussed in section 4.10.6, and dust and noise impacts on nearby residences are discussed in sections 4.12.1.4, 4.12.1.5, 4.12.2.2, and 4.12.2.3.

Table 4.9-3

Residences and Structures Within 50 feet of the Pipeline Construction Areas

Residence/ Structure	Parish	Milepost	Distance to Construction Work Area (feet)
Commercial Structure*	Calcasieu	0.3	0
House*	Calcasieu	0.9	0
House and Shed*	Calcasieu	1.0	18, 9
Construction Office	Calcasieu	1.9	11
Shed/Barn	Calcasieu	8.1	13
Paintball Field	Calcasieu	12.0	5
House, Barn, Shed	Calcasieu	27.5	25, 7, 6
House	Calcasieu	49.4	18

*Driftwood intends to acquire and control this property.

For any residence closer than 25 feet to the construction work area, DWPL would:

- ensure that the trench is not excavated until the pipe is ready for installation and that the trench is backfilled immediately after pipe installation;
- Ensure there are no known residences that would not be controlled by DWPL at the time of construction within 10 feet of the workspace. If any are identified, DWPL would provide landowner concurrence to FERC prior to construction;
- work closely with landowners affected by Pipeline construction;
- provide landowner notification in advance of construction activities on the property and prior to commencing construction;
- ensure that landowners are provided with sufficient access during construction activities;
- provide necessary traffic management services during construction,
- place and maintain construction fencing along areas of open ditches,
- construct between 7:00 a.m. and 7:00 p.m.; and,
- direct construction crews to keep vehicle speeds minimal in these areas.

The route would be adjacent to existing rights-of-way for about 70 percent of the Pipeline route. Overall, impacts on residential land would be minor and temporary, and therefore would not be significant.

4.9.2.6 Landowner and Easement Requirements

LNG Facility

The 790-acre LNG Facility site has been secured by DWLNG through lease/purchase agreements. One parcel of land, (about 480 acres) is currently owned by the Lake Charles Harbor and Terminal District, the second parcel (about 170 acres) is owned by a private company, and the two remaining parcels (totaling about 140 acres) are owned by DWLNG. The leases on the 480 and 170 acre tracts each have an option to enter into a long-term lease for a total duration of 50 years, consisting of an initial term of 20 years and six options to renew for five years each. This lease term covers the operational life of the LNG Facility, including the initial contracts for supply, which would have a term of up to 20 years. The entire LNG Facility site is zoned for heavy industrial use.

Pipeline

The Pipeline permanent right-of-way and associated permanent facilities would cross a total of 532 individual land tracts. DWPL would negotiate with landowners to acquire the necessary permanent right-of-way, ATWS, road access agreements, and surface land requirements for aboveground facilities associated with the Pipeline. Along the Pipeline route, DWPL would secure an easement to convey both temporary and permanent rights-of-way prior to construction. The easement acquisition process is designed to provide fair compensation to the landowners for the right of DWPL to use the property during construction and operation of the Pipeline.

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

4.9.2.7 Planned Developments

LNG Facility

There are no existing or known planned developments within 0.25 mile of the LNG Facility (Calcasieu Parish Police Jury, 2016a and b).

Pipeline

The Pipeline route does not cross any recorded planned developments. According to the parish planning offices, there are 29 planned residential developments and 3 planned commercial developments within a 5-mile radius of the Pipeline. Of the identified planned developments, 31 are planned in Calcasieu Parish, and 1 development is planned in Evangeline Parish. No developments are planned for Acadia or Jefferson Davis parishes. Only 1 residential development (Dreamview Estates Phase III) is planned approximately 820 feet south of the Pipeline route near milepost 29.5. Based on 2017 aerial imagery, a portion of the development has been completed. Based on the Pipeline alignment, no residences in this area would be directly affected, and no aboveground facilities would be in proximity. Therefore, there would be no impacts on planned developments due to the Project.

4.9.2.8 Public and Private Conservation Land

DWPL's Pipeline construction workspaces would abut two parcels that are designated as NRCS Wetland Reserve Program (WRP) easements; no other public conservation easements or other private conservation lands or land trusts, including NRCS Conservation Reserve Program easements are within 0.25 mile of the LNG Facility and Pipeline route or within 0.5 mile of aboveground facilities (National

Conservation Easement Database, 2016). No portion of DWPL's temporary or permanent easements would cross onto either of the identified WRP easements. Therefore, there would be no impacts on public or conservation easements from the Project.

4.9.2.9 Recreation and Special Interest Areas

LNG Facility

There are no designated natural, recreational, scenic areas, or wildlife refuges within or adjacent to the LNG Facility site (USFWS, 2016h; National Wild and Scenic River Systems, 2016). The recreational areas closest to the LNG Facility include the Intracoastal Park (about 1.3 miles southwest) and Calcasieu Point Landing (about 1.4 miles east) that is associated with use of the Calcasieu River and Calcasieu Lake for boating, fishing, and birding. The LNG Facility would also be about 0.25 miles south of the Driftwood Community, which includes access to boat slips with both commercial and recreational uses (e.g., boating or fishing) that use the Calcasieu River. The boat slips associated with the Driftwood Community are more than 2,500 feet inland from the Calcasieu Ship Channel.

Portions of two NWRs are near the Calcasieu Ship Channel and offer a variety of recreational activities. The East Cove Unit of the Cameron Prairie NWR extends along a portion of the southeastern shore of Calcasieu Lake (USFWS, 2016h). The Cameron Prairie NWR is distant from the Calcasieu Ship Channel, and there is a strip of land on the eastern side of the channel that blocks views from the refuge (figure 4.9-1). The Sabine NWR is 8 miles south of Hackberry, Louisiana, and the refuge extends to the ship channel between river miles 9 and 12 (USFWS, 2016h).

Construction of the LNG Facility would require dredging in the waters of the Calcasieu Ship Channel adjacent to the LNG Facility site and would increase barge and support vessel traffic in the channel (also see section 2.5.2.11). Operation of the LNG Facility would increase the number of LNG carriers using the Calcasieu Ship Channel. Users of the NWRs, recreational areas adjacent to the channel, and boat slips associated with the Driftwood Community may observe an increase in marine traffic, as discussed in section 4.10.7.1. Recreational fishermen and boaters in the area are accustomed to ship traffic and the increase in marine traffic during construction would not adversely affect recreational fishing and boating activities.

In accordance with 33 CFR 165.805 (a)(2), a moving security zone would be established around each LNG Carrier "commencing at U.S. territorial waters and extending channel edge to channel edge on the Calcasieu Ship Channel and shoreline to shoreline on the Calcasieu River, two miles ahead and one mile astern" of the vessel. The Captain of the Port (COTP) of Lake Charles has the discretion to adjust the moving security zone based on the USCG's assessment of current risk. Under normal circumstances, the moving security zone has the potential to close the channel to traffic and recreation. Recreational activity outside the channel itself is not likely to be affected, and activity within the Calcasieu Ship Channel would resume after the moving security zone passes. Users of the NWRs, recreational areas adjacent to the channel, and boat slips associated with the Driftwood Community would be subject to channel closure during passage of the LNG carriers (approximately 20-25 minutes at a typical speed of 8 knots; Ausenco, 2015) and during maneuvering in the turning basin (approximately one hour; Ausenco, 2015). Based on one LNG carrier per day during operation and channel closure duration of 20-25 minutes at locations outside the turning basin, the impact on recreational boating would not be significant.

Legend

- Facility Boundary
- Black Bayou Boat Launch
- Nelson Rd Boat Launch

Recreational Sites

- Calcasieu Point Landing
- Intracoastal Park

0 0.25 0.5 1 Miles

NOTES:
Aerial Imagery: ESRI World Topographic Map
Reproduced under license in ArcGIS 10.4

Figure **4.9-1**: Public Recreational Sites Near the Facility
Driftwood LNG Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

It is not anticipated that users of Sabine and East Cove Unit of Cameron Prairie NWRs, Intracoastal Park and Calcasieu Point Landing, and the Driftwood Community boat slips would not likely be affected by traffic in the channel due to construction and operation of the Project, other than the temporary delays caused by the implementation of the moving security zones described above.

The Creole Nature Trail All-American Road is a roadway system about 180 miles long that extends through Calcasieu and Cameron Parishes. It includes the portion of Highway 27 that extends from Sulphur to the Gulf Coast, including the highway near the LNG Facility.

During construction of the LNG Facility, there would be a substantial increase in traffic on LA-27 between Sulphur and the Project site, potentially causing impacts on access for the Creole Nature Trail All-American Road. In addition, the majority of the traffic would be from construction workers commuting to and from the site during early morning or evening hours, times when many tourists and recreational users of the roadway would not be affected. Impacts on this portion of the Creole Nature Trail All-American Road could also include visual impacts (see section 4.9.2.10) and noise and dust impacts (see sections 4.12.1.4 and 4.12.1.5, and 4.12.2.2 and 4.12.2.3, respectively). We conclude the impacts of construction and operation of the LNG Facility on the Creole Nature Trail All-American Road would be minor to moderate with implementation of Driftwood's Traffic Management Plan and the Driftwood Plan and Procedures.

Pipeline

The pipeline would not be within 0.5 mile of NWRs or state wildlife refuges and not within 0.25 mile of federally-managed public lands (national historic landmarks, national forests, national parks, national recreational trails, national wild and scenic rivers, NWRs, Indian lands, and wilderness areas), state-managed historic sites, nor state parks. One state-managed Scenic River, the Calcasieu River, would be crossed by the Pipeline near MP 37.5 using the HDD construction method. DWPL would set the HDD entry and exit workspaces back at least 400 feet from the edge of the waterbody, and visual and noise impacts would be minimal and temporary.

DWPL would further minimize impacts on the state managed Scenic River by not clearing the right-of-way above the HDD segment of pipeline with the exception of a 10-foot-wide access road for placement of a pump and hose for withdrawing water that is to come no closer than 100 feet to the ordinary water mark of the Calcasieu River. In the event of an inadvertent return during the HDD crossing of the Calcasieu River, DWPL would minimize and mitigate potential impacts by implementing measures outlined in its HDD Plan. To prevent and minimize potential accidental releases of hazardous materials, DWPL would develop and adhere to the Project-specific SPCC Plan. DWPL would have secondary containment in place at all locations where fuel or oil would be temporarily stored and where construction vehicles would be parked. Spill containment kits would be on site to prevent a spill or leak from affecting the Calcasieu River.

During construction of the Project, most non-local workers, and in some cases their families, would reside primarily in Calcasieu Parish (see section 4.10.4). Driftwood anticipates that that up to 498 permanent employees would be hired to operate the LNG Facility, and the Pipeline would require 41 new permanent employees. It is likely that some workers and/or their families would visit nearby parks in those parishes, or visit parks in Cameron Parish, resulting in indirect impacts. However, there is a large inventory of recreation areas in the three parishes spread over a large geographic area, and although some facilities may be stressed due to use by workers and/or their families, the overall impact on these facilities would not be significant.

4.9.2.10 Visual Resources

LNG Facility

The primary existing receptors in the viewshed of the LNG Facility include residential areas, recreational areas associated with the Calcasieu River, and a portion of the Creole Nature Trail All-American Road (Highway 27). The north edge of the LNG Facility perimeter berm would be about 2,500 feet from the Driftwood Community. The distance to the residential area to the west is about 4,000 feet to the edge of the LNG Facility perimeter berm. There are no mapped recreational areas associated with the Creole Nature Trail All-American Road near the LNG Facility site. The Dutch Cove cemetery is adjacent to the LNG Facility. Residences along the shores of Calcasieu Lake, Calcasieu Ship Channel, and recreational boaters and fishermen would also be within the viewshed of the LNG Facility and the associated ship traffic. No schools or churches would be within the viewshed of the LNG Facility.

Construction of the LNG Facility would increase traffic on Highway 27, which would affect the views of those using the highway. These changes to the visual character of the area during construction that highway users could observe include increased equipment, vehicles, workers, and structures on the LNG Facility site. The portion of the Creole Nature Trail All-American Road near the LNG Facility site represents only a small portion of the 180 miles of the Creole Nature Trail All-American Road, and those traveling along the highway would have a short time to view the site during construction. The impact on visual resources during construction would be short-term due to the presence of workers and equipment for the approximately 7-year construction period, but the impacts of the facilities would be permanent as discussed below.

Prominent features visible within the LNG Facility would include the three LNG storage tanks, flare stacks, the LNG plants, and LNG carriers (table 4.9-4) that would be visible to nearby residences, motorists along Highway 27 and other roadways, and boaters in the channel. The LNG Facility would require outdoor lighting for safety and security that would also be visible at night. DWLNG would operate the LNG Facility with outdoor lighting that consists primarily of downlighting for safety and lights on tall structures for aircraft warnings. In addition, nearby residents and viewers of the LNG Facility would see the flares during the occasional flaring events at night. A total of 4 flares would be constructed to a height of 350 feet and be lighted according to the FAA Advisory Circular 70/7460-1 L Change 1, chapters 4, 8, and 12.

Daytime rendering from Driftwood Road near the southwestern corner of the Driftwood Community

Nighttime rendering from Driftwood Road near the southwestern corner of the Driftwood Community

Figure 4.9-2

Daytime and Nighttime Renderings for Driftwood LNG

Daytime rendering from the residential area west of the proposed Driftwood LNG Terminal

Nighttime rendering from the residential area west of the proposed Driftwood LNG Terminal

Figure 4.9-3

Table 4.9-4

Major Structures of the Terminal Expansion

Structure	Height (feet)
LNG Plant Turbine Stacks	152
Wet/Dry Flares	350
LNG Storage Tanks (with piping)	204
Marine Flare	140
Enclosed Ground Flare Stacks	184
Oil Heater Stacks	132
Absorber Stacks	122
Telecom Tower	180

Once completed, the appearance of the LNG Facility would be consistent with other existing industrial developments along the Calcasieu Ship Channel such as Cameron LNG and Lake Charles LNG. The Project's flare stacks (approximately 351 feet above mean sea level) would be consistent with nearby facilities (e.g., 420 feet at Cameron LNG, 201-350 feet at Lake Charles LNG). FAA-required lighting on the flare stacks would be visible to the general population (e.g. the Driftwood Community, residential areas to the west, and Highway 27), but would be consistent with lighting on other tall structures in the area. Flares would be employed only during process upset conditions (i.e., about five hours during startup, about 12 hours during the first year, about 6 hours per subsequent year, generally in 15-30 minute flaring events). These intermittent, temporary events would not have a significant visual impact on nearby residences.

We received comments on the draft EIS noting the area surrounding the LNG Facility is a mix of forested and agricultural area, which would be more attractive than the LNG Facility regardless of whether it would be consistent with other developments in the area. The LNG Facility site was previously used for industrial purposes, and infrastructure from the previous facility currently is on site as part of the existing viewshed. We agree that construction and operation of the LNG Facility would result in a change in the visual landscape, although it would be consistent with the character of the surrounding area as there already are two existing LNG facilities within three miles of the Driftwood LNG Facility, as well as several other industrial developments.

The areas between the LNG Facility and some residences, including the Driftwood Community, consist of forested and scrub-shrub habitats (about 1,250 feet wide with trees 25-30 feet tall). DWLNG has secured land use agreements for properties located to the north of Burton Shipyard road and south of the Driftwood Community that would prohibit construction during the life of the LNG Facility, therefore these habitats would remain in place and provide visual buffers. Figure 4.9-2a provides daytime and nighttime visual simulation renderings of the LNG Facility, including flares, from ground-level perspective at the Driftwood Community, north of the LNG Facility. This figure was updated based on Driftwood's updated visual renderings provided as a comment on the draft EIS (FERC eLibrary accession number 20181019-5180). In addition, in their comments on the draft EIS, Driftwood has committed to plant trees to the south of the Driftwood Community to provide for additional screening between the LNG Facility and the residences (figure 4.9.2b). Vegetation and trees at Dutch Cove cemetery adjacent to the LNG Facility would remain as natural screening. Figure 4.9-3 provides daytime and nighttime visual simulation renderings of the LNG Facility, including flares, from ground-level perspective at the residential area located about 4,000 feet to the west of the LNG Facility. Based on updated visual renderings from Driftwood and on their mitigation measure, the LNG Facility would be minimally visible above the intervening trees during daytime and normal nighttime operations. In addition, the LNG Facility would be consistent with the visual character of the industrial developments along the Calcasieu Ship Channel. Therefore, the visual impact on the nearby Driftwood Community would not be significant.

Pipeline

DWPL's right-of-way vegetation clearing would cause the primary impact on visual resources during construction and operation of the Pipeline and associated facilities. To minimize visual impacts, about 70 percent of the proposed right-of-way would parallel existing permanent rights-of-way. This would limit the extent of changes in the viewshed. However, clearing of forested lands within the construction right-of-way, and maintaining the permanent right-of-way as herbaceous and scrub/shrub vegetation types would change the viewscape for viewers in the area. The impact would not be significant because there would be few observers of the change. DWPL would allow all other forested lands to revert to pre-construction conditions, although it could require 20 to 40 years to reach that stage, resulting in long-term visual impacts on those areas.

In addition to clearing of vegetation, construction of the Pipeline and associated facilities would require the presence of personnel, large construction equipment, and vehicles, all of which could be visible in areas accessible to the public, such as at roadways crossed by the route and near residences. DWPL identified four residences within 50 feet of the construction right-of-way, one of which is currently owned by DWPL and one for which DWPL has executed an option to purchase; the two residences to be owned by DWPL would likely be demolished prior to construction, or Driftwood would ensure the structures would not become residences in the future. Visual impacts on the remaining locations due to the presence of construction equipment and personnel would be temporary. Therefore, those visual impacts would not be significant.

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

The Pipeline route would cross one state managed Scenic River in Calcasieu Parish. DWPL would cross this waterbody by the HDD method to avoid impacts on the bed or banks. Additionally, DWPL would set the HDD entry and exit workspaces back at least 400 feet from the edge of the waterbody. Although most viewers would not see the right-of-way from the waterbody or the construction equipment on the right-of-way, it is possible that portions of the drilling equipment would be visible from some locations. This temporary visual impact would not be significant due to the small change in viewscape.

CS-01 would be about 1,420 feet from the nearest residence to the east; a tree line separating the site from the residence would remain undisturbed during construction and operation. CS-02 would be about 1,850 feet from the nearest residence to the north. CS-03 would be about 1,200 feet from the nearest residences to the east and about 1,359 feet from the nearest residences to the southwest; a tree line separating the site from the residences to the east would remain undisturbed during construction and operation. An existing compressor station is located between the site and the nearest residences to the southwest.

Following construction of the compressor stations, DWPL would maintain existing vegetation on the property outside of the fenced area during operations, paint all buildings and outdoor equipment to be maintained throughout the life of the asset, install fencing and, if necessary, plant local vegetation to further shield the station from neighboring structures. The stations would have inside lighting for operational purposes.

Visual impacts during construction of the compressor stations would be temporary. DWPL would limit outdoor lighting at the compressor stations to include floodlights affixed to pole structures for operational work at night or during inclement weather. Additional lighting would be installed on the building structures and within the station yards for safety and security purposes during operation. Additional lighting would only be necessary when active maintenance operations at the compressor stations require nighttime work. Outdoor lighting would be designed to minimize visual effects at night, including directional shielding and downward direction where practicable. As a result, the nighttime appearance of the compressor stations would not have a significant impact on visual resources. Although the visual impacts during operation would be permanent, they would not be significant due to the mitigation proposed by DWPL, distance from visual receptors, presence of similar industrial facilities in the viewshed, and the use of downlighting to shield aboveground facility lighting at night.

4.9.3 Contaminated or Hazardous Waste Sites

The LNG Facility site is located adjacent to a site containing known soil and groundwater contamination, which occurs to the north of the North Slip associated with the marine berth. This site and the anticipated impacts and mitigation are discussed in detail in section 4.2.6.1.

4.9.4 Coastal Zone Management

The LDNR OCM is charged with implementing the Louisiana Coastal Resources Program under authority of the Louisiana State and Local Coastal Resources Management Act of 1978, as amended (Act 361, Louisiana Revised Statutes § 49:214.21 et seq.). Work within the Louisiana Coastal Zone requires a Joint Permit Application submitted to LDNR and the COE for a CUP determination process conducted concurrently with a Section 404/10 permit application. The inland extent of the coastal zone boundary is defined by the ICW. Within the coastal zone, areas are divided into Environmental Management Units by the LDNR. The LDNR evaluates activities or development affecting land within Louisiana's coastal zone for compliance with the CZMA through a process called "federal consistency."

The LNG Facility site would be outside of the Louisiana Coastal Zone boundary, which borders the southeastern edge of the LNG Facility site, the Pipeline lies outside the coastal zone, and the only portion of the Project within the coastal zone are the BUDM sites, which are part of a separate established program as discussed in section 2.5.2.6. However, following removal of the temporary barrier and dredging the MOF and marine berth, the coastal zone management area would extend into the newly dredged areas. Coastal zone management compliance and permitting for routine maintenance dredging of the marine berths would be required thereafter. DWLNG filed a Joint Permit Application with the COE and LDNR for the Project in March 2017; the current status of the application is included in table 1.5-1 in appendix A.

4.10 SOCIOECONOMICS

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

The Project would include facilities in four parishes: the LNG Facility in Calcasieu Parish; and the Pipeline in Calcasieu, Jefferson Davis, Acadia, and Evangeline parishes. The Lake Charles Metropolitan Statistical Area (MSA) consists of Calcasieu Parish (the LNG Facility site) and Cameron Parish. For the purposes of our socioeconomic analysis, the four parishes where facilities would be located, as well as the Lake Charles MSA, are defined as the “Project area.”

4.10.1 Population

Table 4.10-1 provides a summary of selected population and demographic information for the Project area.

4.10.1.1 LNG Facility

The U.S. Census Bureau (2017) reported that in 2015, the population of Calcasieu Parish was 195,887, with a population density of 184.1 persons per square mile (table 4.10-1). The average population density for Louisiana in 2015 was 107.0 persons per square mile.

Driftwood anticipates construction of the LNG Facility would require a total construction period of 86 months. Driftwood estimates a peak construction workforce of about 5,400 workers for the LNG Facility, with an average workforce of about 3,107 workers per month. Driftwood anticipates hiring about 30 percent of required workers locally; non-local personnel are expected to be highly skilled tradesmen.

The peak construction workforce would represent a sizeable increase to the local population (2.8 percent), even if all 5,400 workers were housed within Calcasieu Parish. As discussed in section 10.4.5, there is an abundance of transient housing in Calcasieu Parish.

Table 4.10-1

Existing Socioeconomic Conditions in the Project Area

State/ Parish	Population 2010 [a]	Population 2015 [b]	Population Density (per square mile) 2010 [a]	Population Density (per square mile) 2015	Civilian Labor Force 2015 [b]	Unemployment Rate (percent) 2015 [b]	Top Two Major Industries by Percentage of Jobs 2015 [b]
Calcasieu	192,768	195,887	181.2	184.1	94,684	8.3	Education services, health care, and social assistance
							Agriculture, forestry, fishing and hunting, and mining [c]
Cameron	6,839	6,706	5.3	5.2	3,283	6.3	Education services, health care, and social assistance
							Arts, entertainment, recreation, accommodation, and food services
Jefferson Davis	31,594	31,434	48.5	38.3	13,937	9.2	Education services, health care, and social assistance
							Agriculture, forestry, fishing and hunting, and mining [c]

Table 4.10-1

Existing Socioeconomic Conditions in the Project Area

State/ Parish	Population 2010 [a]	Population 2015 [b]	Population Density (per square mile) 2010 [a]	Population Density (per square mile) 2015	Civilian Labor Force 2015 [b]	Unemployment Rate (percent) 2015 [b]	Top Two Major Industries by Percentage of Jobs 2015 [b]
Acadia	61,773	62,163	94.3	94.9	27,380	10.1	Education services, health care, and social assistance Agriculture, forestry, fishing and hunting, and mining [c]
Evangeline	33,984	33,768	51.3	51.0	12,254	10.4	Education services, health care, and social assistance Retail trade
Louisiana	4,533,372	4,625,253	104.9	107.0	2,194,199	8.1	Education services, health care, and social assistance Retail trade

[a] U.S. Census Bureau, 2010a
[b] U.S. Census Bureau, 2017
[c] Mining includes oil and gas extraction activities

The 2010 Census data for Louisiana indicate that the average family size in the state is 2.6 persons (U.S. Census Bureau, 2015). If all non-local workers move to the LNG Facility area with their families, up to 9,828 people could relocate to Calcasieu and surrounding Parishes during construction of the LNG Facility. Although it is unlikely that all non-local workers would bring families, an increase of 9,828 people would result in a 5.0 percent increase in the population of Calcasieu Parish for the peak 11 months of construction. For the remainder of the construction period, the population could increase by about 5,655 people if all non-local workers brought families.

According to the Project-specific socioeconomic study report Driftwood anticipates hiring up to 498 permanent employees to operate the LNG Facility; of these about 360 would be Driftwood employees and 138 would be contractors (Scott, 2017). About 60 percent of the permanent LNG Facility operational employees would be hired locally. The remaining non-local workforce and their families would represent a minor but permanent increase in the population near the LNG Facility.

4.10.1.2 Pipeline

The Pipeline route traverses four Parishes: Calcasieu, Jefferson Davis, Acadia, and Evangeline. Calcasieu Parish is described above. All other parishes traversed by the Pipeline are significantly less populated than Calcasieu Parish. Acadia Parish has the next highest population at 62,163 (94.9 persons per square mile), and Cameron Parish has the lowest at 6,706 (5.2 persons per square mile) (U.S. Census Bureau, 2015).

Driftwood anticipates pre-mobilization of Pipeline construction activities to begin shortly after mobilizing for construction of the LNG Facility, with construction beginning approximately one year after receiving the FERC Order and occurring in three phases over 30 months. Driftwood anticipates the construction phase of the Pipeline would occur in stages so that the arrival of feed gas to the LNG Facility is increased over time as the individual liquefaction plants are constructed and placed into service.

Driftwood estimates a peak construction workforce of about 1,020 workers for the Pipeline, with an average workforce of about 523 workers per month for the entire Project. Driftwood anticipates hiring about 20 to 40 percent of required workers locally; non-local personnel are expected to be highly skilled tradesmen. If all non-local workers bring 2.6 family members, the temporary population would increase by about 952 individuals. As described in section 4.10.2, those workers would likely reside in Calcasieu Parish, presenting a less than 1.0 percent increase in the population of the parish and a minor population increase near the Pipeline.

Driftwood anticipates hiring 41 new permanent employees to operate the Pipeline, with about 90 percent to be hired locally. This increase in population would represent a negligible increase in the local population near the Pipeline.

4.10.1.3 Project Impacts

Construction of the LNG Facility and the first phase of Pipeline construction (which would occur in Calcasieu Parish) would coincide for a period of up to 20 months (section 2.3.2). For this period, the combined construction workforces would range from 600 to nearly 6,500 workers, depending on when the workforce for the LNG Facility peaks. The total population for the five parishes near the Project is about 329,960. Assuming 70 percent of workers are non-local and would be accompanied by 2.6 family members, the population increase could be between 1,092 and 11,769. This would represent a potential 0.3 to 3.6 percent increase in the population of the Project area, which is a minor increase.

Operation of the LNG Facility and Pipeline would require a permanent workforce of 539 new employees, with an estimated 64 percent to be hired locally. This increase in population would represent a minor permanent impact on the local population.

4.10.2 Economy and Employment

Table 4.10-2 provides selected employment and income statistics for the Project area. The main employment sector in the Project Area is education services, health care, and social assistance.

Table 4.10-2

Employment and Income Characteristics of the Project Area

State/Parish	Civilian Labor Force 2015	Per Capita Income (dollars) 2015	Population Below Poverty Level (percent) 2015	Unemployment Rate (percent) 2015
Calcasieu	94,684	25,005	13.0	8.3
Cameron	3,283	29,679	8.3	6.3
Jefferson Davis	13,937	22,260	17.5	9.2
Acadia	27,380	20,552	16.3	10.1
Evangeline	12,254	18,484	21.3	10.4
Louisiana	2,194,199	24,981	15.2	8.1

Source: U.S. Census Bureau, 2017

4.10.2.1 LNG Facility

The civilian labor force is defined as the sum of employed persons and those searching for work. As presented in table 4.10-2, the civilian labor force in 2015 numbered 94,684 in Calcasieu Parish. Per capita income in 2015 was $25,005 in Calcasieu Parish, which is slightly above the state's average per capita income of $24,981.

Calcasieu Parish has an unemployment rate of 8.3 percent, and 13.0 percent of the population is below the poverty line. The other parishes in the Project area have unemployment rates between 6.3 (Cameron) and 10.4 (Evangeline) percent. With the exception of Cameron Parish, all have unemployment rates are higher than the state average of 8.1 percent. Poverty rates in the Project area outside of Calcasieu Parish range from 8.3 (Cameron) to 21.3 (Evangeline) percent. With the exception of Cameron Parish, all have poverty rates are higher than the state average of 15.2 percent.

During construction, Driftwood estimates a total payroll for the LNG Facility of about $3.25 billion. Construction of the LNG Facility would increase economic activity within the area in several ways.

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

According to the Project-specific socioeconomic study report Driftwood anticipates construction spending within the Lake Charles MSA would directly and indirectly produce $5.9 billion in new business sales, $1.7 billion in earnings, and 3,934 new jobs per year (Scott, 2017). This increase in economic activity resulting from construction of the LNG Facility would result in a temporary positive economic impact within the Lake Charles MSA.

Anticipated operational expenditures are estimated to be $247.1 million per year including $122.1 million in salaries, or about $245,181 per worker per year (Scott, 2017). As this is well above the average income for the area, we conclude that the permanent workforce associated with the LNG Facility would result in a positive permanent impact on the local economy.

4.10.2.2 Pipeline

The civilian labor force and per capita income for Calcasieu Parish is discussed above. As presented in table 4.10-2, the civilian labor force in 2015 of the other four parishes comprising the Project area was 56,854. The per capita income in 2015 was highest in Cameron Parish ($29,679) and lowest in Evangeline Parish ($18,484).

Unemployment rates in the Project area are presented in table 4.10-2. Cameron Parish had the lowest unemployment rate in 2015 at 6.3 percent, and Evangeline had the highest at 10.4 percent.

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

Operation of the pipeline would require 41 new permanent employees, including 11 for compressor stations, with about 64 percent to be hired locally. These permanent positions would result in a negligible positive impact on the local economy.

4.10.3 Local Taxes and Government Revenue

4.10.3.1 LNG Facility

Driftwood estimates spending a total of $14.5 billion to construct the LNG Facility, of which $3.8 million would be spent within the Lake Charles MSA (Scott, 2017). This would indirectly generate increased local, state, and federal sales tax revenue in the Project Area. The expenditures on goods and services by the construction workforce and the families of the workers would generate increased tax revenues. In addition, local, state, and federal governments would tax the $3.25 billion in total workforce payroll. Driftwood estimates the $1.7 billion in new income over the eight year construction period for the LNG Facility would generate $53.5 million in new sales taxes in Calcasieu Parish; Cameron Parish does not impose sales tax (Scott, 2017). This increase in tax revenue would be a minor, temporary, positive impact on the tax revenue in the LNG Facility area.

After construction, Driftwood would pay parish property taxes on its LNG Facility and associated equipment. There also would be long-term increases in sales tax revenue from expenditures on materials, goods, and services by Driftwood and the operational workforce. Based on the present tax laws and Driftwood's assumed LNG Facility life of 20 years, Driftwood estimated that the total property tax paid to Calcasieu Parish would be $1.2 billion.

On December 14, 2018, DWLNG received approval to participate in the State of Louisiana's Industrial Tax Exemption Program. This program waives property taxes for five years with the potential for an extension for another five years, and will decrease the accrual of Project property taxes to Calcasieu Parish over the life of the Project.

4.10.3.2 Pipeline

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

DWPL estimates spending $45 million on material purchases in Louisiana during construction of the Pipeline. As with the LNG Facility, this would generate increased local, state, and federal sales tax revenue in the Project area, and the expenditures on goods and services by the construction workforce and the families of the workers would also generate increased tax revenues. In addition, local, state, and federal governments would tax the $220 million in total workforce payroll (FERC eLibrary accession number 20170331-5058). This increase in tax revenue would be a minor, temporary, positive impact on the tax revenue in the parishes crossed by the Pipeline. Operation of the Pipeline would also have a positive effect on local property tax revenue based on Driftwood's tax projections of about $407 million over the life of the pipeline (Calcasieu Parish: $151.2 million; Jefferson Davis Parish: $126.0 million; Acadia Parish: $71.1 million; and, Evangeline Parish: $58.5 million) (FERC eLibrary accession number 20170331-5058.

4.10.4 Housing

Table 4.10-3 provides data on the local rental and other temporary housing options in the Project area. According to the U.S. Census Bureau, Calcasieu Parish had a total of 9,629 vacant housing units in 2015; of these, 2,128 units were rentals. There are also 85 hotels/motels in Calcasieu Parish that could be used by any of the short-term workforce, and a number of temporary housing developments, totaling 18,076 units that have recently been permitted in Calcasieu Parish to accommodate the expected temporary worker influx in the next few years.

4.10.4.1 LNG Facility

As stated previously, DWLNG anticipates local residents would comprise a portion of the workers hired for construction of the LNG Facility. The LNG Facility site is in Calcasieu Parish and much of the parish would be easily accessible to workers. Calcasieu Parish has the most vacant housing units with 9,629 units, as well as rooms at 85 hotels and motels (table 4.10-3), and it is likely that the majority of the workforce would be housed there.

The currently available transient housing in the Project area is sufficient to accommodate the maximum peak workforce for the Facility along with families of the workers who choose to bring their families. Housing of those workers and family members would result in a moderate, temporary impact on housing availability in the Project area that would last about six years. Outside of the time when the workforce peaks, the impact on transient housing would be minor. Construction of the LNG Facility would not result in significant impacts on transient housing availability in the area.

We have determined that the addition of 498 permanent staff required to operate the LNG Facility would have, at most, a minor permanent impact on local housing markets.

Table 4.10-3

2010 Housing Characteristics of the Project Area

State/Parish	Total Housing Units [a]	Occupied Units [a]	Vacant Units [a]	Rental Units [a]	Rental Vacancy Rate (percent) [a]	For Seasonal, Recreational, or Occasional Use [a]	Hotels/ Motels [b]
Calcasieu	84,954	75,325	9,629	23,647	9.0	13,580	85
Cameron	3,524	2,608	916	239	13.1	1,268	7
Jefferson Davis	13,519	11,652	1,867	3,030	6.7	2,566	12
Acadia	25,737	22,599	3,138	6,641	8.0	4,820	8
Evangeline	14,815	11,954	2,861	4,059	7.3	2,207	4
Louisiana	1,999,855	1,727,919	271,936	591,210	8.1	267,856	> 1,875

[a] U.S. Census Bureau, 2017

[b] HotelMotels, 2017

4.10.4.2 Pipeline

Driftwood anticipates local hires would comprise 20 to 40 percent of the peak of 470 workers for the Pipeline. Those workers would commute daily from their homes to the construction right-of-way or the compressor station site. Based on the number of available rental housing units and hotels/motels in the Project Area, adequate housing exists to accommodate those workers and their families, and thus the Pipeline would result in a minor, temporary impact on transient housing. Overall, construction of the Pipeline would not result in significant impacts on transient housing in the area.

Operation of the Pipeline would require 41 new permanent employees who would relocate to the Pipeline area. These new employees would represent a negligible decrease in available permanent housing.

4.10.4.3 Combined Terminal and Pipeline Impacts

Construction of the LNG Facility and the first phase of Pipeline construction (which occur in Calcasieu Parish) would coincide for a period of up to 20 months (section 2.3.2). For this period, the combined construction workforces would range from 600 to 6,430 workers, depending on when the workforce for the LNG Facility peaks. The total population for the five parishes in the Project area is about 329,960. Assuming 70 percent of workers are non-local and would be accompanied by 2.6 family members, the population increase could be up to between 1,092 and 11,703. This would represent a potential 0.3 to 3.5 percent increase in the population of the Project area, which may result in minor to moderate increase. As noted above, there is sufficient vacant transient housing in the Project Area to accommodate the construction workforce peak and in the rooms available in the 116 hotels and motels in the parishes. The impact on transient housing availability would last no more than 20 months and would not be significant.

Operation of the Project would require 539 permanent employees, of which about 36 percent who would be non-local and relocate to the area. These new employees would represent a minor impact on housing.

4.10.5 Property Values

The LNG Facility would be visible from nearby residential areas, as described in section 4.9.2.10. One study on the effect of the construction of industrial facilities on property values showed that the construction of fossil fuel generation plants near residential areas may have a minor negative effect on property values in those residential areas (Davis, 2011); however, the study also found that many factors affect the results. As the region is already industrial in character, there are several industrial facilities nearby, and the LNG Facility site was previously occupied by an industrial site, the potential to affect property values would be reduced. We conclude that although property values near the LNG Facility could experience downward pressure from the presence of the LNG Facility and increased traffic during construction, they would also be expected to experience upward pressure from the increased economic opportunities associated with the Project, and the net outcome would be minor.

Our review of multiple studies indicates that there is no measureable impact on sales price or sales frequency of properties along or in proximity to a natural gas pipeline versus properties not along or in proximity a pipeline. Other factors, most importantly the preferences of the individual buyer, seem to be far more likely to affect property values. We conclude that property values near the Pipeline should not be affected.

4.10.6 Public Services

Table 4.10-4 summarizes local community public services in the Project area.

4.10.6.1 LNG Facility

Calcasieu Parish has 72 public schools with a 2015-2016 enrollment of 35,614 students. There are 7 hospitals in Calcasieu Parish with a total of 792 beds. Calcasieu Parish has 9 police departments, and 16 fire departments.

Table 4.10-4

Public Service Data for the Project Area

	Education		Public Safety		Healthcare	
Parish	Number of Public Schools [a]	Total Enrollment 2015-2016 [a]	Number of Police Departments [b]	Number of Fire Departments [b]	Number of Hospitals [c]	Number of Hospital Beds [c]
Calcasieu	72	35,614	9	16	7	792
Cameron	4	1,314	1	6	1	49
Jefferson Davis	15	6,310	6	9	2	69
Acadia	33	12,532	6	14	4	174
Evangeline	13	6,737	5	7	3	307

[a] Louisiana Department of Education, 2017; Niche, 2017; Greatschools, 2017; Private School Review, 2017; National Center for Education Statistics, 2017

[b] Louisiana Office of State Fire Marshall, 2017; USA COPS, 2017; County Office, 2016

[c] Google Maps, 2017; American Hospital Directory, 2016

We anticipate the peak construction workforce of 5,400 workers for the LNG Facility to last up to 28 months. Assuming about 30 percent of the workforce would be hired locally, and all non-local workers relocate to the LNG Facility area with two children each, local school system enrollment would increase by 7,560 students, or an increase of 21 percent in Calcasieu Parish. However, DWLNG would not employ many of the workers for the full duration of construction, and it is unlikely that those workers would relocate with their children. Based on the average workforce of 4,093 for both the LNG Facility and Pipeline, and assuming two children per worker, school enrollment could increase by 5,730 students, or 16 percent of current enrollment in Calcasieu Parish. Many construction workers do not have families or would not relocate their families while they work on the LNG Facility. We conclude that the impacts on schools in the Project area would likely be much less than the above estimates, and negligible.

During operation of the LNG Facility the 350 permanent workers would not likely cause any adverse impact on local schools. If all 350 permanent workers have two children, this would result in 700 additional children in local parish school systems. Combined, this addition would represent less than a 2.0 percent increase in total enrollment in Calcasieu Parish, with students spread out over many grade levels. As a result, we have determined that no adverse impacts from operation of the LNG Facility would occur on school districts.

During construction, enforcement and support activities associated with permitted large vehicle loads and widths could increase, workplace injuries may require emergency medical services, and periodic police services could be required. Local fire departments participate in a regional mutual aid program that provides emergency assistance to many petro-chemical facilities in the area, are experienced with industrial incidents, and could help in emergencies during construction. Therefore, we have determined that impacts on public services during construction of the LNG Facility would be temporary and minor.

4.10.6.2 Pipeline

Driftwood's peak construction workforce of 1,030 would not likely bring family members to the area due to the Pipeline's relatively short construction period. Further, the temporary increase in population due to construction would be negligible compared with the current population in the area. As a result, the Pipeline would minimally affect schools in the Pipeline area. Although it is likely that there would be some need for increased police, fire, and medical services during construction, those public services would experience only minor impacts during construction.

Driftwood's 41 new permanent positions would represent a negligible increase in the local population. Therefore, we have determined local services would not be affected.

4.10.7 Transportation

4.10.7.1 LNG Facility Impacts

A Traffic Mitigation Report was developed for the Driftwood LNG Facility (FERC eLibrary accession number 20170331-5058). The objective of the Traffic Mitigation Report was to describe and evaluate traffic generated by the construction and operation of the LNG Facility, which is south of the Interstate Highway-10 corridor.

The study area is in southwestern Lake Charles, Calcasieu Parish, Louisiana. Construction is scheduled to occur for approximately 86 months, with a maximum number of construction and operation personnel estimated for the second year of the construction period. Four park-and-ride facilities have been proposed to minimize the impact of worker vehicles on existing traffic conditions. These facilities are expected to accommodate a total of 4,904 vehicle trips generated by construction workers arriving in the morning and departing after the work shift during peak traffic hours. Buses would be used to transport workers from the park-and-ride facilities to the LNG Facility site. In addition to the park-and-ride sites, bus pickup/drop-off loops would be used to transport up to 545 additional workers directly from residential areas to the LNG Facility site.

Based on assumed routes from the park-and-ride facilities to the LNG Facility site, eighteen existing and eight temporary construction intersections were included in the analysis. Traffic counts were collected at the study intersections in January 2017 to determine existing conditions. The construction period with the maximum number of workers and start of operation is anticipated to be 2021; therefore, traffic analyses for no build and build conditions were performed for this year. To determine traffic volumes for the 2021 No Build analysis, a 0.6 percent annual growth rate was applied to existing traffic counts. Anticipated construction and operation traffic was added to the 2021 No Build traffic volumes to determine 2021 Build volumes.

The study intersections were analyzed using Synchro Pro software based on the Highway Capacity Manual 2010 methodologies for analyzing signalized and stop controlled intersections. The quality of traffic at each intersection was ranked (A-F) for LOS based on the amount of time a driver would take to get through the intersection. A LOS of A would be the fastest crossing (under 10 seconds), with a LOS of F being the slowest crossing (greater than 50 or 80 seconds at a two-way stop or traffic signal, respectively). The Existing Conditions analysis results show that all study intersections currently operate within acceptable LOS D or better, with the exception of intersection 1003 during the PM analysis period. The LA 27 and LA 108/LA 1133 intersection experiences LOS F during PM operations due to the high volume of northbound and southbound through traffic on LA 27 causing delays for traffic turning left from the westbound approach on LA 1133.

The 2021 No Build analysis results show that all study intersections would operate at LOS D or better, with the exception of the LA 27 and LA 108/LA 1133 and the LA 27/LA 3077 and IH-10 WB Ramp intersections in the PM peak period. The LA 27 and LA 108/LA 1133 intersection would continue to operate at LOS F as it did in the Existing Conditions analysis. The LA 27/LA 3077 and IH-10 WB Ramp intersection would drop from LOS D to LOS E due to the increase in traffic based on the annual growth rate of 0.6 percent.

The 2021 Build analysis results show that there would be increased delay at some of the study intersections. Seven existing intersections in the AM and PM periods are expected to operate at a LOS below D as well as all of the driveway intersections for the park-and-ride sites during the PM peak period, making them areas of concern. To minimize the effect that project construction traffic is expected to have on the study intersections, a number of generally accepted mitigation methods are available. This includes temporary signals, uniformed officers directing traffic, roadway widening, construction of additional right turn and left turn lanes within existing Right of Way, signal timing modifications, coordinating worker shift times and deliveries away from peak hours, regulating the number of workers using each park-and-ride site, and encouraging carpooling for workers using the park-and-ride sites. Driftwood's mitigation actions would improve the study intersections to LOS D or better when compared with 2021 Build conditions without mitigation. Applying mitigation should improve the LOS at the LA 27 and LA 108/LA 1133 intersection, which is currently operating below LOS D, and also LA 27/LA 3077 and IH-10 WB Ramp intersection, which is expected to operate below LOS D in the 2021 No Build scenario.

As noted in section 1.4.1.5 of this document, Driftwood has committed to coordinating improvements to Burton Shipyard Road, including a right-hand turn lane to the north onto Highway 27 and a left-hand turn lane on Highway 27 for traffic turning onto Burton Shipyard Road and connecting Olsen Road directly to Highway 27 to allow local traffic to avoid Burton Shipyard Road. Driftwood is engaged in ongoing discussions with Calcasieu Parish Police Jury and LADOTD officials with respect to plans for mitigation measures to be implemented to minimize traffic impacts, including improvements to Highway 27. These projects would help alleviate traffic concerns near the LNG Facility relative to the modeled 2021 Build conditions.

Marine Traffic Impacts

During construction of the LNG Facility, DWLNG would receive large equipment, bulk materials, and other supplies by barge at the MOF and Pioneer Docks on the Calcasieu Ship Channel. Driftwood estimates about 2,000 barge trips would be required during the seven years of construction. In the initial phases of construction (about 15 months), the additional barge traffic would average three barge trips per day, declining to less than one trip per day for the remainder of construction. Driftwood anticipates that Driftwood's LNG carrier traffic would begin with facility operations approximately five years after receiving the FERC Order at an average of about one trip per three days, increasing to two trips per three days the next year and one trip per day after all five liquefaction plants are in service.

The Calcasieu Ship Channel currently handles about 1,000 vessel trips per year to and from existing facilities within the Channel. This volume is anticipated to increase steadily to about 2,900 vessel trips per year over the next ten years (Ausenco, 2016). The incremental increase in the average annual ship traffic within the Calcasieu Ship Channel attributable to Driftwood would be about 20-30 percent during construction and about 12 percent during operation.

Recreational and commercial fishermen and boaters in the area are accustomed to ship traffic; however individual boaters may experience more frequent delays associated with the increase in ship traffic. We have determined that associated delays would constitute a minor to moderate impact on these boaters.

On April 25, 2017, the USCG provided an LOR based on a WSA, and a follow-on WSA was provided to the USCG by Driftwood. Based on USCG's analysis, the LOR provided the recommendation to consider the waterway suitable for the additional LNG traffic. The USCG, through their process, consulted local stakeholders including marine and emergency groups in providing this determination, and stated that the small increase in LNG traffic would represent a minor impact relative to current conditions.

4.10.7.2 Pipeline

DWPL would attempt to schedule construction activities to avoid traffic flow interruptions on dirt and gravel roads, which it proposes to open-cut. Delivery of pipe and other materials to the construction right-of-way, the storage yard, and the compressor station sites, may result in some disruption of traffic; however, this temporary impact would occur primarily in the early stages of construction.

Where access roads are identified as needing improvements (such as grading, widening, the addition of gravel, or removal of obstructions), construction would be executed while providing sufficient drainage and safe road conditions for construction equipment and vehicles. The erosion control and restoration measures installed along these areas would follow the Driftwood Plan and Procedures. Dust emissions along unpaved access roads would be controlled by applying water, as needed, and by restricting vehicle speeds. If excessive rutting takes place on access roads, DWPL would perform maintenance activities on the road prior for continued use. The entrance of the construction right-of-way would be positioned so that mud is not tracked off site from vehicles and equipment leaving the right-of-way, and any mud that is carried onto public pavement roadways would be removed.

The compressor station site would accommodate necessary parking for construction personnel. Pipeline construction would have site personnel parking at the respective pipe yard or contractor yard, and an approximate total of 12-15 busses (based on 10-20 passengers) would be used to make a single return trip each day. Waste materials from construction activities would be collected (at compressor stations, contractor yards or right-of-way locations) and moved with pickup/loading trucks on as as-required basis respective to the period of construction (e.g., daily during peak). Additional vehicles are required to collect and haul waste water from the compressor stations (about two trucks/day) and Pipeline construction right-of-way locations (two to three trucks/day for Phase 1 and 2; one truck/day for Phase 3).

Pipeline construction personnel would commute to the construction right-of-way, and Driftwood anticipates that most personnel would travel to and from the construction site outside of peak commuting hours. Therefore, we expect construction of the Pipeline to result in minor, temporary impacts on traffic flow by the construction workforce.

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

4.10.8 Environmental Justice

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires that each federal agency address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

As described below and consistent with our understanding of Executive Order 12898, we reviewed the Project to determine if its resulting impacts would be disproportionately high and adverse on minority and low-income populations and appreciably exceed impacts on the general population or other comparison group. The Project would include facilities in four parishes: the LNG Facility in Calcasieu Parish; and the Pipeline in Calcasieu, Jefferson Davis, Acadia, and Evangeline parishes. For the purposes of our environmental justice analysis, the four parishes where facilities would be located are defined as the "Project area."

Review Methodology

In consultation with the EPA, based on published EPA guidance concerning environmental justice reviews (1998), and incorporating the EPA's *Promising Practices for EJ Methodologies in NEPA Reviews* (EPA, 2016), we used a three-step approach to conduct an environmental justice review of the Project. These steps are

- determine the existence of minority and low-income populations,
- determine if the impacts are high and adverse, and
- determine if the impacts fall disproportionately on environmental justice populations.

Minority and Low-Income Populations

A minority population exists when

- the total racial minorities in a U.S. Census Bureau-defined census tract (U.S. Census Bureau, 2012b) are more than 50 percent of the tract's population;
- the percentage of a racial minority in a census tract is "meaningfully greater" than in the comparison group;
- the total ethnic minorities in a census tract are more than 50 percent of the tract's population; or
- the percentage of ethnic minorities in a census tract is meaningfully greater than in the comparison group.

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.

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; or
- the median household income for the census tract is lower than the median household income for the state where the census tract is located.

Existing Conditions

Based on U.S. Census Bureau (2015) – Racial/ethnic population and income statistics for the Project, are presented at state and parish levels in table 4.10-5.

Table 4.10-5

Existing Ethnic and Economic Conditions

State/ Parish	Race/Ethnicity (percent) White	Black	Native American	Asian	Hispanic or Latino [a]	Other	Total Minorities [b]	Annual Per Capita Income	Percent Below Poverty Level
Louisiana	64.3	33.1	1.3	2.0	4.7	1.3	35.7	$24,981	15.2
Calcasieu	72.6	26.3	1.0	1.5	2.9	0.7	27.4	$25,005	13.0
Jefferson Davis	81.2	18.3	1.4	0.6	2.1	0.3	18.8	$22,260	17.5
Acadia	80.6	19.0	0.8	0.3	2.1	1.1	19.4	$20,552	16.3
Evangeline	70.1	29.0	0.5	0.3	2.8	1.8	29.9	$18,484	21.3

Source: U.S. Census Bureau, 2015c

a. The Census Bureau treats ethnicity and race separately. Hispanics may be of any race, so also are included in applicable race categories; thus, the Hispanic/Latino percentages should not be added to percentages for other racial categories.

b. Total minorities is calculated as total population minus white non-Hispanic population.

As shown in table 4.10-5, some of the communities near the Project have a higher percentage of minority population and higher poverty rates than the State of Louisiana, while others have a lower percentage of minority population and lower poverty rates than the State of Louisiana. In addition, none of the communities near the Project have a significantly higher proportion of Native Americans.

To evaluate information more specific to the area affected by the Project, we assessed environmental justice statistics at the U.S. Census block group level, which is the smallest available geographic census unit. As shown in table 4.10-6, the Project would intersect 18 census block groups (BGs); ten of which are located in Calcasieu Parish, three in Jefferson Davis Parish, one in Acadia Parish, and four in Evangeline Parish. Of the 18 census BGs that would be affected, the highest minority composition is in CT 1, BG 2 of Jefferson Davis Parish (48.7 percent), and the lowest minority composition is in CT 27, BG 3 (0.0 percent). The average minority population across all BGs is 12.7 percent.

Table 4.10-6

Summary Characteristics of the Populations in the 18 BGs Intersected by the Project

Parish	Census BG	Population	Number of Households	Minority (%)	Family Poverty (%)
Calcasieu	CT 32, BG 1	2,426	895	9.85%	13.63%
Calcasieu	CT 33, BG 1	2,631	877	4.64%	3.59%
Calcasieu	CT 34, BG 2	3,559	1,242	0.28%	5.09%
Calcasieu	CT 27, BG 3	1,933	761	0.00%	1.48%
Calcasieu	CT 27, BG 4	2,342	888	8.75%	21.19%
Calcasieu	CT 23, BG 1	2,687	982	9.49%	1.44%
Calcasieu	CT 22.01, BG 1	1,443	537	3.53%	4.80%
Calcasieu	CT 22.01, BG 2	2,283	818	2.10%	3.82%
Calcasieu	CT22.01, BG 3	4,155	1,499	5.90%	0.00%

Table 4.10-6

Summary Characteristics of the Populations in the 18 BGs Intersected by the Project

Parish	Census BG	Population	Number of Households	Minority (%)	Family Poverty (%)
Calcasieu	CT 20, BG 2	3,012	1,013	10.66%	12.88%
Calcasieu Parish	**-**	***195,887***	***75,325***	***31.28%***	***13.00%***
Jefferson Davis	CT 2, BG 1	1,503	606	8.92%	10.87%
Jefferson Davis	CT 1, BG 1	2,168	872	42.34%	10.82%
Jefferson Davis	CT 1, BG 2	708	303	48.73%	30.46%
Jefferson Davis Parish	**-**	***31,434***	***11,652***	***21.82%***	***17.50%***
Acadia	CT 9603, BG 1	1,015	356	17.14%	7.75%
Acadia Parish	**-**	***62,163***	***22,599***	***22.30%***	***16.30%***
Evangeline	CT 9503, BG 1	628	242	9.39%	10.27%
Evangeline	CT 9503, BG 3	946	300	13.42%	12.00%
Evangeline	CT 9508, BG 2	1,049	362	3.05%	13.33%
Evangeline	CT 9508, BG 3	1,054	464	30.46%	5.88%
Evangeline Parish	**-**	***33,768***	***11,954***	***32.48%***	***21.30%***

Source: U.S. Census Bureau, 2015a

Louisiana currently has no defined state-specific criteria for an environmental justice community. Therefore, environmental justice communities would be based on the criteria outlined by the EPA, which considers an environmental justice area or community to be a location with a "meaningfully greater" percentage of minority population than the general population, or locations in which minority populations comprise more than 50 percent of the affected area's population. None of the BGs intersected by the Project exceed the environmental justice community threshold identified by the EPA; therefore, no environmental justice communities exist in the affected Project area, using the EPA criteria.

Impacts and Mitigation

In general, construction and operation of the Project would not have a significant socioeconomic effect on the local population, including public services, property values, or disadvantaged communities. Although construction sites can attract children and construction activity can present a potential safety risk, Driftwood would use appropriate security measures to prevent unauthorized entry into construction sites, and this risk would not be significant. During operation, the Project would have a positive economic effect on the general community, as well as minority and economically disadvantaged populations through job creation, economic activity, and tax payments.

The Driftwood LNG Project would not significantly affect urban or residential areas, nor would there be disproportionately high and adverse human health or environmental effects on minority populations, low-income communities, or Native American Tribes. Therefore, we conclude that construction and operation of the Project would not disproportionately affect any population group, and no environmental justice or protection of children issues are anticipated as a result of construction or operation of the Project.

4.11 CULTURAL RESOURCES

Section 106 of the NHPA (36 CFR 800) and the NGA of 1938, as amended (18 CFR 157, Subpart F, Appendix II—"Procedures for Compliance with the National Historic Preservation Act of 1966 Under Section 157.206(d)(3)(ii)") requires FERC to take into account the effect of its undertakings (including the issuance of Certificates) on properties listed in or eligible for listing in the NRHP and to afford the ACHP an opportunity to comment on the undertaking. These regulations along with the Office of Pipeline Regulation's Guidelines for Reporting on Cultural Resources Investigations (December 1994) provide the framework for fulfilling Section 106 obligations under FERC regulated projects. Driftwood, as a non-federal party, is helping FERC in meeting our obligations under Section 106 by preparing the necessary information, analyses, and recommendations, as authorized by 36 CFR 800.2(a)(3).

Construction and operation of the Project could have the potential to affect historic and archaeological properties, including pre-contact or historic archaeological sites, districts, buildings, structures, and objects, as well as locations of traditional cultural properties of significance to tribes or other groups. Historic and archaeological historic properties generally possess integrity of location, design, setting, materials, workmanship, feeling, and association, and meet one or more of the criteria specified in 36 CFR 60.4.

We sent copies of our NOI for the Project to a wide range of stakeholders, including the ACHP, the Louisiana SHPO, and Indian Tribes that may have an interest in the Project area. The NOI contained a paragraph about Section 106 of the NHPA and stated that we use the NOI to initiate consultations with the SHPO, and to solicit their views and those of other government agencies, interested tribes, and the public on the Project’s potential effects on historic properties.

4.11.1 Cultural Resources Investigations

Prior to fieldwork, Driftwood reviewed site files including available site forms, previous cultural resource reports, related documents, and NRHP database records regarding previous cultural surveys near the Project. The direct area of potential effect (APE) are areas that would be affected by ground disturbing activities and the indirect APE are locations that may be visually, vibratory, or audibly affected by the Project. Driftwood has conducted cultural resources investigations for the LNG Facility and associated Pipeline workspace. The archaeological survey coverage consisted of about 718 acres to address the direct APE for the LNG Facility in Calcasieu Parish, Louisiana, and about 3474.1 acres to address part of the direct APE for the Pipeline in Calcasieu, Jefferson Davis, Acadia, and Evangeline Parishes, Louisiana. To address the indirect APE, Driftwood reviewed above ground resources within 0.5 miles of both the LNG Facility and Pipeline. The height of structures associated with the LNG Facility has been revised since previous consultation on the Project was filed with the SHPO. Given the height of some of the structures, the Project will increase the indirect APE to a 1.0-mile radius from the LNG Facility and request comment from the SHPO.

Additionally, in the analysis, FERC staff reviewed ethnographic studies conducted by Driftwood, which identified modern tribes who relocated to the Project area after historic contact during the 18th and 19th centuries, and supplemental information filed by FERC staff on January 31, 2018 (FERC eLibrary accession number 20180131-3063), regarding tribes that were already in the area at European contact.

4.11.2 LNG Facility

The direct APE for the LNG Facility is an area of about 883 acres with typical depths of impact on land of about 3 feet and maximum depths of impacts extending up to 130 feet where piling is required. Of the 883 acres, 718 acres would be the permanent LNG Facility. The temporary offsite areas would include work activities associated with dredging, transport, and deposition of dredged material. Height of structures within the permanent LNG Facility would vary from 122 to 152 feet for various stacks (Absorber, Enclosed Ground Flare, and LNG Plant Turbine), with LNG Storage Tanks 204 feet in height, and Wet/Dry Flares of 350 feet in height for a maximum height not to exceed 350 feet. The review of the indirect APE will consider a radius of 1.0 mile beyond the boundary of the LNG Facility based on the height of the structures.

A review of existing site files indicated there had been three previous cultural surveys within the direct APE for the LNG Facility, which were Phase I surveys for pipelines and a natural gas facility. Three cultural resources sites within the direct APE were recorded during the previous survey for a natural gas facility, including archaeological site 16CU86, and historic structures 10-00494, and 10-00495. Site 16CU86, a late 19th and early 20th century historic artifact scatter, was previously recommended ineligible for listing on the NRHP. The two historic structures (10-00494 and 10-00495) are mid-20th century abandoned storage barns or maintenance facilities. Both structures had also been previously recommended ineligible for listing on the NRHP. During Project review, the Dutch Cove Cemetery (16CU186) was identified immediately adjacent to the LNG Facility boundary and within the indirect APE. The NRHP eligibility of the cemetery dating back to the 19th century is undetermined. The cemetery is delineated by a well-maintained fence. Driftwood began consultation with the Louisiana SHPO in a letter dated May 4, 2016, inviting them to participate in the pre-filing process, and in an initial consultation letter to SHPO dated May 6, 2016. The SHPO stated that they would respond to all communication requests from FERC pertaining to the Project. Additional consultation with the SHPO occurred on June 9, 2016, including submittal of the draft Phase I cultural resources survey report for the LNG Facility. The SHPO concurred with the report that no historic properties would be affected within the Project area in a letter dated June 29, 2016, but that 16CU186 remained undetermined pertaining to its eligibility for nomination to the NRHP. The SHPO accepted the final report on August 2, 2016 with no additional comments.

4.11.2.1 Pipeline

The direct APE for the Pipeline would typically vary from 110-to 130-foot widths with typical neck downs to 75-to 110-foot widths in wetland areas for the 96 linear miles of pipeline corridor with typical depths of impacts ranging from 7 to 9 feet for the Pipeline. The indirect APE would be limited to areas directly adjacent to the direct APE for buried segments of the Project and should be incorporated or visible from within the initial 300-foot-wide survey study corridor. The indirect APE for above ground facilities associated with the Pipeline would be 0.5 mile in radius.

Cultural resource investigations included archaeological and architectural resources. A review of existing site files indicated there had been 19 previous surveys intersect the 300-foot-wide survey study corridor, most of which are Phase I linear surveys conducted within the 20 years. Of these, six previous surveys overlapped the direct APE for the Pipeline. There were eight previously recorded sites within the 300-foot-wide study corridor (16AC23, 16CU28, 16CU31, 16CU70, 16CU71, 16EV22, 16EV23 and 16JD39).

All eight of the previously recorded sites within the study corridor were historic archaeological sites, and six of the sites were no longer extant (no artifacts or features) within the survey corridor. Sites

16AC23, 16CU70, 16EV23, and 16JD39 are early to mid-20th century artifact scatters recommended ineligible for listing in the NRHP, and no associated artifacts were identified within the survey corridor. Site 16CU31 was a late 19th to early 20th century residence recommended ineligible. No artifacts were within the survey corridor and recent disturbances had removed the previously recorded cement foundation. Site 16CU71 is an early 20th century railroad grade recommended ineligible, and current investigations discovered that the segment within the study corridor had been destroyed. Site 16EV22 is an early 20th to early 21st century residence previously described as a "Cajun cottage." Though subsurface artifacts and a shed were observed, the house structure was no longer standing, and the site was recommended ineligible. The shed contained primarily mid-20th century and modern artifacts including glass, Bakelite, whiteware, and part of a television screen. Additionally 16CU28, a historic Sulfur Mine site which is considered eligible for the NRHP, is within the APE. The site boundary follows the original property boundary of the mine, and associated features and artifacts were previously recorded in the center and the western half of the property. All twelve shovel tests excavated within the site boundary and the study corridor were negative for cultural materials. Though the Project passes through the eastern portion of the site, all contributing elements of the historic property are 0.25 miles from Project workspaces.

Archaeological sites recorded during the surveys included 16EV79, 16JD59, and 16CU92. Site 16EV79 is classified as a modern industrial structural ruin with a "1964" date stamp. Site 16JD59 is an early to mid-20th century historic site consisting of a brick pier, metal fragments, and Depression-era Coca Cola bottle glass. Site 16CU92 is a pre-contact site consisting of one isolated Late Woodland grog-tempered rim sherd. All three archaeological sites were recommended ineligible for inclusion in the NRHP. Thirteen historic structure complexes (HS 10-00694, HS 10-00695, HS 10-00696, HS 10-00697, HS 10-00698, HS 20-00059, HS 20-00060, HS 27-00031, HS 27-00033, HS 27-00034, HS 27-00035, HS 27-00036, and HS 27-00037) ranging from the 1930s to modern-era were encountered during architectural surveys. Specifically, five were located within the direct APE and eight within the indirect visual APE. All thirteen structures were recommended ineligible for the NRHP.

On November 1, 2016, Driftwood submitted the draft Phase I cultural resources survey report for the Pipeline to the SHPO. The SHPO provided comments on November 22, 2016. In the SHPO response they requested additional information on eight archaeological sites and documentation that no contributing elements of NRHP eligible site, 16CU28, would be affected by the Project. The SHPO concurred that 16EV22, 16EV79, 16JD59, and 16CU92 were ineligible for the NRHP but withheld comments on eligibility of remaining sites (16AC23, 16CU28, 16CU31, 16CU70, 16CU71, 16EV23 and 16JD39) until submission of a final report. The SHPO also concurred that all historic structures identified during the survey were ineligible for inclusion in the NRHP. The final revised report was submitted to the SHPO on December 21, 2016. A draft addendum report was submitted to the SHPO on March 27, 2018 for the access roads and Project realignments and in a letter dated April 13, 2017, the SHPO concurred with the recommendations that no archaeological historic properties would be affected. A final Addendum report was submitted on April 18, 2017. The report was accepted by the SHPO on April 24, 2017 with no additional comments.

4.11.3 Pending Surveys

Driftwood surveyed about 3474.1 acres in two mobilizations to address the direct APE of the Pipeline. Access was not granted to all land tracts to complete the archaeological investigations for the Project. The areas that still require survey are listed in table 4.11-1 and total an estimated of 3,988.8 acres. Driftwood reviewed the indirect APE of the LNG Facility at a radius of 0.5 miles. Given the height of structures at the LNG Facility, **we recommend that**

<u>Prior to construction</u>, DWLNG should increase the indirect APE to a radius of 1.0 mile for the LNG Facility. The revised indirect APE and associated addendum report should be sent to the SHPO for comments.

Table 4.11-1

Areas Requiring Survey for Cultural Resources

Facility/Segment	Nearest Milepost	Parish	Estimated Acreage
Pipeline Corridor	3	Calcasieu	32.0
Pipeline Corridor	5	Calcasieu	16.0
Pipeline Corridor	7	Calcasieu	8.0
Temporary Access Road 69	10	Calcasieu	5.3
Pipeline Corridor	12	Calcasieu	8.0
Pipeline Corridor	13	Calcasieu	8.0
Pipeline Corridor	24	Calcasieu	40.0
Contractor Yard 1	25	Calcasieu	1.6
Temporary Access Road 4	25	Calcasieu	2.7
Pipeline Corridor	26	Calcasieu	12.0
Pipeline Corridor	27	Calcasieu	8.0
Temporary Access Road 14	31	Calcasieu	0.5
Pipeline Corridor	34	Calcasieu	136.0
Temporary Access Road 10	35	Calcasieu	1.3
Access Road BH-05 and CPT-104	36	Calcasieu, Jefferson Davis	10.7
Meter Station 5	36	Calcasieu	0.8
Temporary Access Road 74	37	Calcasieu, Jefferson Davis	5.3
Geotech Access Road BH-04	37	Calcasieu, Jefferson Davis	5.3
Calcasieu Exit Workspace	37	Calcasieu	1.0
Calcasieu Entry Workspace	38	Calcasieu	0.9
Pipeline Corridor	42	Jefferson Davis	24.0
Temporary Access Road 18	43	Jefferson Davis	1.3
Pipeline Corridor	49	Jefferson Davis	4.0
Pipeline Corridor	54	Jefferson Davis	16.0
Pipeline Corridor	59	Jefferson Davis	8.0
Pipeline Corridor	69	Jefferson Davis	3.2
Pipeline Corridor	71	Jefferson Davis	3.2
Pipeline Corridor	72	Acadia	3.2
Pipeline Corridor	73	Acadia	3.2
Pipeline Corridor	73	Acadia	8.0
Pipeline Corridor	74	Acadia	4.0
Temporary Access Road 35	76	Evangeline	1.3
Pipeline Corridor	77	Evangeline	16.0

4.11.4 Tribal Consultation

Initial Project letters were sent to the Alabama-Coushatta Tribe of Texas, Coushatta Tribe of Louisiana, Choctaw Nation of Oklahoma, Mississippi Band of Choctaw Indians, Jena Band of Choctaw Indians, and Tunica-Biloxi Tribe of Louisiana by Driftwood on July 21, 2016. The Alabama Coushatta

Tribe of Texas requested additional Project information, including copies of the cultural survey reports, on August 23, 2016, and on June 7, 2017 Driftwood submitted copies of the three cultural resource reports (Phase I reports for Facility and Pipeline and the Addendum Report) to the Alabama Coushatta. In a filing dated June 17, 2016, the Jena Band of Choctaw Indians requested cultural resources information about the Project as it becomes available and to be consulted by FERC. The Choctaw Nation of Oklahoma requested information of the Project area on August 24, 2016, which was provided to them by Driftwood on August 30, 2016. On August 31, 2016, the Choctaw Nation of Oklahoma further responded requesting consultation with FERC, which was followed by a formal filing with FERC on September 6, 2016, of a similar request.

FERC sent its NOI to the same tribes Driftwood notified on October 3, 2016, and follow up letters to the same Tribal nations, as well as the Chitimacha Tribe of Louisiana and the Alabama Quassarte Tribal Town were sent on February 16, 2017. On November 10, 2016, the Choctaw Nation of Oklahoma contacted FERC requesting copies of the EIS and all cultural resource reports. Copies of the cultural resources report were provided to the Choctaw Nation of Oklahoma by Driftwood on May 24, 2017. On June 27, 2017, the Choctaw Nation responded to Driftwood that they concurred that no historic properties would be affected and requested that construction be stopped and their office be contacted in the event of an unanticipated discovery. No other responses have been filed.

4.11.5 Unanticipated Discoveries Plan

Driftwood prepared a UDP that would be used in the event that cultural resources or human remains are encountered during construction of the LNG Facility or Pipeline. An early draft of the UDP for the Facility was submitted to the SHPO on July 20, 2016, with the final Phase I Cultural Resources Survey Report. The draft Facility UDP was updated to include the Pipeline and submitted to the SHPO with the Pipeline Phase I Addendum Report on March 27, 2017. We find the plan acceptable. The SHPO has not commented regarding the UDP, and no other responses have been filed.

4.11.6 Compliance with National Historic Preservation Act

Compliance with section 106 of the NHPA has not been completed for the Project. Cultural resources surveys of portions of the Project and consultation with the SHPO and other parties has not been completed. Driftwood commented on the draft EIS that cultural resources surveys of the LNG Facility site have been completed and SHPO clearance has been obtained; and as such, staff's recommendation should apply only to DWPL. We determined that, because the LNG Facility and the Pipeline are considered a single undertaking, this recommendation would not be modified.

To ensure that FERC's responsibilities under the NHPA and its implementing regulations are met, **we recommend that:**

Driftwood <u>should not begin construction</u> of facilities or use of staging, storage, or temporary work areas and new or to-be-improved access roads <u>until</u>:

a. Driftwood files with the Secretary:

(1) remaining cultural resources survey report(s);

(2) site evaluation report(s) and avoidance/treatment plan(s), as required; and

(3) comments on the cultural resources reports and plans from the Louisiana State Historic Preservation Office (and interested Indian Tribes).

b. The Advisory Council on Historic Preservation is afforded an opportunity to comment if historic properties would be adversely affected.

c. The FERC staff reviews and the Director of OEP approves the cultural resources reports and plans, and notifies Driftwood in writing that treatment plans/mitigation measures (including archaeological data recovery) may be implemented and/or construction may proceed.

All materials filed with the Secretary 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."

4.12 AIR QUALITY AND NOISE

4.12.1 Air Quality

The term *air quality* refers to relative concentrations of pollutants in the ambient air. Construction and operation of the LNG Facility and Pipeline could affect local and regional air quality. This section characterizes the existing air quality and summarizes the estimated impacts the facilities may have on air quality regionally and locally. This section also summarizes federal and state air-quality regulations that may be applicable to the Project.

The subsections below describe well-established air-quality concepts that are applied to characterize air quality; and to disclose the impacts and significance of increases in air pollution. This characterizes the magnitude of emissions of criteria pollutants, VOCs, hazardous air pollutants (HAP), and greenhouse gases (GHG) from construction and operation; compares modeled impacts with ambient air quality standards; indicates mitigation measures to control air and dust emissions; and confirms compliance with state air quality implementation plans.

4.12.1.1 Regional Climate

The climate of the area in which the LNG Facility and Pipeline would be located is humid subtropical with a strong maritime character. The climate is influenced to a large degree by the amount of water surface in the immediate area and the proximity of the Gulf of Mexico. The summer weather is consistently quite warm and humid but the temperature rarely reaches 100 degrees Fahrenheit (F). The humidity is often above 90 percent at night and seldom falls below 50 percent during the afternoons. The winter months are normally mild with cold spells usually of short duration; temperatures of 20 degrees F and below are rare. The spring and fall seasons are very mild with only brief rains interrupting long periods of dry sunny weather. Severe local storms may occur during any season but are most frequent in the spring. The area weather is occasionally influenced by tropical storms or hurricanes.

Prevailing wind flow is southerly (north to south) during much of the year. The flow of air from the Gulf of Mexico helps to temper extremes of summer heat, shorten the duration of winter cold spells, and provide a source of abundant rain. Winds are usually rather light. Rainfall is heavy, with the normal annual total more than 50 inches. Amounts are substantial in all seasons. Almost all rainfall occurs from brief convective showers, except occasionally during winter when nearly continuous frontal rains may persist for a few days. In spite of the large normal rainfall amounts, dry spells of two or three weeks duration are not uncommon (NOAA, 2018). The area may be impacted by hurricane events. Several hurricanes, including Harvey (August 2017), Gustav (September 2008), Rita (September 2005), Katrina (August 2005), and Andrew (August 1992) have caused significant damage the area in recent years. See also Section 4.1.4.3 for information regarding the potential impacts of hurricanes on the Project area, and Section 4.14.2.12 for the projected climate change impacts in the Project area.

4.12.1.2 Existing Air Quality

Ambient Air Quality Standards

The EPA has established National Ambient Air Quality Standards (NAAQS) to protect public health (primary standards) and public welfare (secondary standards). Standards have been set for principal pollutants that are called "criteria pollutants" (EPA, 2017). These criteria pollutants are ground-level ozone (O_3), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), respirable and fine particulate matter (inhalable particulate matter 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. The NAAQS are codified at 40 CFR 50. Louisiana has adopted the NAAQS and does not have additional state-level ambient air quality standards for criteria pollutants.

VOCs in air are regulated by the EPA primarily to prevent the formation of O_3, a constituent of photochemical-derived smog. Many VOCs form ground-level O_3 by reacting with sources of oxygen molecules such as NO_x in the atmosphere in the presence of sunlight. As such, NO_x and VOCs are referred to as O_3 precursors. HAPs are also emitted during fossil fuel combustion and are suspected or known to cause cancer or other serious health effects such as reproductive effects or birth defects, or adverse environmental effects.

Fugitive dust is particulate matter that arises from the mechanical disturbance of soil or rock material and is lifted into the air. It typically is comprised of particles of various sizes. Fugitive dust results from activities such as the physical movement of soil, vehicles traveling over unpaved surfaces, heavy equipment operation, blasting, and wind. Fugitive dust typically contains a mix of particle sizes ($PM_{2.5}$, PM_{10} and larger particulates). Smaller particulates can be health hazards while larger particulates may be a public nuisance (visibility impacts, deposition, and physical irritant).

GHGs produced by fossil-fuel combustion are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide. GHGs status as a pollutant is not related to toxicity. GHGs are non-toxic and non-hazardous at normal ambient concentrations, and there are no applicable ambient standards or emission limits for GHG under the CAA. GHG emissions from permitted stationary LNG Facility and CS-1 sources are subject to Best Available Control Technology (BACT) (see Sections 4.12.1.5 and 4.14.2.12), and certain fugitive sources of GHG emissions are subject to New Source Performance Standards (NSPS) OOOOa (see Section 4.12.1.3).

All GHGs have been assigned a Global Warming Potential (GWP). The GWP represents the ability of each different GHG to trap heat in the atmosphere. They are determined based on the heat-absorbing ability of each gas relative to that of CO_2, as well as the rate of decay, or rate of removal from the atmosphere, of each gas over a given number of years. GWPs are used to define the impact GHG have on global warming over different time periods. Because each of the gases remains in the atmosphere for a different amount of time and each has a varying ability to absorb solar radiation, the calculated GWP for each gas in relation to CO_2 can vary greatly. The 100-year GWPs of CO_2, CH_4, and nitrous oxide are 1, 25, and 298, respectively.

Existing Air Quality

An Air Quality Control Region (AQCR) is defined under 42 USC §7407(c) as "...any interstate area or major intrastate area which [the Administrator of the EPA] deems necessary or appropriate for the attainment and maintenance of ambient air quality standards." Each AQCR, or portion(s) of an AQCR, is classified as either "attainment," "nonattainment," or "maintenance" under the NAAQS. Areas where ambient air concentrations of the criteria pollutants are below the levels listed in the NAAQS are considered in attainment; if ambient air concentrations of criteria pollutants are above the NAAQS levels, then the area is considered to be in nonattainment. Areas that have been designated nonattainment but have since demonstrated compliance with the NAAQS are designated maintenance for that pollutant. Maintenance areas are treated similarly to attainment areas for the permitting of stationary sources; however, specific provisions may be incorporated through the state's approved maintenance plan to ensure that the air quality would remain in compliance with the NAAQS for that pollutant.

Areas where air quality data are not available are considered to be unclassifiable and are treated as attainment areas. The LNG Facility and Pipeline would be in areas classified as in attainment for all criteria pollutant standards.

Although currently in attainment for O_3, both the Lake Charles and Lafayette areas are vulnerable to being re-designated as nonattainment for O_3, and the metropolitan planning districts responsible for air quality planning for these areas have applied for and been accepted into the EPA Ozone Advance Program. This program encourages emission reductions to assist areas to remain in attainment with O_3 NAAQS. Advance Program activities in the Lake Charles and surrounding area are led by the Imperial Calcasieu Planning District, the Southwest Louisiana (SWLA) Economic Development Alliance, the Lake Area Industry Alliance, the Town of Iowa, Calcasieu Parish Police Jury, and Cameron Parish Police Jury. Several hundred tons per year of O_3 precursors (i.e., NO_x and VOC) are expected to be produced during construction and operation of the LNG Facility and compressor stations. The stationary source operating emissions have been reviewed by LDEQ. Nevertheless, DWLNG has not provided information to indicate that these emissions and the proposed emission mitigation measures are compatible with EPA's Ozone Advance Program.

Air Quality Monitoring and Background Concentrations

LDEQ Division of Air Quality Assessment operates a statewide network of stationary monitoring stations to measure ambient air pollutant concentrations in Louisiana. Data from these air monitoring sites are available through the EPA's AIRDATA database, which collects air monitoring data from all over the country. The majority of emissions generated during construction and operation of the LNG Facility and Pipeline would occur in Calcasieu and Acadia Parishes.

Ambient air quality monitoring data from the 3 year period of 2014 through 2016 were identified for those monitors nearest to the Project. However, the data are not necessarily representative of current actual air quality near the Project. For the identified period, each of the measured concentrations were below or equivalent to the applicable NAAQS for the pollutant and averaging period, thus indicating attainment with the standard.

4.12.1.3 State Regulatory Requirements for Air Quality

State air quality rules govern the issuance of air permits for construction and operation of a stationary emission source. The LDEQ is the lead air permitting authority for the LNG Facility and Pipeline. The LDEQ's air quality regulations are codified in LAC 33:III.1 through 59. The regulations incorporate the federal program requirements listed in 40 CFR 50 through 99 and establish permit review procedures for all facilities that can emit pollutants to the ambient air. New facilities are required to obtain an air quality permit prior to initiating construction. For larger facilities subject to major New Source Review (NSR), review and approval at the federal level may be required.

Federal Air Quality Requirements

New Source Performance Standards

Section 111 of the CAA authorized the EPA to develop technology-based standards that apply to specific categories of stationary sources. These standards, referred to as New Source Performance Standards (NSPS), are found in 40 CFR 60. The NSPS apply to new, modified, and reconstructed affected facilities in specific source categories. The DWLNG has identified that the following NSPS would be applicable to one or more of Project facilities.

Subpart A - General Provisions

The general provisions listed in Subpart A include definitions of applicability and various methods for maintaining compliance with requirements listed in subsequent subparts of 40 CFR 60. Subpart A also specifies the state agencies to which the EPA has delegated authority to use and enforce standards of performance. The LDEQ has been delegated authority for all NSPS standards applicable to either the LNG Facility or Pipeline. Equipment at the LNG Facility and Pipeline subject to any of the NSPS subparts listed below would all be subject to Subpart A.

Subpart Kb - Standards of Performance for Volatile Organic Liquid Storage Vessels

Subpart Kb applies to storage vessels for which construction, reconstruction, or modification commenced after July 23, 1984, and with a capacity greater than or equal to 75 m^3 that are used to store volatile organic liquids. This subpart does not apply to storage vessels with a capacity greater than or equal to 151 m^3 storing a liquid with a maximum true vapor pressure less than 3.5 kilopascals [0.51 pound per square inch (psi)] or with a capacity greater than or equal to 75 m^3 but less than 151 m^3 storing a liquid with a maximum true vapor pressure less than 15.0 kilopascals (2.18 psi). Tanks that are subject to Subpart Kb have various compliance options depending on the tank capacity and the true vapor pressure.

Although the capacity of the LNG storage tanks and condensate tanks would exceed 75 m^3, LNG is not a volatile organic liquid because the partial pressure of VOCs in LNG is negligible (CH_4 and ethane are not VOCs). Hence, the LNG storage tanks are not subject to Subpart Kb.

The condensate tank emissions would comply with Subpart Kb by routing emissions to a control device (e.g., a flare) for vapor destruction.

Subpart IIII - Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

Subpart IIII applies to owners and operators of stationary compression ignition (CI) internal combustion engines (ICE) that commence construction after July 11, 2005 where the stationary CI ICE are manufactured after April 1, 2006, and are not fire pump engines, or are manufactured as a certified NFPA fire pump engines after July 1, 2006. The following equipment at the LNG Facility would be subject to Subpart IIII:

- five non-emergency stormwater pump engines that would be used during heavy rain events;
- two fire water pump engines;
- the main substation emergency generator;
- the control room emergency generator;
- the loading substation emergency generator; and
- five essential generators.

Subpart IIII specifies emission standards, fuel requirements, compliance requirements, and testing requirements for CI ICE, some of which vary by model year, engine power, and displacement, and also specifies notification, reporting, and recordkeeping requirements for owners and operators of CI ICE subject to this subpart. Compliance with this subpart would be achieved by procuring engines that conform to the emission standards and by complying with the notification, record keeping, and reporting requirements and operational restrictions.

Subpart JJJJ - Standards of Performance for Spark Ignition Internal Combustion Engines

Subpart JJJJ applies to manufacturers, owners, and operators of certain categories of stationary spark ignition ICE. An emergency natural gas-fired lean-burn stationary spark ignition ICE manufactured after January 1, 2009, with rated output equal to 130 hp or greater must emit no more than 2.0, 4.0, and 1.0 grams per hour of NO_x, CO, and VOC, respectively. The stand-by generator engines at all three compressor stations (CS-01, -02, and-03) would be subject to this subpart and these emissions limitations. They would also be subject to the operational restrictions of 40 CFR 60.4243(d), which limit nonemergency operation to 100 hours per year. Compliance with this subpart would be achieved by procuring engines that conform to the emission standards and by complying with the notification, record keeping, and reporting requirements and operational restrictions.

Subpart KKKK - Standards of Performance for Stationary Combustion Turbines

Subpart KKKK applies to owners and operators of stationary combustion turbines with a peak load heat input equal to or greater than 10 million BTU/hour that commenced construction, modification, or reconstruction after February 18, 2005. Subpart KKKK regulates emissions of NO_x and SO_2. Subject turbines must meet the applicable emission limits and operational requirements as well as recordkeeping and reporting requirements of this subpart.

Compliance with Subpart KKKK would be achieved as follows:

- At the LNG Facility, the mixed refrigerant compressor gas turbines would comply with the NO_x limit by using dry low-NO_x emissions technology and/or SCR, and with the SO_2 limit by using low-sulfur fuel gas derived from the feed natural gas.

- At the Pipeline aboveground facilities (CSs), the compressor turbines would comply with the NO_x limit by using $SoLoNO_x$ (Solar's proprietary dry low-NO_x emissions technology) and with the SO_2 limit by using low-sulfur natural gas.

Subpart OOOOa - Oil and Natural Gas Sector: Emission Standards for New and Modified Sources

Subpart OOOOa applies to certain oil and gas extraction, transportation, and distribution operation. It establishes standards for GHG as CH_4 as a regulated pollutant. It places leak detection and reporting (LDAR) requirements on new compressor stations and on existing compressor stations where a new compressor is added or one or more compressors are replaced with compressors of greater horsepower. Subpart OOOOa requires quarterly LDAR testing of VOC and CH_4 emissions from specified equipment. Compliance with Subpart OOOOa would be achieved by conducting prescribed LDAR testing of compressors, equipment, and pneumatic controllers at all three compressor stations (CS-01, -02, and -03).

The LNG Facility is not expected to be subject to Subpart OOOOa because it does not meet the definition of a well site, compressor station, or natural gas processing plant. DWLNG has stated that it is committed to employing a leak management program which may use any combination of optical, instrument, or OVA (olfactory, visual, audible methods) as deemed appropriate to minimize leaks.

National Emissions Standards for Hazardous Air Pollutants

Section 112 of the CAA authorized the EPA to develop technology-based standards that apply to specific categories of stationary sources that emit HAPs. These standards are referred to as National Emission Standards for Hazardous Air Pollutants (NESHAP) and are found in 40 CFR 61 and 63. NESHAP can apply to major and/or area (minor) sources of HAPs.

40 CFR 63 establishes standards for specific categories major sources of HAPs and certain area (minor) sources of HAPs. Major source thresholds for are 10 tons per year (tpy) of any single HAP or 25 tpy of total HAPs. The LNG Facility's potential operational emissions of HAPs would exceed the major source thresholds. The potential operational emissions of each individual HAP would be less than 10 tpy, and the total annual emissions of all HAPs would be less than 25 tpy at each of the three compressor stations (CS-01, -02, and -03). Therefore, these would be each be a minor source of HAPs.

Subpart ZZZZ - NESHAP for Stationary Reciprocating Internal Combustion Engines

Subpart ZZZZ regulates HAP emissions from reciprocating internal combustion engines. The LNG Facility would be a major source of HAP emissions. The emergency generator engines and emergency and non-emergency pump engines would each be subject to the emission and operating limitations prescribed its output rating and use.

The three compressor stations (CS-01, -02, and-03) would be minor sources of HAPs. In accordance with 40 CFR 63.6590(c), the emergency engines at these stations would comply with Subpart ZZZZ would be achieved through compliance with 40 CFR Subpart JJJJ.

Mandatory Greenhouse Gas Reporting

40 CFR 98 Subpart W requires petroleum and natural gas systems that emit 25,000 metric tons or more of CO_2e per year to report annual emissions of specified GHGs from various processes within the LNG Facility. LNG storage and LNG import and export equipment are regulated by Subpart W. The

LNG Facility would be required to report GHG emissions because annual emissions of GHGs would be above 25,000 metric tpy.

Compressor stations are also subject to GHG reporting requirements under Subpart W. GHG reporting would be required for each CS if its actual GHG exceeds 25,000 metric tons or more of CO_2e in a calendar year.

General Conformity

A General Conformity applicability analysis is required for any part of the project occurring in nonattainment or maintenance areas for criteria pollutants.

The areas where the LNG Facility and Pipeline would be located are classified as in attainment for all NAAQS; therefore, no General Conformity Determination is required.

Federal Permitting - New Source Review - Prevention of Significant Deterioration

Federal pre-construction review under NSR is conducted under separate procedures for sources in attainment areas and sources in nonattainment areas. Nonattainment NSR applies to sources in nonattainment areas. Because the LNG Facility and Pipeline would not be in nonattainment areas, this process does not apply to the Project.

PSD permitting applies to new major sources or major modifications at existing sources in attainment areas or in areas that are unclassifiable. PSD is intended to prevent new air emission sources from causing the existing air quality to deteriorate beyond acceptable levels. Under PSD, any new major source or major modification of an existing source of air pollutants is required to obtain an air quality permit before beginning construction. The definition of a PSD major source of air pollutants as applicable to the Project is any stationary source which emits, or has the potential to emit, 250 tpy of a regulated criteria pollutant (40 CFR 51.166(b)(1)(i)(b)). The PSD permitting process has been delegated to the LDEQ.

The LNG Facility would be a major source and subject to PSD. As a stationary source subject to PSD, the following air quality mitigation and requirements would apply, as necessary, by the LDEQ:

- installation of BACT;
- air quality 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; and
- 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 influences. BACT can be achieved using add-on control equipment or by adopting the production processes or methods that minimize emissions. These include fuel cleaning or treatment and innovative fuel combustion techniques. BACT may be a design, equipment, work practice, or operational standard if imposition of an emissions standard is infeasible.

The PSD, a state required 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, and predictions, using dispersion modeling of ambient concentrations that would result from the Project and future growth associated with the Project. This modeling may be slightly different than the analysis under NEPA. For example, the LDEQ does not require LNG carriers be a part of the PSD air quality model, whereas FERC staff request that the LNG carrier operations be included in the air quality impact model as it is an intrinsic part of the operations of the LNG Facility.

If a new source or major modification of an existing source is subject to the PSD permitting requirements and is within 100 kilometers (km) of a Class I area, the facility is required to notify the appropriate federal officials and assess the impacts of the Project on the Class I area. The permitting authority should also notify the federal land manager of "very large sources" with the potential to impact a Class I area within their jurisdiction, even if the facility is beyond 100 km from the Class I area. In practice, all sources within 200 (and sometimes 300) km are included in the review. The Breton NWR is about 340 km southeast of the LNG Facility, and is the closest designated Class I area. Therefore, a PSD Class I analysis is not required. We are not aware of any special requests of concerns of the federal land manager of the Breton NWR.

The three compressor stations (CS-01, -02, and-03) would not be subject to PSD.

Title V Operating Permit

The Part 70 Operating Permit program, as described in 40 CFR 70, requires major stationary sources of air emissions to obtain a federally enforceable operating permit. Part 70 operating permits are more commonly referred to as “Title V” permits. The EPA has delegated the authority to issue Title V permits to the LDEQ, which has incorporated the program in LAC 33:III.507. The emission threshold levels for determining the applicability for a Title V permit are 100 tpy of any criteria air pollutant;10 tpy of any individual HAP; or 25 tpy of any combination of HAPs.

The LNG Facility would obtain a combined PSD and initial Title V permit. LDEQ issued the PSD and Title V permit for the LNG Facility on July 10, 2018. The three compressor stations (CS-01, -02, and -03) would each require a combined pre-construction and initial Title V permit. The combined permit for CS-01 was issued by LDEQ on October 2, 2017.

Louisiana Air Quality Requirements

Driftwood outlined the methods and measures by which they would comply with the requirements of each applicable LDEQ air quality regulation in their permit applications. These are codified in LAC 33:III and are listed below. The regulations would apply to the facilities associated with the LNG Facility, including combustion turbines, flares, heaters, generators, thermal oxidizers, fire water and stormwater pumps, condensate loading, amine units with incinerator, and fugitive emissions:

- Chapter 3 - Regulatory Permits
- Chapter 5 - Permit Procedures
- Chapter 9 - General Regulations on Control of Emissions and Emission Standards
- Chapter 11 - Control of Air Pollution from Smoke
- Chapter 13 - Emission Standards for Particulate Matter

- Chapter 15 - Emission Standards for Sulfur Dioxide
- Chapter 17 - Control of Emissions of Carbon Monoxide (New Sources)
- Chapter 21 - Control of Emissions of Organic Compounds
- Chapter 22 - Control of Emissions of Nitrogen Oxides (NO_x)
- Chapter 29 - Odor Regulations
- Chapter 51 - Comprehensive Toxic Air Pollutant Emission Control Program
- Chapter 56 - Prevention of Air Pollution Emergency Episodes
- Chapter 59 - Chemical Accident Prevention and Minimization of Consequences

The LDEQ would include permit conditions in the respective permits to ensure compliance with these regulations.

LAC 33:III LDEQ requires that an application for an air permit for a major source of HAPs include ambient air impact analysis of toxic air pollutants (TAP). If the major source emits, or is permitted to emit, any TAP at a rate equal to or greater than its minimum emission rate (MER), compliance with applicable ambient air standards beyond the source's property line must be demonstrated. Certain emissions are exempt from this analysis. If the screening air dispersion modeling predicts impacts beyond the source's property line are less than 7.5 percent of the applicable ambient air standards (AAS), the sources is deemed comply with the TAP rules. If the predicted impact exceeds the AAS, further analysis is required.

The LNG Facility would be a major source of HAPs; therefore, Driftwood performed an ambient impact analysis for TAPs in accordance with LAC 33:III Chapter 51 and LDEQ's *Air Quality Modeling Procedures.*[19] The stationary non-exempt emissions (not including LNG carriers) of ammonia, hexane, and benzene each exceed their respective MER. Screening analysis results beyond the LNG Facility's property line was less than 7.5 percent of the applicable AAS for each TAP. No further analysis was needed to show compliance with the LDEQ regulations, and the results are listed in table 4.12-1.

Table 4.12-1

Air Toxic Screening Model Results

Toxic Air Pollutant	Meteorological Data Year	Maximum Modeled Concentration (µg/m³)	Ambient Air Standard (µg/m³)	7.5% of Ambient Air Standard (µg/m³)	Refined Modeling Required?
Ammonia	2015	5.56	640	48	No
Hexane	2015	21.56	4,190	314.3	No
Benzene	2015	0.17	12	0.90	No

4.12.1.4 Construction Air Emissions and Impacts and Mitigation

Air pollutant emissions during construction of the LNG Facility and Pipeline would result from the operation of construction equipment, marine traffic, vehicles driven by construction workers commuting to and from work sites, and the generation of fugitive dust during construction activities. Construction equipment, marine traffic, and vehicle engines would combust fuel (primarily diesel and gasoline), resulting in criteria pollutant, GHG, VOC and HAP emissions; as well as fugitive dust generated by construction equipment. Emission levels would depend on the number, sizes, and types of engines, the hour of operation, the emissions controls used by the engines, and the quantities and types of fuel combusted.

Fugitive dust emission levels would vary in relation to moisture content, composition, and volume of soils disturbed. Fugitive dust and other emissions from construction activities generally do not result in a significant increase in regional pollutant levels, although local pollutant levels could intermittently increase during the lengthy construction period. Fugitive dust generated by construction-related activities would depend on several determinants, include: size of area disturbed; nature and intensity of construction activity; surface properties (such as the silt and moisture content of the soil); wind speed; and speed, weight, and volume of vehicular traffic.

LNG Facility

Construction of the LNG Facility would occur for about seven-years. Driftwood developed an inventory of non-road equipment, vessels, on-road vehicles, off-road vehicles, and expected activity levels (either hours of operation or miles travelled) based on expected duration of construction at the site. The level of activity for each piece of construction equipment was combined with the relevant emission factors to determine estimates of annual construction emissions. For the purpose of estimating construction emissions, construction was divided into six categories consisting of the following:

- **Site Preparation**: includes of site clearing by removing debris, followed by stripping/grubbing topsoil (stockpiled at the site where required by the Driftwood Plan and Procedures), cut-fill and rough grading operations, road construction, and backfilling and grading.

- **LNG Storage Tanks:** includes foundation construction using concrete piles driven by hydraulic pile drivers and site-erected tank construction using perlite expansion.

- **Marine Work**: includes the berthing and waterway access area, which involves onshore excavation using backhoe and track-hoe equipment and dredging the dock area using hydraulic cutter-head suction mounted on a self-propelled vessel. The activities also include construction of a bulkhead with sheet piles and breasting of dolphins by pile driving steel pilings into the soil.

- **LNG Plant Foundation**: includes foundation activities for the equipment, laydown yard, and appurtenant equipment, such as generator and fire water pumps.

- **Architectural/Building Construction and Demolition**: includes onsite building construction and demolition of the existing buildings at the site.

- **Miscellaneous Construction**: miscellaneous construction tasks would occur throughout construction and would include operation of equipment that is not tied to a specific task, but would be used for general construction activities throughout the duration of construction. This includes operation of two concrete batch plants, each with an output capacity of 160 cubic yards per hour.

Annual emissions estimates for activities associated with construction of the LNG Facility are summarized in table 4.12-2. The fugitive emission estimate consists of contributions from general site construction work (acreage affected), earth-moving fugitive dust emissions (quantity of soil moved), and unpaved road travel (distance of travel and weight of vehicles), as well as material (i.e., sand, aggregate, and cement) transfers during onsite concrete batching operations. Construction material would be loaded via barge or truck. Emissions associated with the trucks as well as the personnel transportation to designated parking areas are included in the emission estimate. Three types of marine vessels would be used during construction of the marine loading area:

- tugboats would be used to transport barges carrying aggregate, sand, and cement to and from the dock;
- ships would be used to transport modules and heavy equipment; and
- dredging vessels with 1,500 hp hydraulic pumps would be used to dredge the channel and Marine Facilities area.

Emission estimates for these vessels were derived from the EPA Guidance Document *Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories* (April 2009).

Table 4.12-2

LNG Facility Annual Construction Emissions by Year

	Emissions (tons)							
Year	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	CO_2e [a]	Total HAPs
2018	812.21	413.83	1.01	380.70	120.18	108.50	170,790	68.50
2019	904.59	449.07	1.11	234.53	108.45	119.28	188,784	73.43
2020	991.17	460.57	1.22	237.32	111.01	126.57	208,517	76.98
2021	818.75	342.29	1.10	219.84	94.06	102.18	191,144	63.85
2022	442.59	198.90	0.69	195.03	70.02	59.28	120,285	36.53
2023	486.54	194.76	0.77	195.72	70.75	63.82	136,610	6.00
2024	245.30	88.81	0.41	181.77	57.34	43.02	73,737	27.21
2025	48.59	19.65	0.09	65.47	34.79	7.05	16,003	4.50

[a] CO_2e is expressed in English tons (not metric tons) in all section 4.12 tables

Fugitive dust emission levels vary in relation to moisture content, composition, activity level, and volume of soils disturbed during construction. Fugitive dust would be produced primarily during the initial phase of preparing the site for construction of the LNG Facility when the site would be cleared of debris, leveled using cut-and-fill techniques, and graded. The fugitive dust emission estimate consists of contributions from general site construction work, earth moving, and paved road traffic.

The construction emissions summarized above are substantial relative to other regulatory thresholds. There is no CAA or LDEQ requirement to permit construction emissions. By way of comparison, a new stationary source with the potential to emit 250 tpy (or in some instances 100 tpy) of a criteria pollutant would require an NSR permit. A new or existing source with the potential to emit 100 tpy of a criteria pollutant or 25 tpy of total HAPs would require a Title V permit. The estimated construction emissions exceed the NSR or Title V thresholds in all but the last calendar year listed in the preceding table. However, the LNG Facility construction emissions are not subject to either NSR or Title V permitting.

Pipeline

Construction of the Pipeline, which includes three compressor stations (CS-01, -02, and -03), and metering stations would result in a temporary increase in the emissions of pollutants due to combustion of fuel in vehicles and equipment, dust generated from excavation, grading and fill activities, and general construction activities (e.g., coating and welding operations). Driftwood anticipates that the construction phase of the Pipeline would occur over about 4 years.

Compressor station and pipeline construction air emissions would be temporary and localized. The air emissions from the construction at a particular pipeline location would occur at that location for a brief duration. The air emissions from the construction at compressor station site, however, would persist at that fixed location over an extended period (i.e., the duration of construction of the compressor station). Estimated emissions associated with construction of the Pipeline are summarized in table 4.12-3.

Table 4.12-3

Pipeline Construction Emissions

	Emissions (tons)							
Year	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	CO_2e	Total HAPs
2018	454.43	996.83	2.06	452.06	165.12	164.66	126,117	37.88
2019	394.64	363.26	0.92	349.48	84.89	77.50	110,206	35.39
2020	352.70	185.58	5.95	327.08	63.31	56.21	105,796	33.16
2021	318.69	176.94	0.61	178.17	45.47	48.89	107,010	31.02

Standard EPA emission thresholds do not apply to construction emissions, and General Conformity thresholds do not apply because the area is in attainment or the equivalent for all the NAAQS. Pipeline construction activities are comparable to those of other types of infrastructure projects or industrial facilities, and would represent a small portion of the overall annual emissions in the region. Therefore, the construction emissions would not have a long-term effect on air quality in the area, although they would result in temporary impacts near construction activities.

Pipeline construction emissions are not subject to either NSR or Title V permitting. Nevertheless, the estimated construction emissions exceed the NSR and Title V thresholds in all of the calendar years listed in the preceding table, although they would not occur at a single location.

Mitigation Measures

LNG Facility

DWPL stated that its contractors and construction management team would ensure the diesel equipment is properly maintained and operated so as to minimize exhaust emissions, but have not committed to using only construction equipment with Tier 4 engines. Driftwood's Fugitive Dust Control Plan would be used to address these activities. It includes dust suppression techniques, such as water spraying on the construction workspaces, limiting track-out onto the roads, enforcing a speed limit on unpaved roads, and covering open-bodied haul trucks, and would be used on construction roadways and corridors if and whenever necessary to prevent or mitigate nuisance dust. The planned mitigation measures are consistent with measures commonly employed to minimize incremental fugitive dust impacts, which in turn minimizes incremental impacts on local air quality.

Pipeline

Fugitive dust emission levels can vary in relation to moisture content, composition, and volume of soils during construction. Fugitive dust would primarily be produced at sites involving land disturbance and earthwork, such as trenching and excavation of soil, stockpiling and transport of soil, and restoration. Dust control measures would be used as necessary during appropriate construction activities such as transporting soil or rock, trenching, and use of access roads. Driftwood's Fugitive Dust Control Plan would be used to address these activities. DWPL stated that its contractors and construction management team would ensure the diesel equipment is properly maintained and operated so as to minimize exhaust emissions. The construction team would also use dust suppression techniques (e.g., water spraying on the construction workspaces and access roads, limiting track-out onto the roads, enforcing a speed limit on unpaved roads, covering open-bodied haul trucks) on construction roadways and corridors if and whenever necessary to prevent or mitigate nuisance dust. The planned mitigation measures are consistent with measures commonly employed to minimize incremental fugitive dust impacts, which in turn minimizes incremental impacts on local air quality.

Conclusions

Construction emissions would extend over a more than 7 year period at the LNG Facility. Overall, the emissions would be comparable to other types of infrastructure projects or industrial facilities. Driftwood provided a comment on the draft DEIS that operational emissions would be only 10 to 15 percent higher than total operational emissions for two years and is unlikely to result in DWLNG causing or contributing to a NAAQS violation. However, we conclude that during the three years of concurrent commissioning, construction, and operation of the LNG Facility emissions would be additive. As indicated, construction and especially commissioning emissions are very large. Construction emissions tend to be very low to the ground and thus have higher impacts near the construction site. Commissioning emissions, it's assumed, would be primarily flaring emissions from the flares and would be elevated, but are also very large. While operational emissions would not exceed the NAAQS, operational emissions, when considered in combination with construction and commissioning emissions, have the potential to cause highly localized exceedances of the NAAQS in the immediate vicinity of the LNG Facility.

For construction of the Pipeline, the construction periods are much shorter and, while some elevated emissions may occur near the construction areas, these would be short-term and minor. Thus, construction emissions would not have a permanent effect on air quality in the area.

4.12.1.5 Operation Air Emissions Impacts and Mitigation

LNG Facility

Operating Air Emissions

Each of the five liquefaction plants within the LNG Facility would include the following emission sources:

- four MR compressor gas turbines;
- one hot oil heater (start-up);
- one essential generator (for emergency use); and
- one thermal oxidizer.

In addition, the LNG Facility would also have:

- two wet flares (for emergency use);
- two dry flares (for emergency use);
- one marine flare;
- four ground flares;
- one condensate vapor thermal oxidizer;
- two fire water pumps;
- six stormwater retention pond pumps;
- two LNG spill containment pumps;
- one main generator (for emergency use);
- one control room generator (for emergency use);
- a loading substation generator (for emergency use); and
- fugitive emissions from pipe flanges, valves, and pump/compressor seals.

A summary of total annual emissions for the LNG Facility is provided in table 4.12-4. Emission estimates include control technologies proposed for the LNG Facility, based on the completion of the required BACT assessment for NO_x, CO, SO_2, PM_{10}, $PM_{2.5}$, VOC, and GHGs (as CO_2e). The LNG Facility would be a PSD major source and a Title V major source for NO_X, CO, PM_{10}, $PM_{2.5}$, VOC, and HAP emissions. The LNG Facility SO_2 and CO_2e emissions would be above the PSD significant emission rate. Driftwood has submitted analyses that demonstrate compliance with the NAAQS and PSD increment for NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$, and compliance with the O_3 NAAQS. It is also subject to comply with the federal requirements for major sources of CO_2e. Compliance with these requirements is discussed below.

Table 4.12-4

LNG Facility Operational Emissions

Activity	Emissions (tpy) NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	CO_2e
LNG Facility Operation							
Stationary Source Operation							
Plant 1	164.9	421.8	13.7	65.0	65.0	73.0	1.58E6
Plant 2	164.9	421.8	13.7	65.0	65.0	73.0	1.58E6
Plant 3	164.9	421.8	13.7	65.0	65.0	73.0	1.58E6
Plant 4	164.9	421.8	13.7	65.0	65.0	73.0	1.58E6
Plant 5	164.9	421.8	13.7	65.0	65.0	73.0	1.58E6
Flares	859.3	3917.4	5.11	30.6	30.6	82.0	1.60E6
Fugitive Sources						94.0	9,267
Other Stationary Sources	20.3	12.6	0.2	0.4	0.4	14.4	4,552
Total Stationary Sources	1,703.9	6,039.1	73.75	356.2	356.2	555.6	9.51E6
Marine Vessel Operation [a]	94.8	251	0.4	2.5	2.5	14.9	25,264
Other Mobile Source Operation	1.7	25.9	0.02	0.06	0.05	0.9	2,917
Total LNG Facility Operation (per year)	**1,800**	**6,316**	**74**	**359**	**359**	**571**	**9.54E6**

[a] DWLNG has stated the tug boats would meet Tier 4 engine emission limits using SCR or other technology providing Tier 4 emissions levels.

During LNG Facility operation, the estimated emissions of the largest three HAPs are formaldehyde at 33.8 tpy, n-hexane at 13.9 tpy, and toluene at 11.5 tpy and total HAPS are 73.38 tpy. During LNG Facility commissioning, the estimated emissions of the largest single HAP (i.e., n-hexane) and total HAPS are 6.48 and 8.13 tpy, respectively.

The LNG plants would be brought on line sequentially. Temporary emissions (primarily emissions from flare operations) would occur during the commissioning of each LNG plant. Commissioning emissions would not overlap with Total Stationary Source Emissions (i.e., full operational emissions), however, they would overlap with construction emissions, and partial facility operation during commissioning of plants 2, 3, 4 and 5.

LNG Facility Ambient Impacts

Air quality dispersion modeling using the EPA AERMOD program suite using five years (2011 - 2015) of surface and upper air data from the Lake Charles Regional Airport was conducted for the LNG Facility's stationary and marine sources for NO_2, CO, SO_2, PM_{10}, and $PM_{2.5}$. AERMOD's updated tier 2 Ambient Ratio Method option was used in line with EPA modeling guidance. With the Ambient Ratio Method, the NO_x concentration predicted by AERMOD for each hour at each receptor is multiplied by an NO_2/NO_x ambient ratio, derived from the NO_x concentration predicted by AERMOD for that hour and receptor.

The following stationary sources were modeled:

- Twenty MR compressor gas turbines;
- Five thermal oxidizers;

- Five hot oil fired heaters;
- Ten flares;
- Eight emergency generators;
- Two fire water pumps; and
- Seven spill containment and stormwater retention pond pumps.

Driftwood conducted dispersion modeling, including significance and area of influence analyses, for NO_2, CO, SO_2, PM_{10}, and $PM_{2.5}$ for the stationary sources at the LNG Facility. The results for each pollutant and averaging period are summarized in table 4.12-5, along with the associated significant impact level (SIL), background concentration, and NAAQS. If the significance analysis reveals that the predicted ground-level concentration for a particular pollutant and averaging period exceeds the applicable SIL, a total impact analysis was conducted. The total impact analysis considers impacts of the proposed source and the sources within the area of influence at the significant receptors. (Note, the area of influence is the area where the predicted ambient air quality impacts of the proposed source exceed the SIL). Results from the significance analysis also dictate if pre-construction ambient monitoring is required. The predicted concentration of NO_2 (1-hour and annual averages), SO_2 (1-hour average), and $PM_{2.5}$ (24-hour average), however, each exceed its relevant SIL concentration, and hence require total impact modeling.

The total impact modeling includes LNG Facility operations (i.e., stationary sources and marine vessels in the moored safety zone) and stationary sources within an approximately 60 km radius of the LNG Facility. As stated above, the modeling shows that the impacts from the LNG facility operations (and LNG carriers) would not cause exceedances of the NAAQS. Operation of the LNG Facility would result in air quality impacts, however, these impacts would not be significant.

Table 4.12-5

LNG Facility Air Dispersion Modeling Results Summary

Pollutant	Averaging Period	Screening Model Concentration (µg/m³) [a]	Significant Impact Level Concentration (µg/m³)	Refined Model Concentration (µg/m³) [b]	Ambient Background Concentration (µg/m³)	Total Concentration (µg/m³)	NAAQS (µg/m³)
NO_2	1-hour	37.4	7.5	4,719	68	4,787 [/c]	188
	Annual	1.21	1.0	13.8	11.3	25.1 [/c]	100
CO	1-hour	156	2,000		802	958 [/d]	40,000
	8-hour	401	500		573	974 [/d]	10,000
SO_2	1-hour	11.6	7.8	427	86	513 [/c]	196
	3-hour	10.9	25		131	142 [/d]	1,300
PM_{10}	24-hour	2.08	5.0		77	79 [/d]	150
$PM_{2.5}$	24-hour	1.77	1.2	51	16	67 [/c]	35
	Annual	0.24	0.3		7.3	7.54 [/d]	12

[a] LNG Facility only
[b] LNG Facility and other sources within an approximately 60 km radius.
[c] Model concentration + ambient
[d] Screening + ambient

µg/m³ = microgram per cubic meter
NO_2 = nitrogen dioxide
CO = carbon monoxide
SO_2 = sulfur dioxide
$PM_{2.5}$ = particulate matter with an aerodynamic diameter ≤2.5 µm
PM_{10} = particulate matter with an aerodynamic diameter ≤10 µm

Several NAAQS exceedances were predicted from the cumulative air quality model:

- The modeling predicted a maximum high-eighth-high (H8H) 1-hour NO_2 concentration of 4,787 μg/m^3. The ambient background concentration was added to the H8H value to obtain the total concentration of 4,855 μg/m^3, which far exceeds the 1-hour NO_2 NAAQS. The model identified that this predicted impact is 30 miles east of LNG Facility. The LNG Facility's contribution to this exceedance, and all other predicted 1-hour NO_2 NAAQS exceedances, are less than SIL value of 7.5 μg/m^3. Therefore, this demonstrated that the LNG Facility's operation would not cause or significantly contribute to an exceedance of the 1-hour NO_2 NAAQS. However, this is indicative of significant air contaminant sources included in the multi-source inventory in the vicinity of the exceedances.
- The modeling predicted a maximum high-fourth-high 1-hour SO_2 concentration of 427 μg/m^3. The ambient background concentration was added to the high-fourth-high value to obtain the total concentration of 513 μg/m^3, which exceeds the 1-hour SO_2 NAAQS. The model identified that the LNG Facility's contributions to this result, and all other predicted 1-hour SO_2 NAAQS exceedances, are less than the SIL value of 7.8 μg/m^3. Therefore, this demonstrated that the LNG Facility's operation would not cause or significantly contribute to an exceedance of the 1-hour SO_2 NAAQS.
- The modeling predicted a maximum H8H 24-hour $PM_{2.5}$ concentration of 51 μg/m^3. The ambient background concentration was added to the H8H value to obtain the total concentration of 67 μg/m^3, which exceeds the 24-hour $PM_{2.5}$ NAAQS. The model identified that the LNG Facility's contributions to this result, and all other predicted 24-hour $PM_{2.5}$ NAAQS exceedances, are less than the SIL value of 1.2 μg/m^3. Therefore, the modeling predicts that the Facility's operation would not cause or significantly contribute to an exceedance of the 24-hour $PM_{2.5}$ NAAQS.

Driftwood also conducted dispersion modeling, for NO_2, CO, SO_2, PM_{10}, and $PM_{2.5}$ for the LNG Facility stationary sources, LNG carriers and tugboats in the moored safety zone, and stationary sources located within an approximately 60 km radius of the LNG Facility. The results would be below the NAAQS, and are summarized in Table 4.12-6. Three marine source emission scenarios were evaluated:

- maneuvering through the moored safety zone;
- hoteling within the moored safety zone; and
- loading within the moored safety zone.

Table 4.12-6

LNG Facility and Vessel Air Dispersion Modeling Results Summary

Pollutant	Averaging Period	Screening Model Concentration (μg/m^3) [a]	Significant Impact Level Concentration (μg/m^3)	Refined Model Concentration (μg/m^3) [b]	Ambient Background Concentration (μg/m^3)	Total Concentration (μg/m^3)	NAAQS (μg/m^3)
NO_2	1-hour	37.4	7.5	4,730	68	4,798[/c]	188
	Annual	1.35	1.0	14.0	11.3	25.3[/c]	100
CO	1-hour	157	2,000		802	959[/d]	40,000
	8-hour	401	500		573	974[/d]	10,000
SO_2	1-hour	11.6	7.8	427	86	513[/c]	196
	3-hour	10.9	25		131	142[/d]	1,300

Table 4.12-6

LNG Facility and Vessel Air Dispersion Modeling Results Summary

Pollutant	Averaging Period	Screening Model Concentration (μg/m^3) [a]	Significant Impact Level Concentration (μg/m^3)	Refined Model Concentration (μg/m^3) [b]	Ambient Background Concentration (μg/m^3)	Total Concentration (μg/m^3)	NAAQS (μg/m^3)
PM_{10}	24-hour	2.09	5.0		77	79[/d]	150
$PM_{2.5}$	24-hour	1.79	1.2	51	16	67[/c]	35
	Annual	0.24	0.3		7.3	7.54[/d]	12

a LNG Facility + vessels only
b LNG Facility + vessels + other sources within an approximately 60 km radius
c Model concentration + ambient
d Screening + ambient

Regional Ozone Impacts

The LNG Facility would be in Calcasieu Parish, which is currently designated as attainment for the 8-hour O_3 NAAQS. Pipeline compressor stations would be situated in Jefferson Davis, Acadia, and Evangeline Parishes, which are also designated as attainment for the 8-hour O_3 NAAQS. Nevertheless, the Project would be near the Greater Baton Rouge Area (which EPA recently re-designated as attainment for the 2008 8-hour O_3 NAAQS), the Houston-Galveston-Brazoria area (which is designated as marginal nonattainment for the 2008 8-hour O_3 NAAQS), and the Lake Charles and Lafayette areas (which are vulnerable to being re-designated as nonattainment for the 2008 8-hour O_3 NAAQS).

Driftwood provided an O_3 ambient impact analysis. The LNG Facility's impact on the regional 8-hour O_3 concentration was estimated by comparing the LNG Facility's emissions to the nearby Sasol North America, Inc. (Sasol) Lake Charles Gas-to-Liquids (GTL) and Lake Charles Cracker Project (LCCP) project. The technical report, *Ozone and $PM_{2.5}$ Impact of the Proposed Sasol Lake Charles Gas-to-Liquids and Lake Charles Cracker Projects*, dated November 13, 2013 and prepared by Alpine Geophysics, LLC (Alpine) was used as a reference for the analysis. It can be obtained (see Document ID: 9175964) from the Louisiana Electronic Document Management System (http://edms.deq.louisiana.gov/app/doc/querydef.aspx). The Alpine report describes photochemical grid modeling O_3 episode which occurred in the Baton Rouge area between May 26 and July 1, 2006 to predict the impact of the impact of the Sasol projects' emissions. The analysis addresses impacts at known monitor locations and unmonitored locations.

The total estimated O_3 precursor emissions from Sasol's GTL and LCCP projects were 4,881 tpy (1,595 and 3,286 tpy of NO_x and VOC, respectively). The greatest predicted increase in the 8-hour O_3 concentration from Sasol's combined GTL and LCCP projects was 0.6 parts per billion (ppb). The LNG Facility's estimated O_3 precursor emissions from stationary and mobile sources is 2,371 tpy (1,800 and 571 tpy of NO_x and VOC, respectively), which is about 49 percent of the O_3 precursor emissions from Sasol's GTL and LCCP projects. Therefore, it can be conservatively assumed that the LNG Facility's maximum increase in the 8-hour O_3 concentration would be about 0.3 ppb. The maximum 8-hour O_3 concentration measured at the monitor nearest the LNG Facility (Carlyss, Site No. 220190002, about 10.4 km from the LNG Facility) between 2014 and 2016, is 68 ppb. The 2008 and 2015 8-hour O_3 NAAQS are 75 and 70 ppb, respectively. Thus, operation LNG Facility is not likely to cause or contribute to an exceedance the O_3 NAAQS, the cumulative impacts are further discussed in Section 14.4.2.12.

Table 4.12-7 provides a summary of the LNG Facility combined construction, commissioning, and operational emissions by year.

As explained previously, each LNG Facility Plant would be brought on-line sequentially, approximately five years after receiving the FERC Order, with full service anticipated after a total construction period of 86 months. In calendar years 2021 through 2025/2026, simultaneous construction, commissioning, and operational emissions would occur. These overlapping emissions would be in excess of the modeled operational emissions during years 2023 through 2025/2026. As previously stated, during the three years of concurrent commissioning, construction, and operation of the LNG Facility, emissions would temporarily impact local air quality levels and may result in exceedances of the NAAQS in the immediate vicinity of the LNG Facility due to very high annual emissions of NO_x, CO, and $PM_{2.5}$ in certain years, which could result in a potential significant impact on air quality in the immediate vicinity of the LNG Facility. However, these potential exceedances would not be persistent at any one time due to the dynamic and fluctuating nature of construction activities, and the emissions levels would not result in a long-term impact on regional air quality.

Table 4.12-7

LNG Facility Combined Construction, Commissioning, and Operational Emissions

	Emissions (tpy)							
Activity	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	CO_2e [a]	Total HAPs
2018	812.21	413.83	1.01	380.70	120.18	108.50	170,790	68.5
2019	904.59	449.07	1.11	234.53	108.45	119.28	188,784	73.43
2020	991.17	460.57	1.22	237.32	111.01	126.57	208,517	76.98
2021	818.75	342.29	1.10	219.84	94.06	102.18	191,144	63.85
2022	682.59	1,293.30	2.09	203.63	78.62	82.48	540,285	38.16
2023	1,686.54	4,909.96	33.17	356.52	231.55	338.62	4,792,610	38.588
2024	2,165.30	7,330.41	62.41	486.17	361.74	546.22	8,545,737	89.13
2025	1,848.59	6,335.65	74.09	424.47	393.79	578.05	9,556,003	77.84
2026	1,800.00	6,316.00	74.00	359.00	359.00	571.00	9,540,000	73.34

[a] CO_2e is expressed in English tons (not metric tons)

Compressor Station Emissions

The Pipeline would result in operational emissions from the three compressor stations (CS-01, -02, and-03) and fugitive methane emissions from leaks and blowdown events. These operational emissions and potential associated effects are discussed below.

<u>CS-01</u>

The stationary sources at this compressor station would include the following:

- five natural gas-fired turbines,
- two natural gas-fired emergency generator engines,
- one condensate tank, and
- one oily water tank.

Emissions also would result from truck loading activities, unit and station blowdown activities, and fugitive emissions from piping components, such as valves and pump seals. Estimated annual emission rates for the equipment are provided in table 4.12-8. Driftwood has submitted to LDEQ an application for a combined construction permit initial Title V and construction permit for CS-01.

Table 4.12-8

CS-01 Estimated Annual Emission Rates

	Annual Emission Rates (tpy)							
Equipment	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	Total HAPs	CO_{2e}
Turbine 1	42.84	40.6	2.13	9.26	9.26	5.74	1.63	108,439
Turbine 2	42.84	40.6	2.13	9.26	9.26	5.74	1.63	108,439
Turbine 3	42.84	40.6	2.13	9.26	9.26	5.74	1.63	108,439
Turbine 4	42.84	40.6	2.13	9.26	9.26	5.74	1.63	108,439
Turbine 5	42.84	40.6	2.13	9.26	9.26	5.74	1.63	108,439
Standby Generator 1	0.38	0.58	<0.01	0.01	0.01	0.1	0.1	115
Standby Generator 2	0.38	0.58	<0.01	0.01	0.01	0.1	0.1	115
Fugitives	-	-	-	-	-	0.15	0.03	316
Condensate Tank	-	-		-	-	4.06	-	-
Oily Water Tank	-	-		-	-	0.11	-	-
Truck Loading	-	-		-	-	0.04	-	-
Blowdowns	-	-	-	-	-	4.16	0.20	9,011
Total	***214.97***	***204.18***	***10.64***	***46.2***	***46.2***	***37.43***	**8.59**	**551,750**

CS-02

The stationary sources at this compressor station would include the following:

- three natural gas-fired turbines; and
- two natural gas-fired emergency generator engines.

Emissions also would result from unit and station blowdown activities and fugitive methane emissions from piping components, such as valves and pump seals. Estimated annual emission rates for the equipment are provided in table 4.12-9. Driftwood has not submitted the initial Title V application for CS-02 to the LDEQ.

Table 4.12-9

CS-02 Estimated Annual Emission Rates

	Annual Emission Rates (tpy)							
Equipment	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	Total HAPs	CO_{2e}
Turbine 1	66.82	68.27	2.26	9.84	9.84	7.75	2.11	115,257
Turbine 2	66.82	68.27	2.26	9.84	9.84	7.75	2.11	115,257
Turbine 3	44.01	49.21	1.63	7.11	7.11	5.15	1.26	83,202
Standby Generator 1	0.3	0.51	<0.01	0.01	0.01	0.13	0.1	83
Standby Generator 2	0.3	0.51	<0.01	0.01	0.01	0.13	0.1	83
Fugitives	-	-	-	-	-	0.04	0.03	84
Blowdowns			-			3.2	0.20	6,626
Total	***178.26***	***186.79***	***6.15***	***26.81***	***26.81***	***24.22***	**5.92**	**320,746**

CS-03

The stationary sources at this compressor station would include the following:

- three natural gas-fired turbines; and
- two natural gas-fired emergency generator engines.

Emissions also would result from unit and station blowdown activities and fugitive methane emissions from piping components, such as valves and pump seals. Estimated annual emission rates for the equipment are provided in table 4.12-10. Driftwood has not submitted the initial Title V application for CS-03 to the LDEQ.

Table 4.12-10

CS-03 Estimated Annual Emission Rates

	Annual Emission Rates (tpy)							
Equipment	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	Total HAPs	CO_{2e}
Turbine 1	48.8	54.08	1.8	7.84	7.,84	5.7	1.26	96,203
Turbine 2	48.8	54.08	1.8	7.84	7.84	5.7	1.26	96,203
Standby Generator 1	0.26	0.63	<0.01	0.01	0.01	0.11	0.1	91
Standby Generator 2	0.26	0.63	<0.01	0.01	0.01	0.11	0.1	91
Fugitives	-	-	-	-	-	0.09	0.03	193
Blowdowns	-	-	-	-	-	2.62	0.20	5,416
Total	***98.12***	***109.42***	***3.6***	***15.70***	***15.70***	***14.34***	**2.93**	**198,198**

Compressor Station Operational Emissions Impacts

Driftwood conducted dispersion modeling, including screening (significance) and area of influence analyses, for NO_2, CO, SO_2, PM_{10}, and $PM_{2.5}$ for the CS-01, CS-02, and CS-03. The results for each pollutant and averaging period are summarized in tables 4.12-11, 4.12-12, and 4.12-13, respectively, along with the associated SIL, background concentration, and NAAQS. For permitting, if the screening analysis reveals that the predicted ground-level concentration for a particular pollutant and averaging period exceeds the applicable SIL, a total impact analysis is required. The total impact analysis considers impacts of the proposed source and the sources within the area of influence at the significant receptors (i.e., the locations where the predicted ambient air quality impacts of the proposed source exceed the SIL). Results from the screening analysis also dictate if pre-construction ambient monitoring is required The tables below compare: the screening or total impact analyses plus ambient background concentrations with the NAAQS.

Table 4.12-11

CS-01 Air Dispersion Modeling Results Summary

Pollutant	Averaging Period	Screening Model Concentration ($\mu g/m^3$) [a]	Significant Impact Level Concentration ($\mu g/m^3$)	Model Concentration ($\mu g/m^3$) [b]	Ambient Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	1-hour	90.2	7.5	114	67.7	182 [c]	188
	Annual	2.19	1.0	3.54	11.3	14.8 [c]	100
CO	1-hour	807	2,000		802	1,609 [d]	40,000
	8-hour	351	500		573	924 [d]	10,000
SO_2	1-hour	6.44	7.8		86.5	91.9 [d]	196
	3-hour	7.21	25		131	138 [d]	1,300
PM_{10}	24-hour	11.1	5.0	8.73	77	85.7 [c]	150
$PM_{2.5}$	24-hour	8.08	1.2	3.9	16	19.9 [c]	35
	Annual	0.26	0.3		7.3	7.56 [d]	12

[a] CS-01 only
[b] CS-01 and other sources within an approximately 60 km radius
[c] Model concentration + ambient
[d] Screening + ambient

Table 4.12-12

CS-02 Air Dispersion Modeling Results Summary

Pollutant	Averaging Period	Screening Model Concentration (μg/m³) [a]	Significant Impact Level Concentration (μg/m³)	Model Concentration (μg/m³) [b]	Ambient Background Concentration (μg/m³)	Total Concentration (μg/m³)	NAAQS (μg/m³)
NO_2	1-hour	71.7	7.5	71.7	67.7	139 [c]	188
	Annual	6.21	1.0	6.21	11.3	17.5 [c]	100
CO	1-hour	935	2,000		5,613	6,548 [d]	40,000
	8-hour	212	500		1,489	1,701 [d]	10,000
SO_2	1-hour	5.14	7.8		86.5	91.6 [d]	196
	3-hour	4.98	25		131	136 [d]	1,300
PM_{10}	24-hour	6.11	5.0	6.11	77	83.1 [c]	150
$PM_{2.5}$	24-hour	4.76	1.2	4.76	14	18.8 [c]	35
	Annual	0.21	0.3		7.6	7.81 [d]	12

[a] CS-02 only
[b] CS-02 and other sources within an approximately 60 km radius. Screening and total impact modeling predict equivalent impacts for this assessment.
[c] Model concentration + ambient
[d] Screening + ambient

Table 4.12-13

CS-03 Air Dispersion Modeling Results Summary

Pollutant	Averaging Period	Screening Model Concentration (μg/m³) [a]	Significant Impact Level Concentration (μg/m³)	Model Concentration (μg/m³) [b]	Ambient Background Concentration (μg/m³)	Total Concentration (μg/m³)	NAAQS (μg/m³)
NO_2	1-hour	54.5	7.5	54.5	67.7	122 [c]	188
	Annual	6.44	1.0	6.44	11.3	17.7 [c]	100
CO	1-hour	2,250	2,000	2,250	5,613	7,863 [c]	40,000
	8-hour	501	500	501	1,489	1,990 [c]	10,000
SO_2	1-hour	4.30	7.8		86.5	90.8 [d]	196
	3-hour	4.25	25		131	135 [d]	1,300
PM_{10}	24-hour	6.39	5.0	6.39	77	83.4 [c]	150
$PM_{2.5}$	24-hour	5.04	1.2	5.04	14	19.0 [c]	35
	Annual	0.26	0.3		7.6	7.86 [d]	12

[a] CS-03 only
[b] CS-03 and other sources within an approximately 60 km radius. Screening and total impact modeling are equivalent for this assessment.
[c] Model concentration + ambient
[d] Screening + ambient

The screening analysis for CS-01 showed that the predicted concentration of each pollutant except NO_2 (1-hour and annual averages), PM_{10} (24-hour average), and $PM_{2.5}$ (24-hour average) is well below the NAAQS. For each of the remaining pollutants, total impact modeling was conducted. For all the pollutants, the predicted impact plus the background concentration is less than its relevant NAAQS. Therefore, we conclude that operation of the CS-01 would not cause or significantly contribute to an exceedance of the NAAQS.

The screening analysis for CS-02 showed that the predicted concentration of each pollutant except NO_2 (1-hour and annual averages), PM_{10} (24-hour average), and $PM_{2.5}$ (24-hour average) is well below the NAAQS. For CS-03, the screening analysis showed that the predicted concentration of each pollutant except CO (1-hour and 8-hour averages), NO_2 (1-hour and annual averages), PM_{10} (24-hour average), and $PM_{2.5}$ (24-hour average) is well below the NAAQS. For CS-02 and CS-03, the area of influence surrounding each facility for all pollutants extends approximately 1 km or less from the facility. Hence, the screening modeling and the total impact modeling are equivalent. For each pollutant, the predicted impact plus the background concentration is less than its relevant NAAQS. Therefore, we conclude that operation of the CS-02 and CS-03 would not cause or significantly contribute to an exceedance of the NAAQS.

Pipeline and Meter Stations

Pipeline and meter station equipment would include the following:

- 96 miles of pipeline,
- 15 meter stations, and
- 3 pipe inspection gauge (PIG) launcher/receivers.

Estimated annual emission rates for the equipment are provided in table 4.12-14.

Table 4.12-14

Pipeline and Meter Station Estimated Annual Emission Rates

	Annual Emission Rates (tpy)							
Equipment or Operation	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	Total HAPs	CO_{2e}
96 Miles of Pipeline	-	-	-	-	-	4.60	< 0.01	9,530
15 Meter Stations	-	-	-	-	-	10.61	0.10	20,640
3 PIG Launcher/Receivers	-	-	-	-	-	0.49	< 0.01	1,024
Total	**-**	**-**	**-**	**-**	**-**	***15.70***	***0.11***	***31,214***

Conclusions

Residents near the construction areas may experience brief but intermittent periods of localized elevated emission levels during the period of construction, primarily from fugitive dust. However, through use of construction work practices, analysis of the estimated emissions from construction and operation, and an analysis of the modeled air quality impacts from operation of the LNG Facility and Pipeline, we find that the facilities themselves would not cause regionally significant impacts on air quality.

4.12.2 Noise

Sound is mechanical energy transmitted by pressure waves in media such as air or water (FTA, 2006). When sound becomes excessive, annoying, or unwanted, it is referred to as "noise." Noise levels (or loudness) are quantified using units of decibels (dB). A-weighted noise, referred to as dBA, is noise corrected to account for the sensitivity of the human ear. The A-weighted scale is used because human hearing is less sensitive to low and high frequencies than mid-range frequencies. Noise may be continuous and steady (constant noise with an unchanging decibel level), continuous and varying (constant noise with a fluctuating decibel level), impulsive (having a high peak of short duration), stationary (occurring from a fixed source), intermittent (at intervals of high and low sound levels), or transient (occurring at different rates). Ambient (or background) sound levels result from sound emanating from natural and artificial sources. The magnitude and frequency of ambient noise may vary considerably over the course of a day and throughout the year, caused in part by weather conditions, seasonal vegetative cover, and human activity.

The noise environment can be affected both during construction and operation of pipeline facilities (meter station, valves), compressor stations, and LNG facilities. The magnitude and frequency of environmental noise may vary considerably over the course of the day, throughout the week, and across seasons, in part due to changing weather conditions and the effects of seasonal vegetative cover.

Noise in Air

To allow comparisons of the many different types of noise, two measures have been defined by federal agencies to relate the time-varying quality of environmental sound levels to known effects on people. These are the 24-hour equivalent sound level (L_{eq}) and the day-night sound level (L_{dn}). The L_{eq} is the level of continuous steady sound with the same total energy as the time-varying sound, averaged over a 24-hour period. The L_{dn} is the L_{eq} with 10 decibels on the A-weighted decibel scale (dBA) added to the nighttime sound levels between the hours of 10 p.m. and 7 a.m., to account for people's greater sensitivity to sound during nighttime hours. The L_{max} is the maximum sound level at a point in time. The potential for noise impacts can be assessed by considering the sound level increase over ambient levels at receptors, referred to as noise sensitive areas (NSAs) such as residences, schools, or hospitals. The human ear's threshold of perception for noise change is considered to be 3 dBA, and 6 dBA is clearly noticeable to the human ear. Increases of 9 dBA are perceived as a doubling of noise or twice as loud.

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* (EPA, 1974). This document provides information for state and local governments to use in developing their own ambient noise standards. The EPA determined that an L_{dn} of 55 dBA protects the public from indoor and outdoor activity noise interference. The Commission's regulations in 18 CFR 380.12(k)(4)(v)(A) specify that noise attributable to the operation of any new or modified compressor station or LNG Facility must not exceed an L_{dn} of 55 dBA at the nearest NSA. FERC also uses 55 dBA L_{dn} as a comparison point in the impact analysis for certain construction noise and meter stations.

An L_{dn} of 55 dBA is equivalent to a continuous noise level of 48.6 dBA. For comparison, normal speech at a distance of three feet averages 60 – 70 dBA L_{eq}. Provided below are common noise sources and each source's typical dBA noise level.

- Pile Driver at 100 feet 90 to 100 dBA
- Chainsaw at 30 feet 90 dBA

- Truck at 100 feet 85 dBA
- Noisy Urban Environment 75 dBA
- Lawn Mower at 100 feet 65 dBA
- Average Speech at three feet 60 to 70 dBA
- Typical Suburban Daytime 50 dBA
- Quiet Office 40 dBA
- Quiet Suburban nighttime 35 dBA
- Soft Whisper at 15 feet 30 dBA

In addition to noise requirements, FERC requires that operation of the compressor station or LNG Facility not result in any perceptible increase in vibration.

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

Applicable exemptions include

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

DWPL does not anticipate nighttime construction activities (other than hydrostatic testing, which does not generate significant noise) at the meter stations, including those in Calcasieu Parish. Nighttime construction activities during HDD pullback (as discussed in section 4.12.2.2) would not be within 165 feet of NSAs (as required by the Calcasieu Parish Ordinance), and DWPL expects to fully comply with the Calcasieu Parish Ordinance.

The compressor stations would be located in Louisiana in Jefferson Davis, Acadia, and Evangeline parishes. As discussed above, the State of Louisiana does not have a noise standard. Jefferson Davis Parish (CS-01) also does not have a noise ordinance. Acadia Parish (CS-02) has a noise ordinance that limits sound levels at residential, commercial, and industrial areas; however, the Acadia Parish noise ordinance does not include a sound level limit for agricultural residences, multi-use districts, or other land use descriptions that apply to the area surrounding CS-02. FERC noise level requirements are more stringent than the parish requirements for commercial and industrial properties. Evangeline Parish (CS-03) has a noise ordinance (Chapter 22, Section 22-6 of the Parish Code of Ordinances) that contains general prohibitions on excessive noise as follows: "It shall be unlawful for any person to make, continue or cause to be made or continued any loud noise or any noise which either disturbs, injures or endangers the comfort, repose, health, peace or safety of others, within the parish."

Underwater Noise

Because sound behaves differently underwater than in air, underwater noise levels are characterized by different metrics than noise in air, and is expressed in terms of decibels referenced to 1 micro Pascal (dB re 1 µPa).[20] These underwater sound pressure levels cannot be directly compared to noise levels in air because of the differences in reference intensities and sound speed (Discovery of Sound in the Sea, 2018). The guidelines for underwater noise sound pressure levels and potential impacts are discussed in section 4.3.3 (fish) and section 4.8.4 (marine mammals).

4.12.2.2 Existing Sound Levels and Noise Sensitive Areas

Driftwood evaluated potential noise impacts during operation of the Project by conducting an ambient noise level survey and noise impact evaluation at the nearest NSAs to each noise emitting facility. The noise impact evaluations included development of estimated sound level increases during construction and operation and comparing those estimates to our standard for permissible sound levels at NSAs.

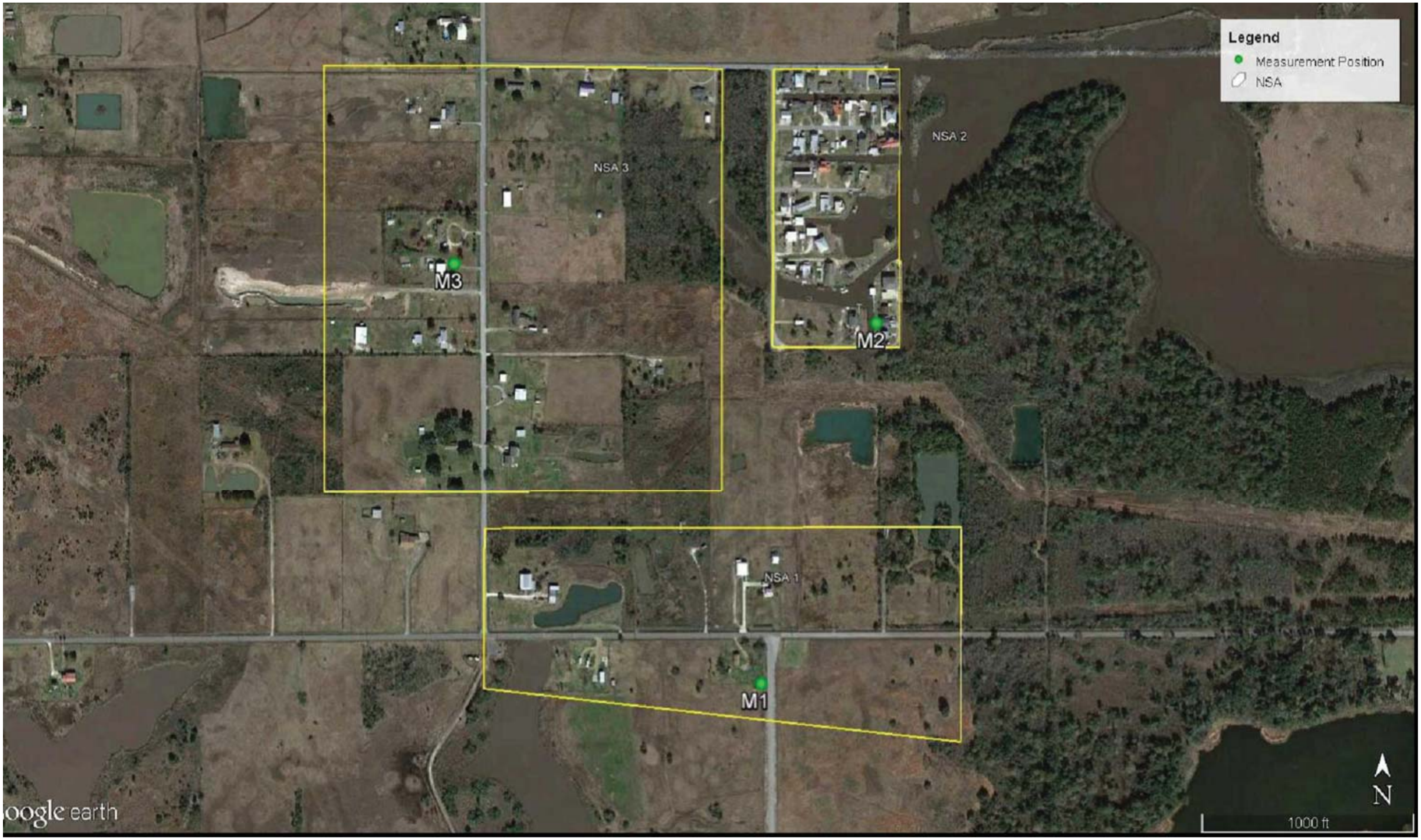
LNG Facility

Six NSAs (points within groups of homes) were identified near the LNG Facility. Ambient noise level measurements were conducted for 24-hour periods at each NSA area. The NSAs, their distance and direction from the site, and the measured ambient sound levels are discussed further in section 4.12.2.3 of this document. The NSA locations in relation to the LNG Facility are provided in figures 4.12-1 through 4.12-5. The residence at measurement site M1 is being purchased by Driftwood prior to construction and is not be considered an NSA for this analysis.

[20] A decibel in air, is referenced to 20 µPa

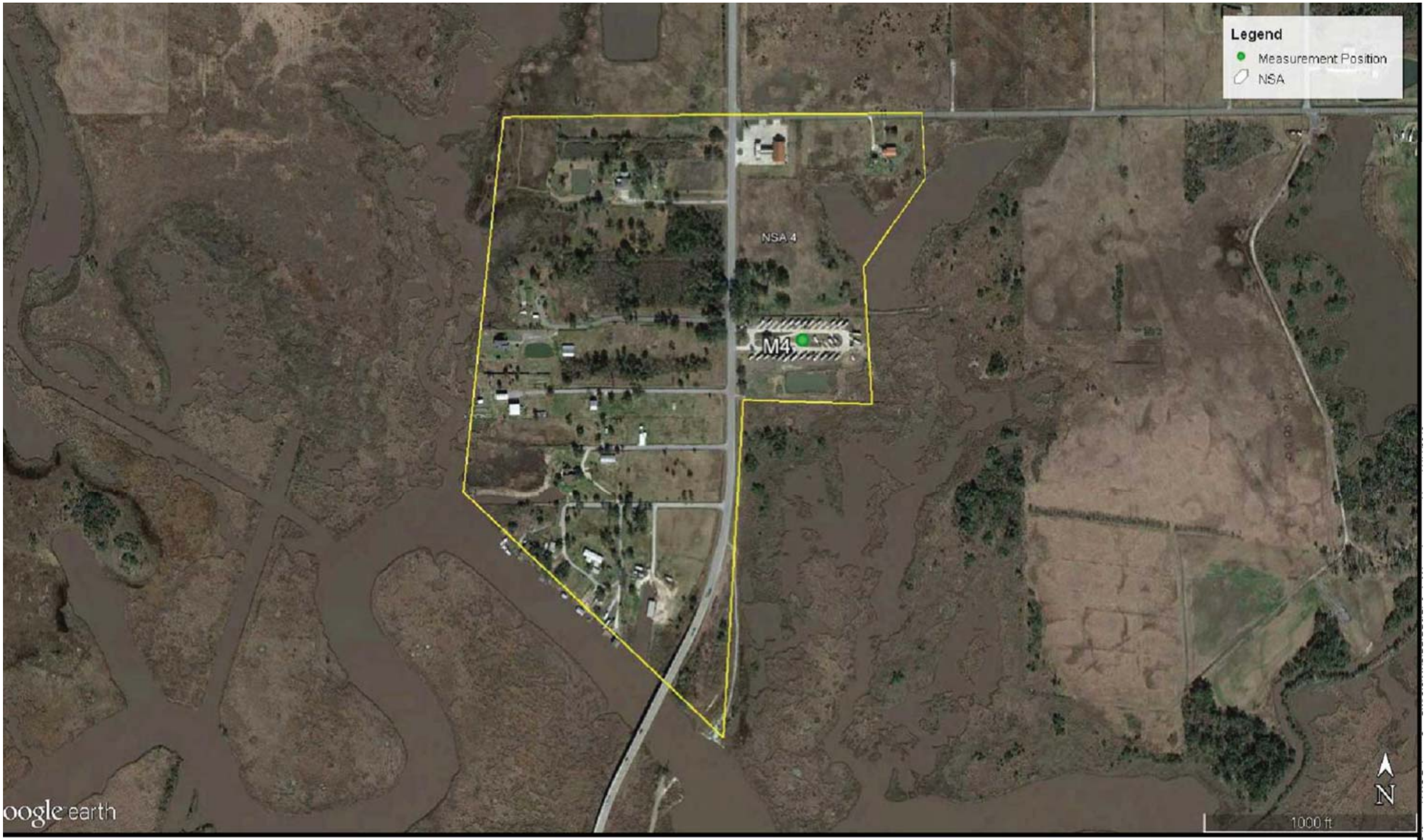
NOTE:
SOURCE: ERM

Project Number:	119.01713.00001	Scale: NTS	Date: 02/28/2017
Description:	ALL 24-HOUR NOISE MEASUREMENT LOCATIONS		By: DMJ / JMC
Project Name:	Driftwood LNG		Figure: 4.12-1



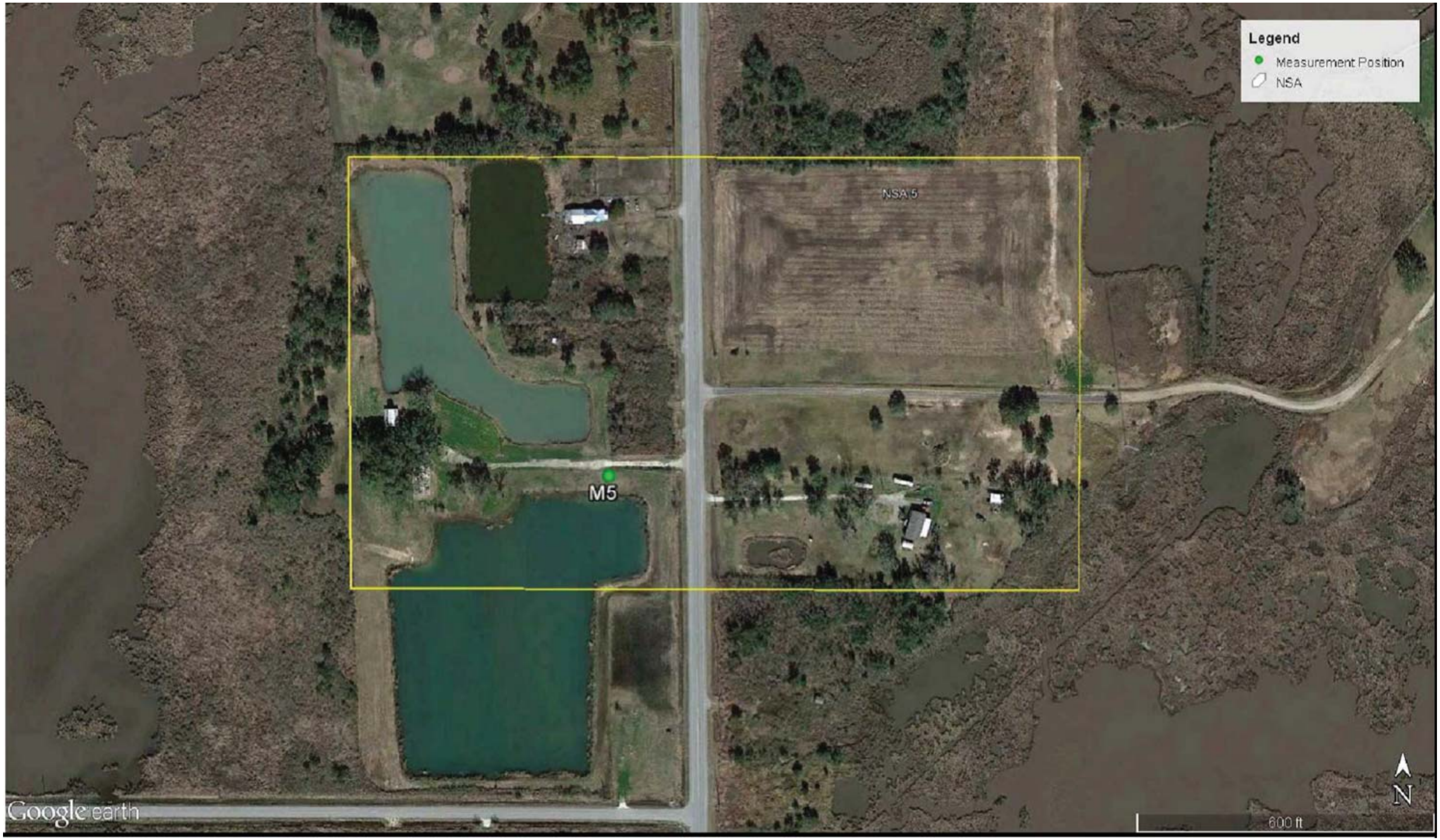
NOTE:
SOURCE: ERM

Project Number:	119.01713.00001	**Scale:** NTS	**Date:** 02/28/2017
Description:	MONITORING LOCATIONS M1, M2 AND M3		**By:** DMJ / JMC
Project Name:	Driftwood LNG		**Figure:** 4.12-2



NOTE:
SOURCE: ERM

Project Number:	119.01713.00001	**Scale:**	NTS	**Date:**	02/28/2017
Description:	MONITORING LOCATION M4			**By:**	DMJ / JMC
Project Name:	Driftwood LNG			**Figure:**	4.12-3



NOTE:
SOURCE: ERM

Project Number:	119.01713.00001	Scale:	NTS	Date:	02/28/2017
Description:	MONITORING LOCATION M5			By:	DMJ / JMC
Project Name:	Driftwood LNG			Figure:	4.12-4

NOTE:
SOURCE: ERM

Project Number:	119.01713.00001	**Scale:**	NTS	**Date:**	02/28/2017
Description:	MONITORING LOCATION M6			**By:**	DMJ / JMC
Project Name:	Driftwood LNG			**Figure:**	4.12-5

Pipeline

Horizontal Directional Drilling

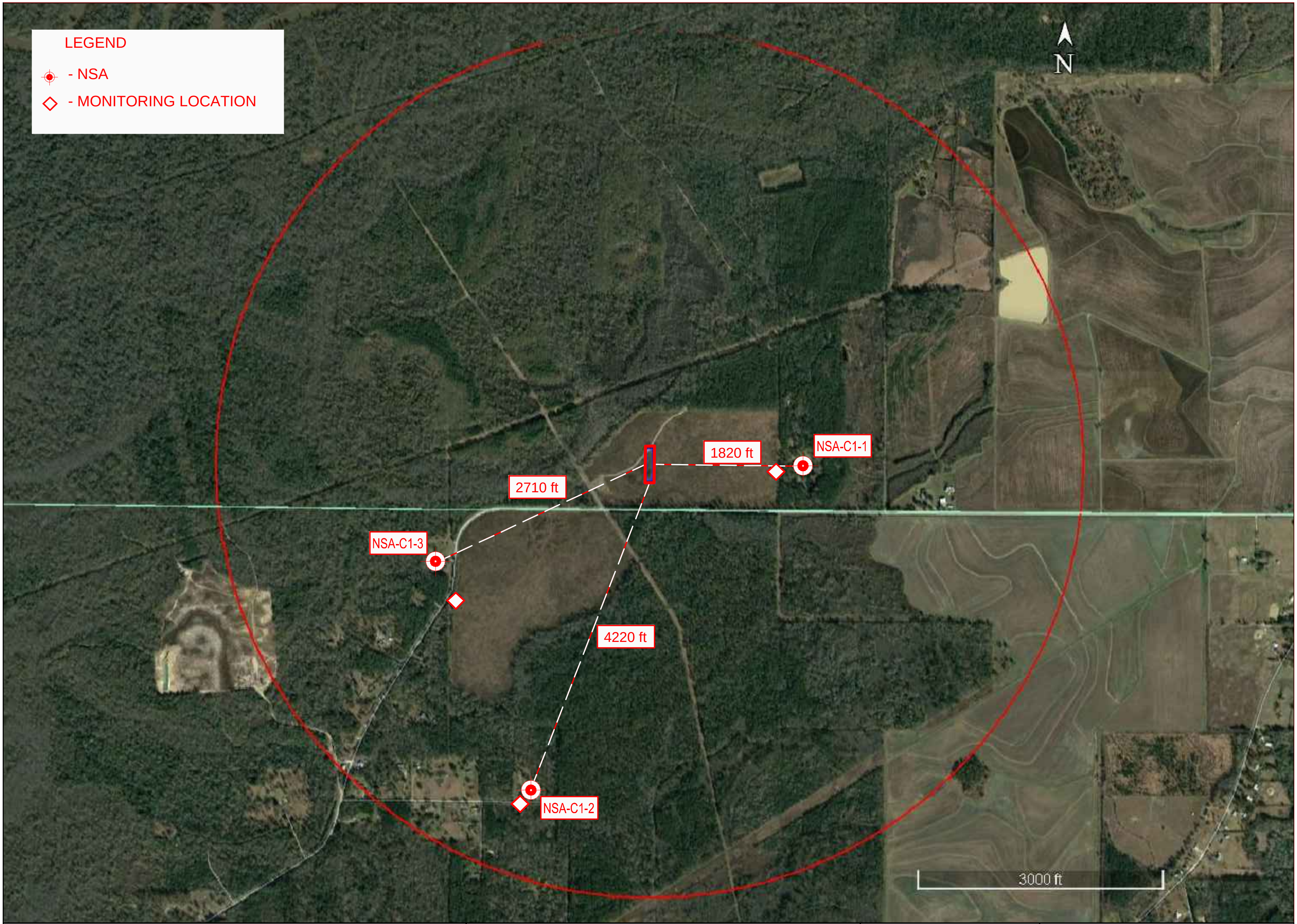
The nearest NSA to each HDD entry and exit site was identified and daytime and nighttime ambient sound level measurements were conducted. Nighttime ambient sound levels were not measured at some of the NSAs near HDD locations, so an estimate of these sound levels was necessary to generate L_{dn} sound levels. The difference in measured daytime and nighttime ambient sound levels at the CS-01 location, which is in a rural setting, was consistently 7 dBA, i.e., nighttime ambient sound levels were consistently 7dBA lower than daytime ambient sound levels. Accordingly, nighttime ambient sound levels were estimated at some of the NSAs near HDD locations by subtracting 7 dBA from the measured daytime ambient levels, allowing calculation of ambient L_{dn} sound levels. The NSAs, their distance and direction from each HDD, and the ambient sound levels, are provided detail in section 4.12.2.2 and are shown in figures 2.5-2 through 2.5-12. We typically do not require a noise analysis for HDD activities with no NSAs within ½ mile of the entry or exit pits.

Aboveground Facilities – Compressor Stations

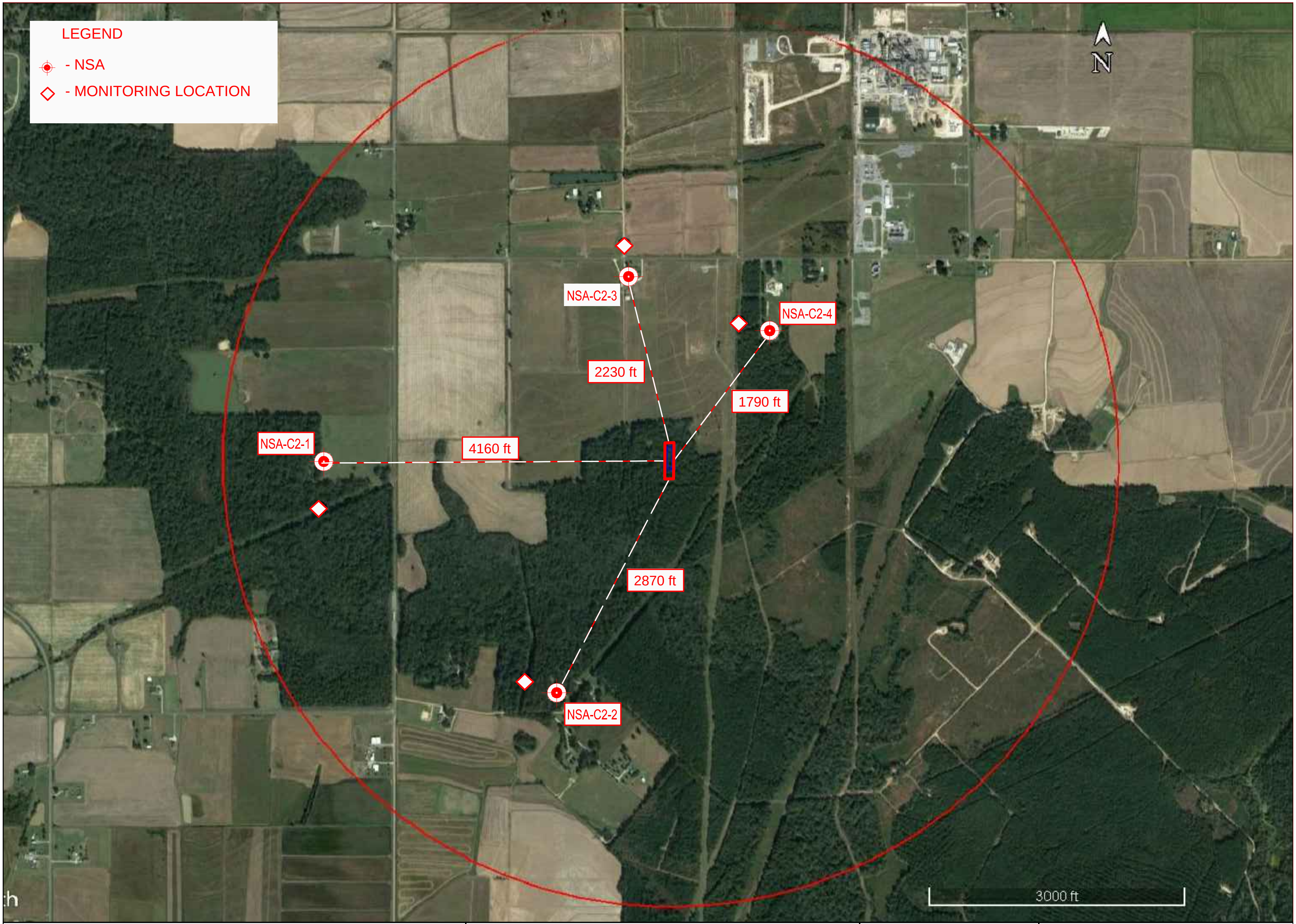
NSAs were identified near each compressor station. Ambient noise level measurements were conducted for 24-hour periods at each NSA. The NSAs, their distance and direction from the site, and the measured ambient sound levels, discussed in more detail in section 4.2.12.3. The NSA locations in relation to the compressor stations are provided in figures 4.12-6 through 4.12-8.

Aboveground Facilities – Meter Stations

Existing ambient conditions at the nearest NSAs to each meter station were not measured but were estimated by using the measured ambient data from the closest or most representative NSA for the compressor station. The distance and direction to the nearest NSA to each meter station, and the estimated ambient sound levels discussed in more detail in section 4.2.12.3.



Project Number: 119.01713.00001	**Scale:** NTS	**Date:**	02/28/2017
Description: Gillis CS: NSA Directions and Distances		**By:**	DMJ / JMC
Project Name: Driftwood LNG		**Figure:**	4.12-6



Project Number:	119.01713.00001	**Scale:**	NTS	**Date:**	02/28/2017
Description:	Basile CS: NSA Directions and Distances			**By:**	DMJ / JMC
Project Name:	Driftwood LNG			**Figure:**	4.12-7

Project Number:	119.01713.00001	**Scale:**	NTS	**Date:**	02/28/2017
Description:	Mamou CS: NSA Directions and Distances			**By:**	DMJ / JMC
Project Name:	Driftwood LNG			**Figure:**	4.12-8

4.12.2.3 Construction Noise Impacts and Mitigation

LNG Facility

Construction activity and associated noise levels would vary depending on the phase of construction in progress at any time. The highest level of construction noise typically occurs during earth-moving and pile-driving work. Construction noise is highly variable. Construction equipment operates intermittently, and the type of equipment in use at a given location at any point in time changes with the phase of construction. The sound level impacts on NSAs due to construction activities would depend on the type of equipment used, the duration of use for each piece of equipment, the number of construction vehicles and machines used simultaneously, and the distance between the sound source and receptor. The loudest equipment sources typically generates up to 95 dBA at 50 feet.

We received comments from the public on the draft EIS regarding the length and impact of construction noise. Driftwood has filed a construction noise analysis as a comment on the draft EIS (FERC eLibrary accession number 20181105-5080) showing that, after the berm is constructed, with peak workers and equipment on site, noise impacts at the NSAs would be below 55 dBA L_{dn}. This analysis shows primarily construction using small equipment work and may not be indicative of noise for other phases of construction (earth moving, grading, etc.) with different or larger equipment types. The analysis also included the berm, which would mitigate noise impacts. However, the analysis does not consider noise impacts at other phases of construction such as during grading/filling/site preparation. Consequently, we cannot determine that these activities are acceptable for night construction.

Driftwood has indicated that it plans to construct at the LNG Facility 24 hours a day, to include after 5:30 pm and during nighttime hours. If Driftwood would construct into later hours, we are recommending they file additional information to ensure that nearby residents are not exposed to excessive noise outside of the previously indicated timeframe. Thus, to ensure that the noise impacts remain below 55 dBA L_{dn} during construction after 5:30 p.m. and during nighttime hours for all construction activities including grading/filling/site preparation, **we recommend that:**

> **<u>Prior to construction,</u> DWLNG should file with the Secretary, for review and approval by the Director of OEP, a Nighttime Noise Mitigation and Monitoring Plan that details the noise mitigation that it would install (such as the berm, equipment limitations, low-noise back-up alarms, etc.) and shows the noise impacts at the NSAs. The Plan shall include predictions of the noise impacts at the NSAs and demonstrate how the proposed mitigation would reduce noise to no more 55 dBA L_{dn} at occupied residences. The Plan shall also provide for advance notification of nighttime construction to nearby NSAs/residents and noise monitoring.**

Pile driving, which would occur between 7:00 a.m. and 7:00 p.m. for three years at the LNG Facility, was calculated to produce L_{eq} sound levels that are below our noise criterion of 55 dBA, as shown in (table 4.12-15). Maximum sound levels would occur during daytime and are therefore estimated using L_{eq} dBA. However, impulsive noise (short noise similar to a car backfiring, firecracker or gunshot) is measured differently than steady state noise and has a much greater potential to annoy local residents, even during daytime. Currently estimated maximum sound levels or L_{max} of pile driving (i.e., each hammer strike) would be well above the existing ambient levels at NSAs M1, M2, and M3. The residence at measurement site M1 is being purchased by Driftwood prior to construction and is not be considered an NSA for this analysis.

Table 4.12-15

Predicted Levels Due to Pile Driving at the Nearest NSAs

NSA Locations	Existing Daytime Background Noise, L_{eq} [a]		Predicted Noise Contribution from DW LNG		Combined Plant and Background Noise Level		Expected Increase Over Existing		Predicted Maximum Levels [b]	Combined L_{max} and Background Noise Level	Expected Maximum Increase Over Existing
	L_{eq} dBA	L_{dn} dBA	L_{eq} dBA	L_{dn} dBA	L_{eq} dBA	L_{dn} dBA	L_{eq} dBA	L_{dn} dBA	L_{max} dBA	L_{eq} dBA	L_{eq} dBA
NSA M1[c]	49	56	56.9	53.9	57.6	58.1	8.6	2.1	62	62.2	13.2
NSA M2	52	53	54.5	51.5	56.4	55.3	4.4	2.3	60	60.6	8.6
NSA M3	52	55	51.5	48.5	54.8	55.9	2.8	0.9	56	57.5	5.5
NSA M4	55	61	50.2	47.2	56.2	61.2	1.2	0.2	55	58.0	3.0
NSA M5	62	67	50.0	47.0	62.3	67.0	0.3	0.0	55	62.8	0.8
NSA M6	50	55	39.9	36.9	50.4	55.1	0.4	0.1	40	50.4	0.4

a Source: AECOM, 2016.

b L_{max} for pile driving is associated with impact noise when the hammer hits the pile. Although multiple pile rigs may be operating at the same time, they are not synchronized and therefore L_{max} is calculated based on a single pile driving event at each NSA.

c M1 is being purchased by Driftwood prior to construction and is not be considered an NSA for this analysis.

We received a comment from the public concerned about the noise level and length of pile driving noise, and stating that the impacts would be more than “annoying.” The impulsive noise of pile driving would be clearly audible outside of residences, and potentially indoors in the numerous homes near the LNG Facility. The World Health Organization has set noise goals for nighttime L_{max} noise levels of 60 dBA (World Health Organization 1999). In a comment on the draft EIS, Driftwood suggested using the American Public Transit Authority’s criterion of 70 dBA L_{max}. The American Public Transit Authority’s criterion was developed for intermittent transit noise such as trolleys, trains, etc. Pile driving noise is both more impulsive in nature, and at a much higher frequency (occurrence). We determined that 60 dBA L_{max} is more protective and would keep pile driving impacts on residents from being significant. Additionally, the 60 dBA L_{max} criterion is a reasonable goal for Driftwood as the majority of NSAs are predicted to have a noise impact less than 60 L_{max}, and the only NSA exceeding 60 dBA L_{max} (NSA M1) is being purchased by Driftwood.

We received a comment on the draft EIS from the public suggesting Driftwood be required to develop and provide a noise management plan before finalization of the EIS. We determined that a noise management plan prepared "before construction" would be more accurate than one prepared "before completion of the final EIS," because at that point Driftwood would have hired the contractors and determined the specific pieces of equipment to be used. This would result in more accurate estimates of noise impacts. Driftwood would be required to show that the specific pile driving equipment would not exceed the 60 dBA L_{max}. This schedule for a noise management plan would also give Driftwood opportunity to consider alternate construction methods (cast-in place piles, etc.) that would have less noise impact.

Therefore, to ensure that impacts due to maximum pile driving noise levels at the LNG Facility would be minimized, **we recommend that:**

Prior to construction, DWLNG should file with the Secretary, for review and written approval by the Director of OEP, a Pile Driving Noise Management Plan. The plan should

outline a monitoring plan for sound levels (L_{eq} and L_{max}) during pile driving, and evaluation and use of noise mitigation to reduce noise attributable to pile driving L_{max} levels to no greater than 60 dBA at any NSAs.

Dredging would take place 24 hours per day for about 30 months. Our review focused on nighttime sound levels, estimated using the nighttime equivalent sound level ($L_{eq,n}$) dBA. Dredging-related sound levels were calculated to be below our 55 dBA L_{dn} criterion at all NSA locations, and the expected noise increases would only be barely perceptible at the nearby NSAs. This would not result in significant impacts on NSAs. Table 4.12-16 shows the calculated increases in sound levels from nighttime dredging.

Table 4.12-16

Predicted Sound Levels Due to Dredging at the Nearest NSAs

NSA Locations	Existing Nighttime Background Noise [a] $L_{eq,n}$ (dBA)	Predicted Noise Contribution from Dredging Only $L_{eq,n}$ (dBA)	Combined Dredging and Background Noise Level $L_{eq,n}$ (dBA)	Expected Increase Over Existing Background $L_{eq,n}$ (dBA)
NSA M1[b]	50	44.2	51.0	1.0
NSA M2	43	43.9	46.5	3.5
NSA M3	47	40.1	47.8	0.8
NSA M4	54	37.3	54.1	0.1
NSA M5	60	35.1	60.0	0.0
NSA M6	48	33.8	48.2	0.2

[a] Source: AECOM, 2016.

[b] M1 is being purchased by Driftwood prior to construction and is not be considered an NSA for this analysis.

Underwater Noise

As previously noted, because sound behaves differently underwater than in air, underwater noise levels are characterized by different metrics than noise in air, and is expressed in terms of decibels referenced to 1 micro Pascal (dB re 1 µPa). Because sound pressure level attenuates rapidly with distance from the source, sound pressure level is referenced at 1 m distance from the source, and the sound pressure level at greater distances is calculated. These underwater sound pressure levels cannot be directly compared to noise levels in air because of the differences in reference intensities and sound speed (Discovery of Sound in the Sea, 2018). See Driftwood's Underwater Noise Impact Assessment for details of assumptions and calculations (FERC eLibrary Accession Number 20170703-5162).

The highest-intensity noise during construction would be associated with in-water impact driving of 48-inch steel piles. Although an estimate of the underwater noise associated with driving 48-inch steel piles was not included in the reference (Caltrans, 2015), an estimate for 60-inch steel piles was used as a conservative surrogate. We agree that using the estimate of underwater noise associated with driving 60-inch steel piles is conservative, as a larger diameter pile would require more force to install and thus would generate more noise during construction. Driving these piles would generate a peak sound pressure level of 230 dB re 1 µPa at 1m.

The sensitive receptors for underwater noise would be fish, especially those with swim bladders, and marine mammals. Impacts on these aquatic species are discussed in sections 4.3.3.1 and 4.8.5.

Pipeline/Compressor Stations

HDD Pipeline Installation

Sound-level increases during Pipeline construction would be intermittent and generally would occur between 7:00 a.m. and 7:00 p.m., with the potential exception of HDD activity. Because the prefabricated segment of pipe for the HDD crossing must be pulled back through the drill hole to complete the crossing during a single, continuous effort that may take 12 hours or more, HDDs may continue into nighttime hours and could operate 24 hours per day for several days. Because of the potential nighttime activity and the fact that the equipment used for the HDDs would be stationary for an extended period of time, there is a greater potential for a prolonged noise impact. In addition, some time-sensitive construction activities, such as hydrostatic testing, waterbody crossings, and tie-ins, could also require nighttime work; these activities would produce noise similar to or less intense than HDD activities, and the following analysis would apply.

HDD is proposed at 11 locations (two of the 12 HDD crossings would be installed at a single location where the mainline and a lateral pipeline run parallel). Of the 11 HDD sites, NSAs were identified within one half mile of seven of the sites. As previously indicated, we typically do not require an acoustical analysis of HDD activities if no NSAs exist within ½ mile.

The primary sound generated during HDD activities would be from the diesel engines that power the drilling equipment. Higher sound levels are generated at the entry point than at the exit point. FERC’s criteria for HDD noise are a limit of no greater than 55 dBA as an L_{dn}, or, if the existing ambient sound level is already greater than 55 dBA L_{dn}, then HDD noise may not increase the ambient sound level by more than 10 dBA.

Driftwood conducted a noise modeling and mitigation analysis of HDD noise at the nearest NSAs to each of the seven HDD entry and exit work sites. Their analysis include a 12-hour workday, which is the typical workday being proposed by Driftwood, and a 24-hour analysis for periods when overnight work may be required during drill pullback. Only the results of the 24-hour workday analysis are presented herein. Driftwood’s analysis indicated that during 24-hour HDD activity, our criteria would be exceeded at the nearest NSAs to HDD entry sites A1, A2, HDD2, A4, A6, and HDD5. Driftwood proposed utilizing sound barriers at HDD A1, A2 and A4 to reduce noise levels. The sound barrier heights would range from 12 feet to 20 feet. However, even though implementation of the sound barriers, noise levels would not be reduced to below 55 dba L_{dn} for 24-hour HDD activity at these HDD sites. For these HDDs, Driftwood has proposed, in addition to the sound barriers, to offer compensation for temporary relocation for planned nighttime work to residents of NSAs where predicted sound levels exceed 55 dBA L_{dn}.

Driftwood requested in a comment on the draft EIS that if the residents of the NSAs accepted compensation for temporary relocation for planned nighttime work, no other noise mitigation would be required. However, we consider relocation of residents to be an impact event. Therefore, we maintain our recommendation that Driftwood propose mitigation to ensure that the noise impacts are below our thresholds. If noise mitigation is not feasible, then relocation or equivalent compensation are options for consideration.

For HDD2 and HDD5, Driftwood has also proposed utilizing sound barriers but did not specify barrier heights. Mitigated HDD noise levels at HDD2 and HDD5 were shown to meet our criteria.

Table 4.12-17

HDD Noise Analysis – 24-Hour Workday (dBA L_{dn})

HDD	NSA	Distance (feet) and Direction to NSA	Daytime L_{eq}	Nighttime L_{eq}	Ambient L_{dn}	Estimated HDD Noise Level Without Mitigation	Estimated Mitigated HDD Noise Level	Total Estimated Combined Noise Level (HDD plus Ambient)	Increase Over Existing Ambient
A1	Entry	170 / E	38.4	38.3	44.7	73.7	61.9	62.0	17.3
	Exit	230 / NNE	38.4	38.3	44.7	62.5	---	62.6	17.9
A2	Entry	470 / W	42.6	38.3	45.6	67.2	62.5	62.6	17.0
	Exit	320 / E	45.9	38.3	47.0	58.9	---	59.2	12.2
A3	Entry		No NSA within ½ mile				No noise analysis required		
	Exit								
HDD1	Entry	1,406 / SE	44.7	37.7	46.1	54.6	---	55.2	9.1
	Exit	671 / W	50.1	43.1	51.5	51.5	---	54.5	3.0
HDD2	Entry	634 / SW	49.2	42.2	50.6	64.1	50.9	53.8	5.1
	Exit	2,180 / SSW	49.2	42.2	50.6	36.9	---	50.8	0.2
A4	Entry	240 / N	36.6	38.3	44.5	74.3	63.4	63.5	19.0
	Exit	470 / E	35.3	38.3	44.4	56.6	---	56.9	12.5
HDD4	Entry		No NSA within ½ mile				No noise analysis required		
	Exit								
A5	Entry		No NSA within ½ mile				No noise analysis required		
	Exit								
A6	Entry		No NSA within ½ mile				No noise analysis required		
	Exit	310 / SW	40.4	39.5	46.1	57.2	---	57.5	11.4
A7	Entry		No NSA within ½ mile				No noise analysis required		
	Exit								
HDD5	Entry	879 / NNW	42.5	35.5	43.9	61.1	51.1	51.9	8.0
	Exit	427 / NW	42.5	35.5	43.9	55.9	50.9	51.7	7.8

No mitigation was proposed for HDD A6. Provided in table 4.12-17 is a summary of the HDD locations, the estimated or measured ambient sound level, the amount of mitigation provided, and the resulting mitigated HDD noise levels at the nearest NSAs.

To ensure that HDD noise levels are reduced to the extent practical, Driftwood has committed to use the following noise mitigation measures at HDD sites:

- HDD A1 Entry Site – 20-foot-tall sound barriers
- HDD A2 Entry Site – 12-foot-tall sound barriers
- HDD A4 Entry Site – 16-foot-tall sound barriers
- HDD2 – sound barriers
- HDD5 – sound barriers
- Limit, to the extent possible, HDD activities to a single 12-hour daytime shift.
- If nighttime work is unavoidable, such as during pullback, offer temporary compensation or relocation for the night work period to the residents of those NSAs at which predicted sound levels exceed 55 dBA L_{dn}.

To ensure that HDD-related noise levels are reduced to the extent practical, with a goal of not exceeding an L_{dn} of 55 dBA, **we recommend that:**

<u>Prior to construction of the Pipeline at HDD locations A1, A2, A4</u> and A6, DWPL should file with the Secretary, for review and written approval by the Director of OEP, an HDD Noise Mitigation Plan to reduce noise levels attributable to the drilling operations at NSAs near their respective entry and exit points to below 55 dBA L_{dn} or 10 dBA over existing sound levels. During drilling operations, DWPL should implement the approved plan, monitor noise levels, and make all reasonable efforts to meet these noise levels attributable to the drilling operations at the NSAs.

<u>Pipeline and Compressor Station Construction</u>

Construction noise is highly variable. Many construction machines operate intermittently, and the types of machines in use at a construction site change with the construction phase. The sound level impacts on residences along the pipeline right-of-way due the construction activities would depend on the type of equipment used, the duration of use for each piece of equipment, the number of construction vehicles and machines used simultaneously, and the distance between the sound source and receptor. Nighttime noise due to construction would be limited since construction generally would occur between 7:00 a.m. and 7:00 p.m..

Construction at the compressor stations would occur for longer timeframes than pipeline construction. Residents near the compressor station would hear construction equipment and experience elevated noise levels. Noise mitigation measures that would be employed during construction include ensuring that the sound muffling devices, which are provided as standard equipment by the construction equipment manufacturer, are kept in good working order. Nighttime noise is not expected to increase during compressor station construction because typical construction activities would be limited to daytime hours.

People near the construction would hear the noise associated with construction. To the extent practicable, we have looked at mitigation measures to reduce noise impacts. Residents would certainly hear the construction noise near the construction locations, especially near the compressor stations and LNG Facility. The impulsive noise of pile driving would be clearly audible outside of residences, and potentially indoors in the numerous homes near the LNG Facility. We have made a recommendation that a Pile Driving Noise Management Plan be developed and implemented, including monitoring for sound levels during pile driving and evaluation and use of noise mitigation to reduce pile driving L_{max} levels to no greater than 60 dBA at any NSAs. With use of our recommendations, and Driftwood's mitigation measures we determine that local residents would not be significantly affected by construction-related noise.

4.12.2.4 Operational Noise Impacts and Mitigation

LNG Facility

Operation of the LNG Facility would generate noise levels that would occur throughout the life of the Project. Noise would be produced continually by a number of sources that include various types of compressors, combustion turbines, cooling fans, pumps and piping. The LNG Facility would ultimately consist of 5 LNG plants. Plant 1 operation would commence approximately five years after receiving the FERC Order, with plants 2 through 5 brought online as they are completed. Operational noise levels were modeled for plants 1 and 2, and then incrementally for the remaining three plants. Modeled noise levels for plants 1, 2, and 3 operating at full load did not exceed our 55 dBA L_{dn} criterion. However, modeled noise levels with 4 or 5 plants in operation do exceed our criterion. Measures to achieve compliance with our criterion may include low noise design for certain sources (e.g., low speed, low noise fans), acoustical enclosures for compressors and turbines, and intake and exhaust silencers. Table 4.12-18 includes existing and the calculated operational noise levels for full LNG buildout (all five plants), existing ambient levels, and predicted future noise levels.

Table 4.12-18

LNG Facility Operational Noise Levels (dBA L_{dn})
All Five Plants in Operation

NSA	Distance (feet) and Direction to NSA	Measured Daytime L_{eq}	Measured Nighttime L_{eq}	Measured Ambient L_{dn}	Modeled LNG Noise Level	Combined Existing Plus LNG Facility	Expected Increase Over Existing
M1 [a]	2,033 / NW	49	50	56	57.7	59.9	3.9
M2	3,850 / NW	52	43	53	54.5	56.8	3.8
M3	3,303 / NW	52	47	55	52.8	57.0	2.0
M4	2,575 / W	55	54	61	52.8	61.6	0.6
M5	2,930 / SW	62	60	67	53.1	67.2	0.2
M6	8,801 / E	50	48	55	44.8	55.4	0.4

[a] The residence at M1 is being purchased by Driftwood.

The noise levels in table 4.12-18 that detail the impacts from the LNG Facility indicate that the overall noise level would not increase dramatically. However local residents and the public at many locations would notice a minor increase in overall noise level and potential hear when certain activities start/stop. Notwithstanding the analysis presented, Driftwood has committed to achieved compliance with our 55 dBA L_{dn} criterion at all NSAs with all five plants in operation. There would also be overlap of construction and operation when the first few LNG plants are brought online. However, to achieve compliance, Driftwood has further committed to the following:

- Conduct a post-construction noise measurement test after Plant 1 is put into operation.
- Develop an as-built noise model of Plant 1 based on sound level measurements of actual operating Plant 1 equipment collected during the post-construction noise measurement test.
- Determine whether the as-built noise levels are lower or higher than the modeled levels.
- Use the updated model to determine if additional noise mitigation would be required for plants still under construction.
- Update the noise mitigation measures, if needed, such that noise levels generated by full load operation of the full Project (plants 1 through 5) comply with our 55 dBA L_{dn} noise criterion.

Driftwood has committed to a post-construction noise survey after commissioning Plant 1 of the LNG Facility, while Plant 1 is operating under standard full-load operating conditions, and providing the results to the Commission within 60 days of commencement of full load operation. The resulting information would be used to model anticipated noise from plants 2 to 5 as they are constructed and phased into operation. To ensure that NSAs are not adversely affected by the phased operation of the LNG Facility, **we recommend that:**

> **DWLNG should file a full power load noise survey with the Secretary for the LNG Facility <u>no later than 60 days</u> after each liquefaction plant is placed into service. If the noise attributable to operation of the equipment at the LNG Facility exceeds an L_{dn} of 55 dBA at the nearest NSA, <u>within 60 days</u> DWLNG should modify operation of the liquefaction facilities or install additional noise controls until a noise level below an L_{dn} of 55 dBA at the NSA is achieved. DWLNG should confirm compliance with the above requirement by filing a second noise survey with the Secretary <u>no later than 60 days</u> after it installs the additional noise controls.**

As described above, Driftwood would need to complete noise surveys after each of the liquefaction plants are placed in-service to ensure that the phased-in third, fourth and fifth (whole facility) liquefaction plant facility operations are below 55 dBA L_{dn} at any nearby NSA. If the noise levels reported in any of the noise surveys are over 55 dBA L_{dn}, Driftwood would need to use the required mitigation to reduce the noise impacts on the nearest NSAs within the time specified in the condition. To ensure that the noise from the LNG Facility does not exceed an L_{dn} of 55 dBA at the nearest NSAs, **we recommend that**:

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

Underwater Noise

As previously noted, sound behaves differently underwater than in air. The LNG Facility would be on the Calcasieu Ship Channel, which contains many sources of natural and anthropogenic noise. Ship traffic currently includes 1,000 vessels per year and is anticipated to increase to about 2,900 vessels per year by 2025 (Ausenco, 2016). The Project ship traffic would increase in-water and airborne noise within and along the ship channel. In addition, construction and/or maintenance of several marine facilities is ongoing, including some in-water pile driving by vibratory and impact hammer.

Flaring

The LNG Facility flare system would include a total of 10 flares, with two totally enclosed ground flares for planned and unplanned maintenance activities. Noise associated with flaring for unplanned maintenance activities at these ground flares has been modeled separately, and is not a normal part of routine operation (table 4.12-19). Driftwood modeled noise levels from non-maintenance flaring and found that the noise would be below our criterion of 55 dBA L_{dn}. However, as indicated in the LNG activities, the light combined with the noise would make this activity obvious to residents around the LNG Facility.

Table 4.12-19

Predicted Noise Contribution at Nearest NSAs from Totally Enclosed Ground Flares

NSA Location	Predicted Noise Contribution from Totally Enclosed Ground Flare L_{dn} (dBA)
M1[a]	49.2
M2	46.2
M3	44.2
M4	44.4
M5	45.7
M6	30.1

[a] M1 is being purchased by Driftwood prior to construction and is not be considered an NSA for this analysis.

Based on the results of the noise analysis and our recommendation, we conclude that operational noise from the LNG Facility, while certainly increasing the noise level of the surrounding area; would not have significant impacts on the residents and the noise environment near the LNG Facility.

Pipeline – Aboveground Facilities

Increases in sound would occur due to operation of each compressor station and meter station. The sound-level increases would occur for the life of the Project. The compressor stations would contain combustion turbines, compressors, cooling fans, and other noise generating sources. The meter stations would contain control valves and ultrasonic meters. No flaring is anticipated at compressor stations. Operational noise sources and impacts on nearby NSAs are discussed below.

Driftwood calculated noise levels that would be attributable to operation of each compressor station and meter station, except for the meter stations that would be part of or adjacent to the compressor stations. The noise analyses for those meter stations was included in the analysis for the respective compressor station. Table 4.12-20 presents the calculated noise levels for each compressor station and meter station operating under full-load conditions, as well as the existing ambient noise level and predicted future noise

Table 4.12-20

Calculated Operational Noise Levels Summary (dBA)

Station	NSA	Distance (feet) and Direction to NSA	Measured Daytime L_{eq}	Measured Nighttime L_{eq}	Ambient L_{dn}	Calculated Aboveground Facility L_{dn}	Cumulative Future (Existing Plus Aboveground Facility)	Increase Over Existing Ambient L_{dn}
CS-01	C1-1	1,820 / E	42.5 [a]	35.4 [a]	43.9 [a]	51.9	52.5	8.6
	C1-2	4,220 / SSW	45.7 [a]	37.4 [a]	46.4 [a]	43.8	48.3	1.9
	C1-3	2,710 / WSW	45.4 [a]	38.1 [a]	46.6 [a]	49.1	51.0	4.4
CS-02	C2-1	4,160 / W	39.6 [a]	36.0 [a]	43.1 [a]	46.8	48.3	5.2
	C2-2	2,870 / SSW	43.6 [a]	38.9 [a]	46.4 [a]	42.8	48.0	1.6
	C2-3	2,230 / N	51.9 [a]	49.9 [a]	56.6 [a]	49.5	57.4	0.8
	C2-4	1,790 / NE	42.5 [a]	42.2 [a]	48.7 [a]	52.2	53.8	5.1
CS-03	C3-1	1,420 / SSW	66.1 [a]	60.0 [a]	68.0 [a]	49.5	68.1	0.1
	C3-2	3,740 / SE	58.0 [a]	51.4 [a]	59.6 [a]	39.5	59.6	0.0
	C3-3	960 / E	55.1 [a]	53.5 [a]	60.2 [a]	52.4	60.9	0.7
MS-01					Included in analysis for LNG Facility			
MS-02	NSA 1	1,001 / N	41.3	34.3	42.7	48.5	49.5	6.8
MS-03					Included in analysis for LNG Facility			
MS-04	NSA 1	467 / N	41.3	34.3	42.7	51.6	52.1	9.4
MS-05					No NSA within one-half mile			
MS-06					Included in analysis for CS-01			
MS-07	NSA 1	1,220 / NNW	41.3	34.3	42.7	49.2	50.1	7.4
MS-08 [a]					Included in analysis for CS-02			
MS-09	NSA 1	688 / E	42.5	42.2	48.7	52.1	53.7	5.0
MS-10 and -11	NSA 1	925 / W	43.6	38.9	46.4	45.5	49.0	2.6
MS-12	NSA 1	1,057 / N	43.6	38.9	46.4	51.5	52.7	6.3
MS-13	NSA 1	2,660 / NW	41.3	34.3	42.7	48.6	49.6	6.9
MS-14 [a]					Included in analysis for CS-03			
MS-15					No NSA within one-half mile			

[a] Compressor station is near existing compressor station. Existing station is audible.

level at the nearest NSAs. The noise analysis for each compressor station incorporated specific noise mitigation measures to reduce impacts. Driftwood indicated that these measures were included in its noise analyses to achieve the noise levels presented. These noise mitigation measures, which were site specific, included the following measures:

- turbine/compressor building enclosures;
- silencers for combustion turbine air inlets and exhausts; and
- pipe lagging (insulation).

Noise mitigation measures were also required for some of the meter stations in the form of low-noise valves or acoustical lagging.

As shown in Table 4.12-20, the calculated noise attributable to each compressor station and meter station, with noise control measures incorporated, is below our 55 dBA L_{dn} criterion. Noticeable increases over existing ambient conditions are shown at the nearest NSAs to CS-01 and CS-02 and several meter stations, due to the low existing ambient conditions, but Driftwood has committed to install noise mitigation to ensure compliance with our criterion.

Based on the noise analysis, several of the meter stations would increase noise levels at the NSAs. The noise impacts are estimated to be less than 55 dBA L_{dn} at all of the NSAs. However, to ensure that the noise from certain meter stations does not exceed an L_{dn} of 55 dBA at the nearest NSAs, **we recommend that:**

> **DWPL should file noise surveys with the Secretary <u>no later than 60 days</u> after placing the MS-2, MS-4, MS-7, MS-9, MS-12, and MS-13 facilities in service. If the noise attributable to the operation of the metering facilities at maximum flow exceeds an L_{dn} of 55 dBA at any nearby NSA, DWPL should install additional noise controls to meet that level <u>within 1 year</u> of the in-service date. DWPL should confirm compliance with the L_{dn} of 55 dBA requirement by filing a second noise survey with the Secretary <u>no later than 60 days</u> after it installs the additional noise controls.**

Based on the noise analysis above, noise levels attributable to operation of CS-01, CS-02, and CS-03 would be less than 55 dBA L_{dn} at all of the NSAs. To ensure that the noise from the compressor stations does not exceed an L_{dn} of 55 dBA at the nearest NSAs, **we recommend that:**

> **DWPL should file a noise survey with the Secretary <u>no later than 60 days</u> after placing CS-01, CS-02, and CS-03 in service. If a full load condition noise survey is not possible, DWPL should provide an interim survey at the maximum possible horsepower load and provide the full load survey <u>within 6 months</u>. If the noise attributable to the operation of all of the equipment at the compressor stations under interim or full horsepower load conditions exceeds an L_{dn} of 55 dBA at any nearby NSAs, DWPL should file a report on what changes are needed and shall install the additional noise controls to meet the level <u>within 1 year</u> of the in-service date. DWPL should confirm compliance with the above requirement by filing a second noise survey with the Secretary <u>no later than 60 days</u> after it installs the additional noise controls.**

As shown in table 4.12-21, Driftwood also conducted an analysis of expected blowdown noise levels at the nearest NSA to each compressor station. The blowdown vents would be equipped with silencers to reduce noise levels. Driftwood's analysis indicated that blowdown noise levels would be well below our criterion at any NSAs, and no significant noise impacts due to blowdown noise are expected.

Table 4.12-21

Calculated Blowdown Noise Level Predictions (dBA)

Station	NSA	Distance (feet) and Direction to NSA	Blowdown Silencer Location at Station Site	Measured Nighttime L_{eq}	Estimated Contribution of Blowdown L_{eq}	Combined Blowdown and Ambient L_{eq}	Short-Term Sound Level Increase During Blowdown (dB)
CS-01	C1-1	1,820 / E	Northwest Corner	35.4	40.7	41.8	6.4
	C1-2	4,220 / SSW		37.4	31.1	38.3	0.9
	C1-3	2,710 / WSW		38.1	38.8	41.5	3.4
CS-02	C2-1	4,160 / W	Southeast Corner	36.0	38.2	40.2	4.2
	C2-2	2,870 / SSW		38.9	31.8	39.7	0.8
	C2-3	2,230 / N		49.9	39.8	50.3	0.4
	C2-4	1,790 / NE		42.2	44.6	46.6	4.4
CS-03	C3-1	1,420 / SSW	Northwest Corner	60.0	41.4	60.1	0.1
	C3-2	3,740 / SE		51.4	22.9	51.4	0.0
	C3-3	960 / E		53.5	45.1	54.1	0.6

As part of the analysis, Driftwood stated that no perceptible increase in vibration from either ground based or low-frequency noise would occur from any of the compressor stations at any NSAs. We agree, however, if problems arise, Driftwood would need to meet its commitment.

Based on the noise analyses above and our recommendations, we conclude that operation of the Project would not have a significant impact on the noise or vibration environment near the LNG Facility, any of the compressor stations, or other aboveground facilities.

4.13 RELIABILITY AND SAFETY

4.13.1 LNG Facility

4.13.1.1 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 specifying the site location, design, construction, and operation of the LNG facilities. In order to ensure companies are managing these risks appropriately, they are regulated by multiple federal agencies that share regulatory authority over the siting, design, construction, and operation of LNG facilities. The safety, security, and reliability of DWLNG's Project would be regulated by the DOT, the USCG, and the FERC.

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. As a cooperating agency, the DOT evaluates whether an applicant's proposed project siting meets the DOT requirements. If the Project is constructed and becomes operational, the facilities would be subject to the DOT's inspection program to ensure compliance with the requirements of 49 CFR 193 would be made by the DOT staff.

The USCG has authority over the safety of an LNG terminal's marine transfer area and LNG marine traffic, as well as over security plans for the entire LNG terminal and LNG marine traffic. The USCG regulations over LNG facilities are codified in 33 CFR 105 and 127. As a cooperating agency, the USCG assists the FERC staff in evaluating whether an applicant's proposed waterway would be suitable for LNG marine traffic and whether the terminal facilities would be operated in accordance with 33 CFR 105 and 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 127.

The FERC authorizes the siting and construction of LNG facilities under the NGA and delegated authority from the DOE. The FERC requires standard information to be submitted to perform safety and reliability engineering reviews. FERC's filing regulations are codified in 18 CFR 380.12 (m) and (o), and requires each applicant to identify how its proposed design would comply with the DOT's siting requirements of 49 CFR 193, Subpart B. The level of detail necessary for this submittal requires the project sponsor to perform substantial front-end engineering of the complete project.[21] 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 issue recommendations for the Commission to consider for incorporation as conditions in the order. If the facilities are approved and the recommendations 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. FERC staff recommend in section 4.13.1.6 that DWLNG be subject to reporting requirements and the LNG Facility be subject to inspections to ensure compliance with the order throughout the life of the facility.

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

[21] Additional guidance on information to be submitted regarding the safety, reliability, and engineering design can be found in our Guidance Manual for Environmental Report Preparation for Applications Filed Under the Natural Gas Act, Volume II, Liquefied Natural Gas Project Resource Reports 11 & 13 Supplemental Guidance, February 2017, FERC Docket No. AD16-3-000.

Federal regulations issued by the Occupational Safety and Health Administration (OSHA) under 29 CFR 1910.119 (Process Safety Management of Highly Hazardous Chemicals; Explosives and Blasting Agents (PSM)) and the EPA under 40 CFR 68 (Chemical Accident Prevention Provisions) cover hazardous substances, such as methane, propane, and ethylene, at many industrial plants in the United States. However, on October 30, 1992, shortly after the promulgation of the OSHA PSM regulations, OSHA issued a letter of interpretation that precluded the enforcement of PSM regulations over gas transmission and distribution facilities. In a subsequent letter on December 9, 1998, OSHA further clarified that this letter of interpretation applies to LNG distribution and transmission facilities.

In addition, EPA's preamble to its final rule in the Federal Register, Volume 63, Number 3, 639-645, clarified that exemption from the requirements in 40 CFR 68 for regulated substances in transportation, including storage incident to transportation, is not limited to pipelines. The preamble further clarified that the transportation exemption applies to LNG facilities subject to oversight or regulation under 49 CFR 193, including facilities used to liquefy natural gas or used to transfer, store, or vaporize LNG in conjunction with pipeline transportation. In subsequent correspondence with OSHA and EPA staff, it was clarified that OSHA's PSM and EPA's RMP regulations would only apply to LNG facilities if they were not subject to DOT LNG regulations or if they contained toxic materials listed under OSHA PSM or EPA RMP regulations above the threshold quantities and concentrations. Given that the Driftwood LNG Project would not meet either of these criteria, the above OSHA and EPA regulations are not applicable.

4.13.1.2 DOT Siting Requirements and 49 CFR 193 Subpart B Determination

The Commission's regulations under 18 CFR 380.12(o)(14) require DWLNG to identify how the proposed design complies with the siting requirements of 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.[22]

Siting the LNG facilities with regard to ensuring that the proposed site selection and location would not pose an unacceptable level of risk to public safety is required by DOT's regulations in 49 CFR 193, Subpart B. DOT reviews the information and criteria submitted by DWLNG to demonstrate compliance with the safety standards prescribed in 49 CFR 193 49, Subpart B and issues a Letter of Determination (LOD) to the Commission on whether the proposed facilities would meet the DOT siting standards. The LOD evaluates the hazard modeling results and endpoints used to establish exclusion zones, as well as DWLNG'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 serves as one of the considerations for the Commission to deliberate in its decision to authorize, with or without conditions, or deny an application.

[22] 49 CFR 193.2001(b)(3), Scope of part, excludes any matter other than siting provisions pertaining to marine cargo transfer systems between the LNG carrier and the last manifold or valve immediately before a storage tank.

The requirements in 49 CFR 193 Subpart B state that an operator or government agency must exercise legal control over the activities as long as 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 of the 2001 edition of NFPA 59A, 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 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 49 CFR 193 prevail.
- Section 193.2057, Thermal radiation protection, requires that each LNG container and LNG transfer system have thermal exclusion zones in accordance with Section 2.2.3.2 of NFPA 59A (2001).
- Section 193.2059, Flammable vapor-gas dispersion protection, requires that each LNG container and LNG transfer system have a dispersion exclusion zone in accordance with Sections 2.2.3.3 and 2.2.3.4 of NFPA 59A (2001).
- Section 193.2067, Wind forces, requires that shop-fabricated containers of LNG or other hazardous fluids less than 70,000 gallons must be designed to withstand wind forces based on the applicable wind load data in ASCE 7 (2005). All other LNG facilities must be designed for a sustained wind velocity of not less than 150 mph unless the DOT Administrator finds a lesser wind speed is justified or the most critical combination of wind velocity and duration for a 10,000-year mean return interval.

As stated in 49 CFR 193.2051, LNG facilities must be provided with the siting requirements of NFPA 59A (2001). The siting requirements within an LNG facility are contained in NFPA 59A, Chapter 2, and include but may not be limited to the following:

- NFPA 59A (2001) section 2.1.1(c) requires consideration of protection against forces with 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 per hour (BTU/ft^2-hr) from reaching beyond a property line that can be built upon. The distance to this flux level is to be calculated with LNGFIRE3 or with models that have been validated by experimental test data appropriate for the hazard to be evaluated and that 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. [23]

Taken together, 49 CFR 193 and NFPA 59A (2001) require that flammable LNG vapors either from an LNG tank withdrawal impoundment or from a design spill do not extend beyond areas in which the operator or a government agency legally controls all activities. Furthermore, consideration of other hazards which may affect the public or plant personnel must be evaluated as prescribed in NFPA 59A (2001) Section 2.1.1(d).

Together, 49 CFR 193 and NFPA 59A (2001) also specify for LNG storage tank spills, there are three radiant heat flux levels which must be considered for as long as the facility is in operation.

- 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.[24]
- 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.[25]
- 10,000 BTU/ft^2-hr - This level cannot extend beyond the plant property line that can be built upon. [26]

[23] 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).

[24] The 1,600 BTU/ft^2-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.

[25] The 3,000 BTU/ft^2-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.

[26] The 10,000 BTU/ft^2-hr flux level is associated with producing pain in less than 1 second, first-degree burns in 1 second, 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.

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, NFPA 59A Section 2.1.1 requires that factors applicable to the specific site with a bearing on the safety of plant personnel and surrounding public must be considered, including an evaluation of potential incidents and safety measures incorporated into the design or operation of the facility. DOT has indicated that potential incidents, such as vapor cloud explosions and toxic releases should be considered to comply with 49 CFR 193 Subpart B.[27]

Design spills are used in the determination of the siting and hazard calculations required by 49 CFR 193. Prior to the incorporation of NFPA 59A in 2000, the design spill in 49 CFR 193 assumed the full rupture of "a single transfer pipe which has the greatest overall flow capacity" for not less than 10 minutes (old 49 CFR 193.2059[d]). With the adoption of NFPA 59A (2001), section 2.2.3.5 specifies design spills for LNG containers, but the basis for the design spills for impounding areas serving only vaporization, process, or LNG transfer areas became the flow from any single accidental leakage source. Neither 49 CFR 193 nor NFPA 59A (2001) define "single accidental leakage source."

DWLNG provided the DOT with information related to the requirements in 49 CFR 193. On December 11, 2017, the DOT provided a letter to FERC staff regarding the information DOT reviewed for the analysis of the DWLNG Project to determine it had no objection to the methodologies being used for the selection of single accidental leakage sources as part of the requirements under 49 CFR 193 Subpart B.[28]

On August 31, 2018, FERC and DOT signed an MOU to streamline LNG project reviews and eliminate duplicative efforts.[29] On December 18, 2018, the DOT issued an LOD to FERC on the 49 CFR 193 Subpart B regulatory requirements, which was filed with the Commission as part of the consolidated record for the Project to be one of the considerations for the Commission to deliberate in its decision to authorize, with or without modification or conditions, or deny an application.[30] The LOD provides PHMSA's analysis and conclusions regarding 49 CFR 193 Subpart B regulatory requirements.

The DOT's conclusion on the siting and hazard analysis required by 49 CFR 193 is 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

[27] The US DOT PHMSA's "LNG Plant Requirements: Frequently Asked Questions" item H1, https://www.phmsa.dot.gov/pipeline/liquified-natural-gas/lng-plant-requirements-frequently-asked-questions, accessed August 2018.

[28] December 11, 2017 letter "Re: Driftwood LNG Project, FERC Docket CP17-117" from Kenneth Lee to Rich McGuire. Filed in Docket Number CP17-117-000 on December 11, 2017. FERC eLibrary accession number 20171211-5007.

[29] https://www.ferc.gov/legal/mou/2018/FERC-PHMSA-MOU.pdf

[30] December 18, 2018, letter "Re: Driftwood LNG LLC Project, Docket No. CP17-117-000, 49 CFR, Part 193, Subpart B, Siting – Letter of Determination" from Massoud Tahamtani to Rich McGuire. Filed in Docket Number CP17-117-000 on December 19, 2018. FERC eLibrary accession number 20181219-3000.

later stages of the project. If the facilities are approved and constructed, final compliance with the requirements of 49 CFR 193 would be subject to DOT's inspection and enforcement programs.

4.13.1.3 LNG Marine Carrier Historical Record

Since 1959, ships have transported LNG without a major release of cargo or a major accident involving an LNG carrier. There are more than 370 LNG carriers in operation routinely transporting LNG between more than 100 import/export terminals currently in operation worldwide. Since U.S. LNG terminals first began operating under FERC jurisdiction in the 1970s, there have been thousands of individual LNG carrier arrivals at terminals in the U.S. For more than 40 years, LNG shipping operations have been safely conducted in U.S. ports and waterways.

A review of the history of LNG maritime transportation indicates that there has not been a serious accident at sea or in a port which resulted in a spill due to rupturing of the cargo tanks. However, insurance records, industry sources, and public websites identify a number of incidents involving LNG carriers, including minor collisions with other vessels of all sizes, groundings, minor LNG releases during cargo unloading operations, and mechanical/equipment failures typical of large vessels. Some of the more significant occurrences, representing the range of incidents experienced by the worldwide LNG carrier fleet, are described below:

- **El Paso Paul Kayser** grounded on a rock in June 1979 in the Straits of Gibraltar during a loaded voyage from Algeria to the United States. Extensive bottom damage to the ballast tanks resulted; however, no cargo was released because no damage was done to the cargo tanks. The entire cargo of LNG was subsequently transferred to another LNG carrier and delivered to its U.S. destination.
- **Tellier** was blown by severe winds from its docking berth at Skikda, Algeria in February 1989 causing damage to the loading arms and the LNG Carrier 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 carrier'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 carrier was required to discharge its cargo, after which it proceeded to dock for repair.
- **Norman Lady** was struck by the USS Oklahoma City nuclear submarine while the submarine was rising to periscope depth near the Strait of Gibraltar in November 2002. The 87,000 m^3 LNG carrier, which had just unloaded its cargo at Barcelona, Spain,

sustained only minor damage to the outer layer of its double hull but no damage to its cargo tanks.

- **Tenaga Lima** grounded on rocks while proceeding to open sea east of Mopko, South Korea, due to strong current in November 2004. The shell plating was torn open and fractured over an approximate area of 20 by 80 feet, and internal breaches allowed water to enter the insulation space between the primary and secondary membranes. The LNG carrier 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 carrier to a safe anchorage for repairs. The Catalunya Spirit was repaired and taken to port to discharge its cargo.
- **Al Gharrafa** collided with a container ship, Hanjin Italy, in the Malacca Strait off Singapore on December 19, 2013. The bow of the Al Gharrafa and the middle of the starboard side of the Hanjin were damaged. Both ships were safely anchored after the incident. No loss of LNG was reported.
- **Al Oraiq** collided with a freight carrier, Flinterstar, near Zeebrugge, Belgium, on October 6, 2015. The freight carrier sank, but the Al Oraiq was reported to have sustained only minor damage to its bow and no damage to the LNG cargo tanks. According to reports, the Al Oraiq took on a little water but was towed to the Zeebrugge LNG terminal where its cargo was unloaded using normal procedures. No loss of LNG was reported.
- **Al Khattiya** suffered damage after a collision with an oil tanker off the Port of Fujairah on February 23, 2017. Al Khattiya had discharged its cargo and was anchored at the time of the incident. A small amount of LNG was retained within the LNG carrier to keep the cargo tanks cool. The collision damaged the hull and two ballast tanks on the Al Khattiya but did not cause any injury or water pollution. No loss of LNG was reported.

4.13.1.4 USCG Regulatory Requirements and Letter of Recommendation

LNG Carrier Regulatory Oversight

The USCG exercises regulatory authority over LNG carriers under 46 CFR 154, which contains the United States safety standards for LNG carriers transporting LNG in bulk. The LNG carriers 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 carriers entering U.S. waters are required to possess a valid IMO Certificate of Fitness and either a USCG Certificate of Inspection (for U.S. flag vessels) or a USCG Certificate of Compliance (for foreign flag vessels). These documents certify that the LNG carrier is designed and operating in accordance with both international standards and the U.S. regulations for bulk LNG carriers under 46 CFR 154.

The LNG carriers which would deliver or receive LNG to or from the proposed facility would also need to comply with various U.S. and international security requirements. The IMO adopted the *International Ship and Port Facility Security Code* in 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 ashore; and reduce the risk to passengers, crew, and port personnel on board ships and in port areas. All LNG carriers, as well as other cargo vessels 500 gross tons and larger, and ports servicing those regulated vessels, must adhere to the IMO standards. Some of the IMO requirements for ships are as follows:

- Ships must develop security plans and have a Vessel Security Officer.
- Ships must have a ship security alert system. These alarms transmit ship-to-shore security alerts identifying the ship, its location, and indication that the security of the ship is under threat or has been compromised.
- Ships must have a comprehensive security plan for international port facilities, focusing on areas having direct contact with ships.
- Ships may 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 carriers servicing the facility would have to comply with the MTSA requirements and associated regulations while in U.S. waters.

The USCG also exercises regulatory authority over LNG facilities that affect the safety and security of port areas and navigable waterways under Executive Order 10173; the Magnuson Act (50 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 carrier engineering and safety standards, and all matters pertaining to the safety of facilities or equipment located in or adjacent to navigable waters up to the last valve immediately before the receiving tanks. The USCG also has authority for LNG FSP review, approval, and compliance verification as provided in 33 CFR 105.

The USCG regulations in 33 CFR 127 apply to the marine transfer area of waterfront facilities between the LNG carrier and the last manifold or valve immediately before the receiving tanks. 33 CFR 127 applies to the marine transfer area for LNG of each new waterfront facility handling LNG and to new construction in the marine transfer areas for LNG of each existing waterfront facility handling LNG. The scope of the regulations includes the design, construction, equipment, operations, inspections, maintenance, testing, personnel training, firefighting, and security of the marine transfer area of LNG waterfront facilities. The safety systems, including communications, ESD, gas detection, and fire protection, must comply with the regulations in 33 CFR 127. Under 33 CFR 127.019, DWLNG 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 (LOI) to the USCG no later than the date that the owner/operator initiates pre-filing with FERC, but, in all cases, at least 1 year prior to the start of construction. In addition, the applicant must submit a Preliminary WSA to the COTP with the LOI.

The Preliminary WSA provides an initial explanation of the port community and the 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 carrier route;
- risk assessment for maritime safety and security;
- risk management strategies; and
- resource needs for maritime safety, security, and response.

A Follow-On WSA must be provided no later than the date the owner/operator files an application with FERC, but in all cases at least 180 days prior to transferring LNG. The Follow-on WSA must provide a detailed and accurate characterization of the LNG facility, the LNG carrier route, and the port area. The Follow-on WSA provides a complete analysis of the topics outlined in the Preliminary WSA. It should identify credible security threats and navigational safety hazards for the LNG marine traffic, along with appropriate risk management measures and the resources (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 NVIC 01-2011 – *Guidance on Assessing the Suitability of a Waterway for Liquefied Natural Gas (LNG) Marine Traffic*.

NVIC 01-2011 directs the use of the three concentric Zones of Concern, based on LNG carriers 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 on people and property could be significant if the vapor cloud reaches an ignition source and burns back to the source.

Once the applicant submits a complete Follow-On WSA, the USCG reviews the document to determine if it presents a realistic and credible analysis of the public safety and security implications from LNG marine traffic both in the waterway and when in port.

As required by its regulations (33 CFR 127.009), the USCG is responsible for issuing a LOR to 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 carrier's characteristics and the frequency of LNG shipments to or from the facility;
- waterway channels and commercial, industrial, environmentally sensitive, and residential areas in and adjacent to the waterway used by LNG carriers en route to the facility, within 25 kilometers (15.5 miles) of the facility;
- density and character of marine traffic in the waterway;
- locks, bridges, or other manmade obstructions in the waterway;
- depth of water;
- tidal range;
- protection from high seas;
- natural hazards, including reefs, rocks, and sandbars;
- underwater pipes and cables; and
- distance of berthed LNG carriers from the channel and the width of the channel.

The USCG may also prepare an LOR Analysis, which serves as a record of review of the LOR and contains detailed information along with the rationale used in assessing the suitability of the waterway for LNG marine traffic.

DWLNG's Waterway Suitability Assessment

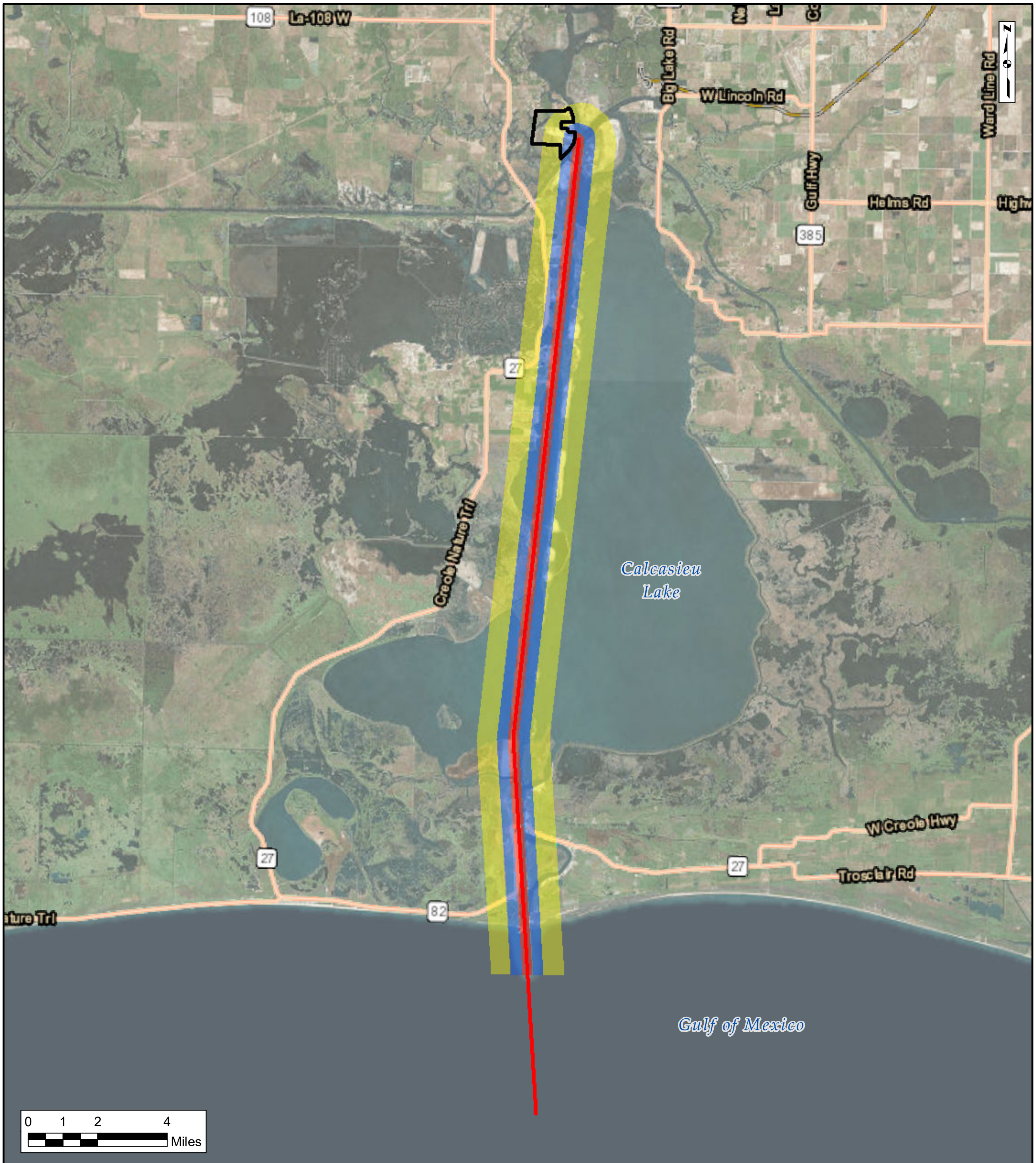
In a letter to the USCG dated May 12, 2016, DWLNG submitted a LOI and a Preliminary WSA to the COTP, Marine Safety Unit Port Arthur to notify the USCG that it proposed to construct an LNG export terminal. In the development of the Follow-On WSA, DWLNG consulted with the USCG, Venture Global LNG, Magnolia LNG, Moran Shipping, and other port stakeholders. As part of its assessment of the safety and security aspects of this Project, the COTP Marine Safety Unit Port Arthur consulted various safety and security working groups, including ABS Consulting, the Marine Pilots Institute of Covington, and Bechtel. In addition, the USCG participated in meetings with the Port of Lake Charles, Lake Charles Pilots, Louisiana State Police, and other federal, state, and local agencies. DWLNG submitted the Follow-On WSA to the USCG on January 17, 2017.

LNG Carrier Routes and Hazard Analysis

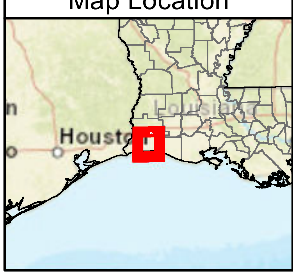
An LNG carrier's transit to the terminal would begin at the pilot boarding station located at the channel's sea buoy. The LNG carrier then would travel northward approximately 27.6 nautical miles toward the Cameron Jetties, which mark the mouth of the Calcasieu River. Once a vessel passes the Cameron Jetties, the LNG carriers would continue up the channel for 20 nautical miles before reaching its final destination at DWLNG's LNG Facility. LNG carriers 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 carriers would be required to maintain voice contact with controllers and check in on designated frequencies at established way points.

NVIC 01-2011 references the "Zones of Concern" for assisting in a risk assessment of the waterway. As LNG carriers proceed along the intended transit route, Hazard Zone 1 would encompasses a narrow corridor that passes the Cameron and Hackberry, Louisiana, communities. Both are rural communities along the Calcasieu River and are considered low-density populated areas. Populated features within Hazard Zone 1 include the Cameron Ferry, Cameron Pogie Plant (no longer in operation), Cameron LNG Terminal, and the Hackberry Rod and Gun Club. Lastly, the Sabine NWR is located on the western bank of the channel. Again, in Hazard Zone 2, residential areas within Hackberry and Cameron, Louisiana, are included in this band. Hazard Zone 3 is a wider band that includes the Moss Lake and Driftwood Community residential areas. Other features present include the Choupique Recreational Vehicle Park, Dutch Cove Cemetery, Intracoastal Park, Cameron Parish Fire Department, and Hackberry Fire Department.

The areas affected by the three different Hazard Zones are illustrated for both accidental and intentional events in figures 4.13-1 and 4.13-2, respectively.



Map Location



Legend

- DWLNG Facility
- Ship Transit Route
- Accidental Sandia Hazard Zone 1 (0-250m)
- Accidental Sandia Hazard Zone 2 (250-750m)
- Accidental Sandia Hazard Zone 3 (750-1700m)

Figure 4.13-1: Accidental Hazard Zones Along LNG Carrier Route
Driftwood Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

NOTES:
Map Projection: NAD 1983 StatePlane Louisiana South FIPS 1702 Feet
Image Source: Esri online World Imagery Service.

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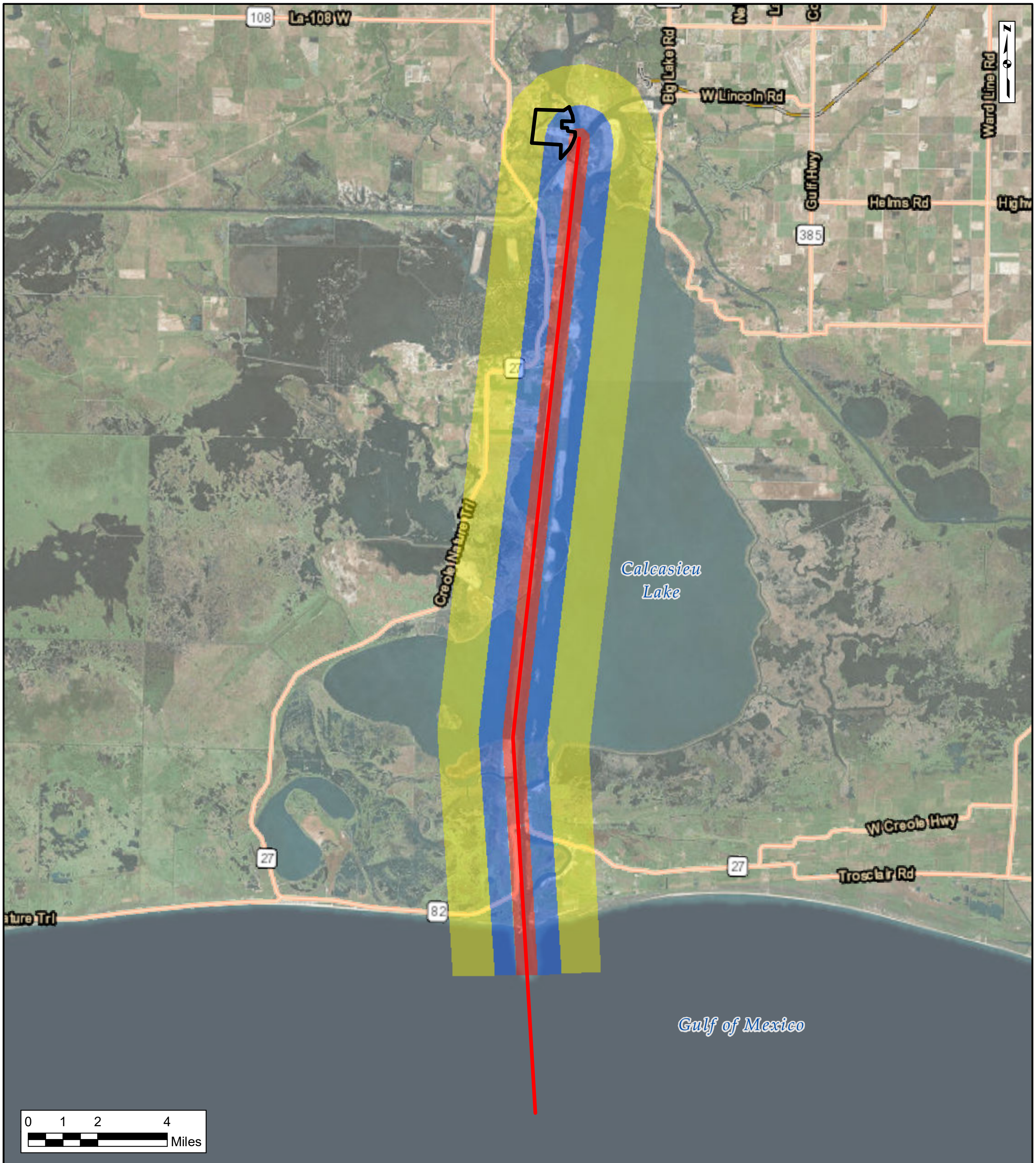
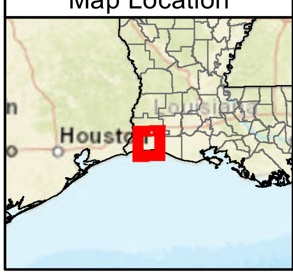


Map Location



Legend

- DWLNG Facility
- Ship Transit Route
- Intentional Sandia Hazard Zone 1 (0-500m)
- Intentional Sandia Hazard Zone 2 (500-1600m)
- Intentional Sandia Hazard Zone 3 (1600-3500m)

Figure 4.13-2: Intentional Hazard Zones Along LNG Carrier Route
Driftwood Project
Driftwood LNG LLC and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

NOTES:
Map Projection: NAD 1983 StatePlane Louisiana South FIPS 1702 Feet
Image Source: Esri online World Imagery Service.

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Coast Guard Letter of Recommendation and Analysis

In a letter dated April 25, 2017, the USCG issued an LOR and LOR Analysis to FERC stating that the Calcasieu Ship Channel should be considered suitable for accommodating the type and frequency of LNG marine traffic associated with this Project. The recommendation was based on full implementation of the strategies and risk management measures identified to the USCG by DWLNG in its WSA.

Although DWLNG has suggested mitigation measures for responsibly managing the maritime safety and security risks associated with LNG marine traffic, the necessary vessel traffic and/or facility control measures may change depending on changes in conditions along the waterway. The USCG regulations in 33 CFR 127 require that applicants annually review WSAs until a facility begins operation. Accordingly, DWLNG is required to submit a report to the USCG identifying any changes in conditions, such as changes to the port environment, the LNG Facility, or the LNG carrier route, that would affect the suitability of the waterway for the LNG carrier traffic.

The USCG's LOR is a recommendation, regarding the current status of the waterway, to the FERC, the lead agency responsible for siting the onshore LNG Facility. Neither the USCG nor the FERC has authority to require waterway resources of anyone other than the applicant under any statutory authority or under the 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 carrier.

Under the Ports and Waterways Safety Act, the Magnuson Act, the MTSA, and the Security and Accountability For Every (SAFE) Port Act, the COTP has the authority to prohibit LNG transfer or LNG carrier movements within his or her area of responsibility if he or she determines that such action is necessary to protect the waterway, port, or marine environment. If this Project is approved and if appropriate resources are not in place prior to LNG carrier movement along the waterway, then the COTP would consider at that time what, if any, vessel traffic and/or facility control measures would be appropriate to adequately address navigational safety and maritime security considerations.

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.[31] 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

[31] 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.

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 an LNG pump with submerged electrical motor causing flammable gas vapors to enter an electrical conduit and settle in a confined space. When a worker switched off a circuit breaker, the gas ignited, causing heavy damage to the building and a worker fatality. With the participation of the FERC, lessons learned from the 1979 Cove Point accident resulted in changing the national fire codes to better ensure that the situation would not occur again. To ensure that this potential hazard would be addressed for proposed facilities that have electrical seal interfaces, we evaluate preliminary designs and recommend in section 4.13.1.6 that DWLNG file the final design details of the electrical seal design at the interface between flammable fluids and the electrical conduit or wiring system, electrical seal leak detection system, and the details of a downstream physical break (i.e., air gap) in the electrical conduit to prevent the migration of flammable vapors.

On January 19, 2004, a blast occurred at Sonatrach's Skikda, Algeria, LNG liquefaction plant that killed 27 and injured 56 workers. No members of the public were injured. Findings of the accident investigation suggested that a cold hydrocarbon leak occurred at Liquefaction Train 40 and was introduced into a high-pressure steam boiler by the combustion air fan. An explosion developed inside the boiler firebox, which subsequently triggered a larger explosion of the hydrocarbon vapors in the immediate vicinity. The resulting fire damaged the adjacent liquefaction process and liquid petroleum gas separation equipment of Train 40, and spread to Trains 20 and 30. Although Trains 10, 20, and 30 had been modernized in 1998 and 1999, Train 40 had been operating with its original equipment since start-up in 1981. To ensure that this potential hazard would be addressed for proposed facilities, we evaluate the preliminary design for mitigation of flammable vapor dispersion and ignition in buildings and combustion equipment to ensure they were adequately covered by hazard detection equipment that could isolate and deactivate any combustion equipment whose continued operation could add to or sustain an emergency. We also recommend in section 4.13.1.6 that DWLNG file the final design details for our approval.

On March 31, 2014, a detonation occurred within a gas heater at Northwest Pipeline Corporation's LNG peak-shaving plant in Plymouth, Washington[32]. This internal detonation subsequently caused the failure of pressurized equipment, resulting in high velocity projectiles. The plant was immediately shut down, and emergency procedures were activated, which included notifying local authorities and evacuating all plant personnel. No members of the public were injured, but one worker was sent to the hospital for injuries. As a result of the incident, the liquefaction trains and a compressor station located onsite were rendered inoperable. Projectiles from the incident also damaged the control building that was located near pre-treatment facilities and penetrated the outer shell of one of the LNG storage tanks. All damaged facilities were ultimately taken out of service for repair. The accident investigation showed that an inadequate purge after maintenance activities resulted in a fuel-air mixture remaining in the system. The fuel-air mixture auto-ignited during startup after it passed through the gas heater at full operating pressure and temperature. To ensure that this potential hazard would be addressed for proposed facilities, we recommend in section 4.13.1.6 that DWLNG file a plan for purging that addresses the requirements of the American Gas Association *Purging Principles and Practice* and to provide justification if not using an inert

[32] 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.

or non-flammable gas for purging. In evaluating such plans, we 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 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 4.13.1.6 that DWLNG file, for review and approval, operating and maintenance plans, including safety procedures, prior to commissioning. In evaluating such plans, we 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 4.13.1.6 that DWLNG incorporate mitigation into their final design with supportive information that demonstrates it would mitigate the risk of a pressure vessel burst or boiling liquid expanding vapor explosion (BLEVE) from occurring.

4.13.1.5 FERC Engineering and Technical Review of the Preliminary Engineering Designs

In addition to DOT regulatory requirements and Subpart B LOD and USCG regulatory requirements and LOR, FERC requires an applicant to provide safety, reliability, and engineering design information as part of its application, including hazard identification studies and front-end-engineering-design (FEED) information for its proposed project. FERC staff evaluates this information to assess the safety and reliability of the project. The objectives of our FEED review focuses on evaluating the potential hazards from within and nearby the site, including external events, which may have the potential to cause damage or failure to the project facilities, and the engineering design 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. Further, the potential hazards are dictated by the site location and the engineering details. For NEPA purposes, the site location is assessed relative to external impacts.

External Impact Review

To assess the potential impact from external events that are dependent on the site location, DWLNG provided FERC with a series of studies that evaluate transportation routes and land use and activities within and surrounding the site and the safeguards in place to mitigate the risk from events, where warranted. FERC staff reviewed these studies in coordination with other federal agencies to assess for the potential likelihood and consequences from vehicle impacts from nearby external roads and rail; aircraft impacts to and from nearby airports and heliports; pipeline incident impacts from nearby pipelines; impacts to and from adjacent facilities that handle hazardous materials under EPA RMP regulations and nuclear facilities under Nuclear Regulatory Commission (NRC) regulations; and impacts to military facilities and operations. Specific mitigation of impacts from use of internal roadways, rail, helipads, airstrips, or pipelines are also be 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 to the project and the resulting consequences posed 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.

Roads

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 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 DOT's inspection and enforcement programs. DOT regulations under 49 CFR 193.2155(a)(5)(ii) 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 LNG 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 requirements do not indicate what collision(s) or explosion(s) could reasonably be expected to cause the most severe loading. FERC staff evaluated frequency and consequence data from these events to evaluate these potential impacts.

FERC staff evaluated the risk of the truck operations based on the frequency of trucks, consequences from a release, using incident data from DOT Federal Highway Administration, National Highway Traffic Safety Administration, and PHMSA, and proposed mitigation to prevent or reduce the impacts of a vehicular incident. 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 and less than 1 percent result in injuries and less than 0.1 percent result in fatalities.

Global Drive is to the west of the facility and Burton Shipyard Road borders the north of the facility property and would be used to access the DWLNG Project. Speed limits are up to 45 mph and Resource Report 5 indicates current usage of this road is relatively low. There were no major highways or roads in proximity to piping or equipment containing hazardous materials at the site that would raise concerns of direct impacts from a vehicle impacting the site. In addition, a Road Safety and Reliability study was provided by DWLNG to evaluate potential increases in risk of hazardous material incidents on external roadways nearby the facility and found a negligible increase in risk. As part of a separate study, DWLNG also identified internal truck access, routes, delivery points, and speed limits. A Hazard Identification Analysis (HAZID) process was also executed to evaluate the routes, associated hazards with truck transit, unmitigated consequences, as well as safeguards to mitigate each hazard.

As a result of no high speed roads adjacent to piping and equipment containing hazardous materials and a negligible increase in risk of hazardous-material incidents impacting nearby populations, FERC staff concludes the proposed Project would not pose a significant risk or significant increase in risk to the public.

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 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 DOT's inspection and enforcement programs. DOT regulations under 49 CFR 193.2155(a)(5)(ii) 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 requirements do not indicate what collision(s) or explosion(s) could reasonably be expected to cause the most severe loading. FERC staff evaluated frequency and consequence data from these events to evaluate these potential impacts.

FERC staff evaluated the risk of rail operations based on the frequency of trucks and consequences from a release using incident data from DOT Federal Railroad Administration, DOT Bureau of Transportation Statistics, and DOT PHMSA. 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 and less than 1 percent result in injuries and less than 0.1 percent result in fatalities. There would be no rail transportation associated with the Project. The closest rail line is a rail spur approximately 2.5 miles away that serviced the Alcoa plant to the northeast across the waterway and rail lines over 3 miles away serving industrial facilities to the north.

Given the incident rates, distance, and position of the rail lines relative to the proposed LNG Facility and the population to the north of the LNG Facility site, FERC staff concludes the proposed Project would not pose a significant increase in risk to the public as a result of the proximity of the Project to the rail lines.

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 DOT's inspection and enforcement programs. DOT regulations under 49 CFR 193.2155(b) require that 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.

The DOT FAA regulations in 14 CFR 77 require DWLNG to provide 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 carrier that would be above the height of the highest mobile object that would normally traverse it would require notification to DOT FAA.

There would be no aircraft associated with the Project. The closest airport to the DWLNG Project site is the Southland Field, which is approximately 11,500 feet away. Other airports within a 20-mile radius include the Lake Charles Regional Airport, Reynolds Airport, Chloe Airport, Chennault Airport, and Morgan Crop Services Airports to the north and northeast, and Cameron Airstrip to the south.

The proposed facilities include equipment taller than 115 feet. Therefore, the regulations in 14 CFR 77 apply to that equipment and require DWLNG to provide notice to the FAA of its proposed construction. On May 5, 2017, DWLNG submitted notice to the FAA for an aeronautical obstruction study required under 14 CFR 77 for each of the facilities that would be over 115 feet in height. On December 20, 2017, DWLNG filed the 43 letters (FERC eLibrary accession number 20171220-5097) from the FAA for the Determination of No Hazard to Air Navigation. The FAA aeronautical study for each of the 43 structures revealed that each structure would not exceed obstruction standards and would not be a hazard to air navigation. This determination (which considers multiple airfields, including the Southland Field) included temporary construction equipment, such as cranes, derricks, etc., which may be used during actual construction of the structure. Equipment which has a height greater than the studied structure would require separate notice to the FAA. In their comments on the draft EIS, DWLNG has filed three notifications, one for each berth location, with the FAA for a maximum carrier height of 193 feet, and has filed FAA concurrence the LNG carriers would not be a hazard to air navigation (FERC eLibrary Accession Number 20181023-5363). Because this concurrence addresses our recommendation, we have removed the recommendation from the final EIS. Also, the majority of the Determination of No Hazard to Air Navigation letters are set to expire on December 27, 2018. DWLNG would need to file with the FAA for an extension of these determinations at least 15 days prior to each letter's expiration date.

In addition, given the proximity to a number of airports in the area, FERC staff requested DWLNG conduct an analysis of potential aircraft impacts using a threshold of 3e-5 per year. While DWLNG provided an analysis that identified airports and included frequency data for aircraft crashes, the frequency of crashes used commercial aircraft data only instead of general aviation aircraft data for which Southland Field has the vast majority of its aircraft operations. In addition, the incident data did not seem to include data parsed out to airport operations and non-airport (i.e., in-flight) operations. FERC staff therefore analyzed aircraft operation frequency data based upon Southlands Field's proximity to LNG storage tanks, type and frequency of aircraft operations, take-off and landing directions, and non-airport flight paths using the DOE Standard, DOE-STD-3014-2006, Accident Analysis for Aircraft Crash into Hazardous Facilities. Based upon that review, the potential impact to the facility was above the initial 3e-5 per year screening threshold identified for the LNG storage tanks and process areas. The potential consequences of such an incident at the tank roof or in the process areas would likely result in a release and fire that would be within the existing hazard footprints already evaluated for a complete tank roof fire and full impoundment fire that is sized for the largest spill in the process area. The existing hazard footprints indicate the 5 kW/m^2 radiant heat from such events would not extend beyond the property line that can be built upon. The potential consequences of an aircraft impact to the LNG storage tanks would also likely result in a release and fire; however, the potential consequence could extend beyond those evaluated, depending on the location of impact and extent of damage. Therefore, FERC staff evaluated whether the full containment walls would withstand such an impact using established methods, such as CEB 187 and other publications. Based on FERC staff's preliminary analysis of the full containment tanks proposed at DWLNG, the proposed LNG storage tanks could withstand impacts without perforation of the outer tank wall from aircraft that exceeded frequencies of 3e-5 per year. However, to confirm these results conducted by FERC staff, we recommend that DWLNG provide detailed aircraft impact analysis that use the appropriate frequencies for the various surrounding aircraft operations per DOE-STD-2014-2006 or other approved methodology and demonstrate the design of the full containment LNG tanks would be able to withstand aircraft impacts with impact frequencies 3e-5 per year or more using CEB 187 or other approved methodology.

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. Pipelines associated with this Project must meet DOT regulations under 49 CFR 192 and are discussed in Section 4.13.8. In addition, all facilities, once constructed, must comply with the requirements of 49 CFR 192 and 193 and would be subject to DOT's inspection and enforcement programs.

DWLNG identified two pipelines that run through the Driftwood site: a 6" Williams pipeline and the Creole Trail natural gas pipeline (CTPL). FERC staff also identified a third pipeline that borders the northern portion of the facility. During construction, the Williams line would be re-routed around the perimeter of the property, away from all excavation and pile-driving activities, and would not be subject to operating equipment loads. The CTPL pipeline crosses the site in an area where no facilities would be constructed. No construction activities are planned over the CTPL line. Both pipelines would be adequately marked during construction. FERC staff evaluated the potential risk from an incident from all three pipelines and their potential impacts for frequencies that exceeded an initial screening threshold of 3e-5 per year. 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 concludes the proposed Project would not significantly increase the risk to the public beyond existing risk levels that are present from the pipelines. Therefore, FERC staff concludes the proposed Project would not pose a significant increase in risk to the public as a result of the proximity of the Project to the pipelines.

Hazardous Material Facilities and Nuclear 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. The closest facilities handling hazardous materials are the Calcasieu Refining Company, Alcoa Plant, and Trunkline LNG Terminal all approximately 2.5 miles away to the north and northeast. FERC staff also evaluated whether NRC-regulated facilities would be located near the proposed site and if these facilities could adversely increase the risk to the DWLNG and if DWLNG could increase risk to the NRC-regulated facilities and subsequently increase the risk to the public. The FERC staff review found that the closest nuclear facility would be 125 miles away.

Given the distance and position of these facilities relative to the proposed LNG Facility and the population to the north of the LNG Facility site, FERC staff concludes the proposed Project would not pose a significant increase in risk to the public.

Military Facilities and Operations

In accordance with the 2007 Memorandum of Understanding between the FERC and the United States DOD (http://www.ferc.gov/legal/mou/mou-dod.pdf), the FERC sent a letter to the DOD on March 28, 2017 requesting their comments on whether the planned Project could potentially have an impact on the test, training, or operational activities of any active military installation. On June 16, 2017, the FERC received a response letter from the DOD Siting Clearinghouse stating that DWLNG's LNG Facility would have a minimal impact on military training and operations conducted in the Calcasieu, Jefferson Davis, Acadia, and Evangeline Parish, Louisiana, area.

Engineering Review

In addition to potential external impacts based on the site location, FERC staff requires the applicant to study the engineering design to assess the safeguards built into the engineering design to reduce the risk of an incident occurring and impacting the public. 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 the following:

- 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 and control equipment, firewater systems, and coordination with local first responders, to mitigate the consequences of a release and prevent it from escalating to an event that could impact the public.

We believe the inclusion of such protection systems or safeguards in a plant design can minimize the potential for an initiating event to develop into an incident that could impact the safety of the offsite public. 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 of past incidents and the potential severity of consequences based on past incidents and validated hazard modeling. As a result of the continuing engineering review, FERC staff provides recommendations 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, and operation.

In developing the FEED, DWLNG conducted a Hazard Identification/Environmental Impact Identification to identify potential hazards (both safety and environmental) associated with the proposed facility location, site layout, and process design. This Hazard Identification/Environmental Impact Identification was a facilitated review which focused on the site layout and process flow diagrams. A more detailed and thorough hazard and operability review (HAZOP) analysis would be performed by DWLNG during the final design phase to identify the major hazards that may be encountered during the operation of facilities. The HAZOP study would be intended to address hazards of the process, engineering and administrative controls and would provide a qualitative evaluation of a range of possible safety, health, and environmental effects that may result from the design or operation of the facilities. Recommendations to prevent or minimize these hazards would be generated from the results of the HAZOP review. We recommend in section 4.13.1.6 that DWLNG file the HAZOP study on the completed final design. We evaluate the HAZOP to ensure all systems are covered and process deviations are covered with appropriate and consistent severity, likelihood, 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 4.13.1.6 that DWLNG file the resolutions of the recommendations generated by the HAZOP review so that FERC staff can monitor these resolutions. Once the design has been subjected to a HAZOP review, the design development team tracks changes in the facility design, operations, documentation, and personnel. DWLNG would evaluate these changes to ensure that the safety, health, and environmental risks arising from these changes are addressed and controlled based on management of change procedures. We also recommend in section 4.13.1.6 that DWLNG file all changes to their FEED for review and approval by FERC staff. However, major modifications could require an amendment or new proceeding.

Geotechnical and Structural Design Review

DWLNG provided geotechnical and structural design information for its facilities to demonstrate the site preparation and foundation designs would be appropriate for the underlying soil characteristics and to ensure the structural design of the Project facilities would be in accordance with federal regulations, standards, and recommended and generally accepted good engineering practices. The application focuses on the resilience of the Project facilities against natural hazards, including extreme geological, meteorological, and hydrological events, such as earthquakes, tsunamis, seiche, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea level rise, landslides, wildfires, volcanic activity, and geomagnetism.

<u>Geotechnical Evaluation</u>

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 demonstrate compliance with regulations under 49 CFR 193 and NFPA 59A. All LNG facilities, as defined in 49 CFR 193, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs. DOT regulations incorporate by reference NFPA 59A (2001), which require in section 2.1.4 soil and general investigations of the site to determine the design basis for the facility. However, no additional requirements are set out in 49 CFR 193 or NFPA 59A on minimum requirements for evaluating existing soil site conditions or evaluating the adequacy of the foundations, therefore FERC staff evaluated the existing site conditions, geotechnical report, and proposed foundations to ensure they are adequate for the LNG facilities as described more fully below.

DWLNG contracted Fugro to conduct geotechnical investigations and report that evaluated existing soil site conditions and proposed foundation design for the Project. The existing site elevation ranges from +1 feet to +17 feet North American Vertical Datum 88 (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 changed from an elevation ranging from +1.0 feet to + 17.0 feet to an elevation of approximately +8.0 feet NAVD88 with approximately 0 to 7 feet of fill that would be added across the site. The facility would be surrounded by an earthen berm with a minimum crest elevation of +15 feet NAVD88 to protect the facilities from storm surge as discussed in more detail later in this section. Fill to raise the site would be minimized to reduce settlement and would be compacted to 90 to 95 percent of maximum dry density for modified proctor tests in accordance with ASTM D1557 depending on the location (nonstructural, basins and berms, foundations, and paved areas). The fill would also have requirements for size, classification, plasticity, organic content, water soluble sulfates, water soluble chlorides, and pH in accordance with ASTM standards.

Fugro conducted 54 soil borings to depths ranging from 20 feet to 300 feet below existing grade 135 cone penetration tests (CPTs) to depths ranging from 80 feet to 200 feet (or to refusal) below existing grade (B.E.G.), 11 test pits, 3 field vane tests, 3 trench dredge tests, and 20 different laboratory tests on 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 investigations to ensure the adequacy in the number, coverage, and types of the geotechnical borings, CPTs, 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 and make recommendations to the Commission for consideration to include in the order and follow through during initial site preparation, construction of final design, commissioning, and throughout the life of the facilities.

Based on the test borings conducted, the site is composed of natural cohesive clayey and silty sand soils from approximately 0 feet to about 15 feet B.E.G.; underlain by natural granula and cohesive silty sand and clayey sand soils from a depth of approximately 3 to 15 feet to about 83 feet B.E.G.; dense to very dense silt, silty sand, and sandy silt with pockets of clay, silty clay, and sandy clay from a depth of approximately 103 feet B.E.G.; natural cohesive clay and silty clay soils from approximately 103 feet to 240 feet B.E.G.; and very dense silty sand and clayey sands from approximately 240 feet to 280 feet B.E.G.

Based on the subsurface conditions, shallow foundations would be suitable for some lightly to moderately loaded structures, however, as is common 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, DWLNG is proposing to drive steel-pipe piles or pre-stressed precast concrete piles depending on the equipment being supported, and subsurface conditions and would be determined during final design. The shallow foundations are recommended to be placed at a depth of 18 inches below final grade, while the piles are proposed to be embedded up to a depth of 90 feet, depending on the equipment being supported, pile spacing, and pile type. Downdrag forces on the piles would be accounted for by applying coatings to reduce the negative skin friction of the piles.

Dredging would occur to create the Pioneer Docks, MOF, and the Marine Berth. The existing shoreline of the Calcasieu Ship Channel 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 riprap armoring. Additional consideration for shoreline erosion is the increase in large ship traffic within the Calcasieu Ship Channel. DWLNG has been consulting with the USCG on its Follow-on WSA to address impacts from passing ships. The proposed riprap armoring would minimize the potential for erosion where the shoreline would be excavated.

Subsidence is unlikely to present a significant hazard to the Terminal site other than the need to consider it in the height of the storm-surge perimeter berm. Subsidence is the sudden sinking or gradual downward settling of land with little or no horizontal motion, caused by movements on surface faults or by subsurface mining or pumping of oil, natural gas, or groundwater. Regional subsidence in southern Louisiana is typically caused through sub-surface water extraction for agriculture, flood protection, or development. Subsidence has also been recorded occurring naturally through fault movements and compaction/consolidation of Holocene deposits. The natural subsidence rate for the area where the Terminal site and associated facilities is located is considered low at 0 to 1.0 foot of subsidence every 100 years (COE, 2013).

The results of DWLNG'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.

Structural and Natural Hazard Evaluation

FERC regulations under 18 CFR 380.12(m) requires applicants address the potential hazard to the public from failure of facility components resulting from accidents or natural catastrophes, how these events would affect reliability, and what design features and procedures have been 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 LNG facilities, as defined in 49 CFR 193, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs. DOT regulations under 49 CFR 193 have some specific requirements on designs to withstand certain loads (e.g., wind) from natural hazards and also incorporates by reference NFPA 59A (2001 and 2006 editions) and ASCE 7-05 and ASCE 7-93 via NFPA 59A (2001). NFPA 59A (2001) Section 2.1.1(c) also requires that DWLNG consider the effects of natural hazards, such as flooding, storm surge, and seismic activities, for the plant site location. This is covered in DOT PHMSA's LOD on 49 CFR 193 Subpart B. However, the LOD does not address whether the facilities are designed appropriately against these hazards, which would be part of 49 CFR 193 Subpart C with the exception of wind loads, which are covered in 49 CFR 193 Subpart B and are covered in the LOD. If authorized and constructed, all LNG facilities, as defined by 49 CFR 193, would be subject to DOT's inspection and enforcement programs. The marine facilities would be subject to 33 CFR 127, which requires, if the waterfront facility handling LNG is in a region subject to earthquakes, that the piers and wharves must be designed to resist earthquake forces. In addition, USCG regulations under 33 CFR 127 incorporate by reference certain portions of NFPA 59A (1994) and ASCE 7-88 via NFPA 59A (1994). However, USCG regulations do not provide criteria for a region subject to earthquakes or the earthquake forces the piers and wharves are to withstand and the NFPA 59A (1994) section referenced in 33 CFR 127 is for seismic design only and is applicable to stationary LNG containers, which would not be under 33 CFR 127. Therefore, we evaluated the basis of design for all LNG facilities for all natural hazards under FERC jurisdiction, including those under DOT and USCG jurisdiction.

In addition, the facilities would be constructed to the requirements in the 2012 International Building Code, ASCE 7-05, and ASCE 7-10 for seismic design. 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 from extreme events, such as earthquakes, tsunamis, seiche, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea level rise, landslides, wildfires, volcanic activity, and geomagnetism. FERC staff evaluated the design basis for the environmental loads as described more fully for the various natural hazards below. In addition, FERC staff recommend in section 4.13.1.6 that DWLNG file final design information (e.g., drawings, specifications, and calculations) and associated quality assurance and control procedures with the documents stamped and sealed by the professional engineer of record. If the Project is authorized and constructed, DWLNG would install equipment in accordance with its final design. In addition, we recommend in section 4.13.1.6 that DWLNG file 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 the shaking ground motion and fault ruptures. Earthquakes and tsunamis often result from sudden slips along fractures in the earth's crust (i.e., faults) and the resultant ground motions caused by those movements, but can also be a result of volcanic activity or other causes of vibration in the earth's crust. The damage 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, DWLNG 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).[33] Louisiana is located within the Gulf Coast Basin geologic tectonic province. The Gulf Coast Basin is characterized as having thick sedimentary rocks above basement rock structures. The province's sedimentary strata thicken toward the south, with salt domes and relatively shallow listric growth faults that run parallel to the Gulf of Mexico Coastline and extend outside of Louisiana. Movement within the fault system has been classified as a general creep as opposed to the breaking of rocks, which is often associated with earthquake events (Stevenson and McCulloh, 2001). Salt domes are prevalent throughout the Gulf Coast Basin, and are characterized by having a system of faults arranged in a circular pattern around them (Gagliano, 1999).

[33] USGS, Earthquake Hazards Program, Quaternary Fault and Fold Database of the United States, https://earthquake.usgs.gov/hazards/qfaults/, 2018.

DWLNG conducted a site-specific seismic risk analysis for the Project, involving field investigations and subsequent data evaluation. DWLNG's geotechnical report includes the examination of growth faults in the region of the Project area. These growth fault systems have previously been assessed by the USGS as not being capable of generating significant earthquakes, and these faults have not previously been considered as seismogenic sources. While growth faults are not a source of seismic hazard for the Project site, they may be a potential source of surface deformation. 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 NFPA 59A (2006), Section 7.2.2 and be designed to continue safely operating with earthquake ground motions at the ground surface at the site that have a 10 percent probability of being exceeded in 50 years (475 year mean return interval), termed the operating basis earthquake. 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 also incorporate by reference of NFPA 59A (2001) Chapter 6, which requires piping systems conveying flammable liquids and flammable gasses with service temperatures below -20 degrees Fahrenheit, be designed as required for seismic ground motions. The LNG facilities, as defined in 49 CFR 193, once constructed, are subject to the DOT's inspection and enforcement programs. In addition, FERC staff recognize DWLNG would also need to address hazardous fluid piping with service temperatures at -20 degrees Fahrenheit and higher and equipment other than piping and LNG storage containers. We also recognize the current FERC regulations under 18 CFR 380.12(h)(5) continues to incorporate NBSIR 84-2833. NBSIR 84-2833 provides guidance on classifying stationary storage containers and related safety equipment as Category I and classifying the remainder of the LNG project structures, systems, and components as either Category II or Category III, but does not provide specific guidance for the seismic design requirements for them. Absent any other regulatory requirements, this guidance recommends that other LNG project structures classified as Seismic Category II or Category III be seismically designed to satisfy the Design Earthquake and seismic requirements of the ASCE 7-05 in order to demonstrate there is not a significant impact on the safety of the public. ASCE 7-05 is recommended as it is a complete American National Standards Institute consensus design standard, its seismic requirements are based directly on the 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 Project area is located in a very low seismic risk region (USGS, 2014a). According to the USGS, there is only a 2 to 4 percent probability that the peak ground acceleration will exceed 0.04 percent the acceleration of gravity in 50 years. These accelerations are for a Site Class rock site and can be amplified by a factor of 1.5 or more for soil sites such as those found at the site, but even when amplified these values represent a relatively low level of shaking.

The geotechnical investigations of the existing site indicate the site is predominately classified as Site Class D, with small portions of the site classified as Site Class E[34] in accordance with ASCE 7-05 and IBC 2009 based on a site average shear wave velocity (V_s) less than 600 feet per second 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.

Bechtel Corporation performed a site-specific seismic hazard study for the site (Bechtel Corporation, 2017). The study concluded that earthquake ground motions at the ground surface of the Site Class D portions of the site that have a 2 percent probability of being exceeded in 50 years have a 5 percent damped horizontal 0.2-second spectral acceleration value of 0.136 gravity (g), while the 5 percent damped 1.0-second spectral acceleration at the site is 0.096 g. The study also concluded that the Site Class E portions of the site that have a 2 percent probability of being exceeded in 50 years have a horizontal 5 percent damped 0.2-second spectral acceleration value of 0.212 gravity (g), while the 5 percent damped 1.0-second spectral acceleration at the site is 0.126 g. These predicted spectral accelerations are relatively low compared to other locations in the United States.

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.[35] FERC staff has identified those portions of the Project located on Site Class D soil conditions as a Seismic Design Category B based on the ground motions for the site and an Occupancy Category (or Risk Category) of III/IV, this seismic design categorization would appear to be consistent with the 2009 IBC and ASCE 7-05 (and ASCE 7-10). The remaing small portions of the project located on Site Class E soil conditions were found to be consistent with Seismic Design Category B.

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

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[34] 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).

[35] 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.

silty. Typically, these soils are located along rivers, streams, lakes, and shorelines or in areas with shallow groundwater. The site-specific seismic study conducted for the Project documented a silty sand strata that could be liquefiable; however, the potential for a large enough seismic event near enough to cause soil liquefaction in the Project area is low. Also LNG facilities at the site would be constructed on deep foundations, which would mitigate any potential impacts of soil liquefaction. Should soil improvement be required to counteract soil liquefaction, DWLNG would utilize ground improvement techniques (e.g., densification, cementitious strengthening) or removal and replacement of existing soils with non-liquefiable material.

Seismic events in waterbodies can also cause tsunamis or seiches by sudden displacement of the sea floors in the ocean or standing water. Tsunamis and seiche may also be generated from volcanic eruptions or landslides. Tsunami wave action can cause extensive damage to coastal regions 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, 2014c), which is not significantly higher than the average breaking wave height of 1.5 feet (Owen, 2008). Hydrodynamic modeling conducted off the coast of south Texas in 2004 indicated that the maximum tsunami run-up could be as high as 12 feet above mean sea level. No earthquake-generating faults have been identified that are likely to produce tsunamis, 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). DWLNG's Seismic Hazard Assessment report included a Tsunami Hazard Assessment for the Project area. There are four main submarine landslide hazard zones in the Gulf of Mexico including the Northwest Gulf of Mexico, Mississippi Canyon and Fan, the Florida Escarpment, and the Campeche Escarpment (USGS, 2009). Based on modeling and limited historical data, it is estimated tsunamis generated from landslides would be more than 4 feet and less than 14 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, DWLNG evaluated such events historically. The severity of these events are often determined on the probability that they occur and are sometimes referred to as the average number years that the event is expected to re-occur, or in terms of its mean return/recurrence interval.

Because of its location, the Terminal site would likely be subject to hurricane force winds during the life of the Project. DWLNG states that all Project process and storage facilities that would normally be classified as ASCE/SEI 7-10 Risk Category IV and III would be designed to withstand a 183 mph 3-second gust and buildings (other than the control building, field operation buildings and substations) that would normally be classified as ASCE/SEI 7-10 Risk Category II would be designed to withstand 135 mph 3-second gusts. A 183 mph 3-second gust and 135 mph 3-second gust would convert to a sustained wind speed of 150 mph and 110 mph, respectively, 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 45,000-year and 1,000-year mean return intervals or 0.11 percent and 5 percent probabilities of exceedance in a 50-year period for the site, based on whether ASCE 7-05, 7-10, or 7-16 is used for 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) and the 135 mph 3-second gust equates to a strong Category 2 Hurricane (96-110 mph sustained winds, 117-140 mph 3-second gusts. DWLNG must meet 49 CFR 193.2067 under Supart 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 LNG facilities, as defined in 49 CFR 193, would be subject to the DOT's inspection and enforcement programs. Final determination of whether the LNG facilities, as defined in 49 CFR 193, 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 and 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-feet of an area. Figures 5-8 and 8-1 from NUREG/CR-4461 indicate a 100,000-year maximum tornado wind speeds would be approximately 140 mph 3-second gusts for the Project site location. Later editions of ASCE 7 (ASCE 7-10 and ASCE 7-16) make reference to International Code Council 500, Standard for Design and Construction of Storm Shelters, for 10,000-year tornadoes. However, the International Code Council 500 maps were conservatively developed based on tornadoes striking regions and indicate a 200 mph 3-second gust for a 10,000-year event, which is higher than the 140 mph 3-second gust in American Nuclear Society 2.3 and NUREG/CR-4461. As a result, FERC staff believes the use of a sustained wind speed of 150 mph, 183 mph 3-second gust, is adequate for the LNG storage tanks and conservative from a risk standpoint for the other LNG facilities. In addition, we agree that the use of 135 mph 3-second gust is adequate for buildings other than control and field operation buildings and substations and other than those that would house hazardous fluids or emergency equipment, which would be designed for a 183 mph 3-second gust.

ASCE 7 also recognizes the facility would be in a wind borne debris region. However, no other criteria is provided in 49 CFR 193 or ASCE 7 on equivalent projectile wind speed, characteristics of projectile, or methodology or model used, which are necessary to determine whether penetration or perforation would occur. NFPA 59A (2016) recommends CEB 187 for determine projectile perforation depths. We recommend in section 4.13.1.6 that DWLNG file 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 NRC guidance.

In addition, FERC staff evaluated historical tropical storm, hurricane, and tornado tracks in the vicinity of the Project facilities using data from Department of Homeland Security (DHS) Homeland

Infrastructure Foundation Level Data and NOAA Historical Hurricane Tracker.[36,37] Historically, flooding caused by hurricanes and associated storm surges has been encountered in Calcasieu Parish. Several hurricanes were particularly damaging to Calcasieu Parish. In 1957 Hurricane Audrey, a Category 4 hurricane, reached wind speeds of 145 mph and a storm surge of 12 feet. In 2005 Hurricane Rita, a Category 3 hurricane, reached wind speeds of 120 mph and storm surge values were 12 to 18 feet across most of Cameron Parish (NOAA, 2010). In 2008 Hurricane Ike, a Category 4 tropical storm produced still-water storm surges approximately 8 feet high. Based on modeling provided by DWLNG, a Category 5 hurricane could result in a storm surge greater than 9 feet at the facility. According to a storm surge map for Calcasieu Parish (NOAA, 2008) the Project area is located in an area that would be affected by a storm surge of at least 4 to 6 feet, consistent with a Category 1 and 2 hurricane.

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 flood hazard areas that have a 0.2 percent probability of exceedance in 1 year to flood (or a 500 year mean return interval). According to the FEMA National Flood Hazard Layer, portions of the Project would be located in the 100-year and 500-year floodplain. In addition, according to FEMA flood hazard maps (2016), the 100-year flood elevation at the Site is 9.0 feet (NAVD88) and the 500-year flood elevation is 13.0 feet (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 stillwater elevation (SWEL) and wave crests. DWLNG 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,[38] which recommends defining a central estimate or mid-range scenario as baseline for shorter-term planning, such as setting initial adaptation plans for the next two decades and defining upper bound scenarios as a guide for long-term adaptation strategies and a general planning envelope.

In accordance with the Louisiana Coastal Protection and Restoration maps, DWLNG determined the 500-year SWEL would be 13 feet NAVD88. DWLNG also carried out wave calculations based on 100-year events and has estimated that relative sea level rise at the Project site would be approximately 0.7 feet higher by 2050 based on COE estimates of sea level rise in the Lake Charles area (COE, 2013). As a result, DWLNG has proposed to construct an earthen berm around the site with a crest elevation measuring 15 feet tall on the northern, southern, and western faces of the facility and 16 feet tall (NAVD88) on the eastern face of the facility. DWLNG also proposes a 14 foot high wave wall on top of the northern, southern, and western berm walls with the lower 2-3 feet being designed for wind driven wave effects. The front of the berm would be protected by grass or crushed rock. In addition, the Storm Surge analysis report recommends

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[36] DHS, Homeland Infrastructure Foundation Level Data, https://hifld-geoplatform.opendata.arcgis.com/, August 2018.

[37] NOAA, Historical Hurricane Tracker, https://coast.noaa.gov/hurricanes/, August 2018.

[38] *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.

that the crest and protected side of the berm be maintained with healthy grass cover over a protective clay soil, unless otherwise sufficiently armored. The wave wall on the north, south, and west sides of the site would be constructed of watertight concrete panels atop piled foundations. The wave wall concrete panels would be designed to meet applicable code requirements to resist run-up wave forces to be determined in the final design of the facility. The berm on the east side would be designed to accommodate overtopping by wind driven waves and the facility drainage pumping system would be designed to handle the potential water flow associated with overtopping.

We evaluated the design against a 500-year SWEL with a 500-year wave crest and account for sea level rise and subsidence. Using maximum envelope of water (MEOW) storm surge inundation maps generated from the Sea, Lake, and Overland Surge from Hurricanes (SLOSH) model developed by NOAA National Hurricane Center, a 500-year event would equate to a Category 2 Hurricane and from 3 feet to over 9 feet MEOW with most areas between 6-9 feet.[39] This is predominantly 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.[40] This data suggests that DWLNG design may withstand Category 3 or 4 Hurricane storm surge SWEL equivalent to approximately a 1,000 to 10,000-year mean return intervals. In addition, using wave heights 0f 0.78*SWEL for controlling waves and 0.49*SWEL for significant wave heights based on FEMA estimates would result in 7.8 foot controlling wave heights and 4.9 foot significant wave heights at the eastern face, but would likely not be that high at the northern, southern, and western sides side given the projected flood elevations and wave run up distances. We also would expect the sea level rise to be closer to the 1.21 foot 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 16.1 feet on the eastern face and 11.2 feet on the western 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 16 foot and 17-18 foot post-settlement berm and wave wall would provide adequate protection of the DWLNG site and should be periodically monitored and maintained to assure the crest elevation would not be lower than 16 feet NAVD88 on the eastern face and 17-18 feet NAVD88 on the other faces. We also recommend in section 4.13.1.6 that DWLNG provide a monitoring and maintenance plan prior to commencement of service to assure these crest elevations and healthy grass/crushed rock coverage are maintained as recommended the Perimeter Berm Elevation Analysis document.

Increased storm activities, shortage of sediment supply, and sea level rise have made shoreline erosion a major concern in southern Louisiana. In the vicinity of the Terminal Site, there has not been published information regarding shoreline erosion. Based on a review of aerial imagery from 1998 to 2016,

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[39] U.S. Department Of Commerce, National Ocean and Atmospheric Administration, National Hurricane Center, *National Storm Surge Hazard Maps*, https://www.nhc.noaa.gov/nationalsurge/#pop, Aug 2018.

[40] Masters, J., Weather Underground, *Storm Surge Inundation Maps for the U.S. Coast*, https://www.wunderground.com/hurricane/surge_images.asp, Aug 2018.

shoreline erosion has been found to be minimal. The shoreline to the north of the facility contains an existing bulkhead and rock rip-rap to mitigate erosion. The shoreline to the south of the facility would remain unprotected; however, wave action from vessels is not anticipated to reach the shoreline due to the proposed distance from the turning basin, approximately 700 to 1,200 feet. The material offloading facility for use of offloading during construction would consist of a sheetpile bulkhead and rock rip-rap to limit shoreline erosion. DWLNG indicated they would perform routine visual inspections of the shoreline and marine facilities for erosion, sedimentation, and scour.

Landslides and Other Natural Hazards

Landslides involve the downslope movement of earth materials under force of gravity due to natural or human causes. Due to the very low relief across the Terminal site, there is little likelihood that landslides or slope movement at the Terminal site would be considered a hazard. The LNG Facility site is characterized by very low relief, making the risk of landslides minimal. Based on topographic maps of Calcasieu Parish and the LNG Facility site, the topography is flat with an approximate maximum slope of 0.067 foot/foot. Soil slopes are between 0 to 8 percent, which indicates low potential for sloughing or landslides. Additionally, field observations and geotechnical information within the LNG Facility site did not identify any features related to 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[41] and DHS[42] of the nearly 1,500 volcanoes with eruptions since the Holocene period (in the past 10,000 years) there is no known active or historic volcanic activity within approximately several hundred miles of the site with the closest being approximately 720 miles away across the Gulf of Mexico in Los Atlixcos, Mexico.

Geomagnetic disturbance (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.[43] The map indicates the DWLNG site could experience GMD intensities of approximately 100 nano-Tesla with a 100-year mean return interval. However, DWLNG would be designed such that if a loss of power were to occur the valves would move into a fail-safe position. In addition, DWLNG is an export facility that does not serve any U.S. customers.

Process Design Review

In order to liquefy natural gas, most liquefaction technologies require that the feed gas stream to be pre-treated to remove components that could freeze out and clog the liquefaction equipment or would

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[41] United States Geological Survey, *U.S. Volcanoes and Current Activity Alerts*, https://volcanoes.usgs.gov/index.html, accessed August 2018.

[42] Department of Homeland Security, *Homeland Infrastructure, Foundation-Level data*, Natural Hazards, hifld-geoplatform.opendata.arcgis.com, accessed August 2018

[43] United States Geological Survey, *Magnetic Anomaly Maps and Data for North America*, https://mrdata.usgs.gov/magnetic/map-us.html#home, accessed August 2018.

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 limit concentrations to less than 0.01 micrograms per normal cubic meter because it can induce embrittlement and corrosion, resulting in a catastrophic failure of equipment.

The inlet gas would be conditioned to remove of solids and water droplets and for pressure regulation prior to entering feed gas pretreatment processes. Once the inlet gas is conditioned, the CO_2 and H_2S would be removed from the feed gas by contact with an amine-based solvent solution in an absorber column. The proposed pre-treatment system would be capable of handling a natural gas feed stream with up to 4 parts per million by volume of H_2S, and 2 mole percent CO_2. After CO_2 and H_2S had accumulated in the amine solution, an amine regenerator would release the CO_2 and H_2S from that solution into an acid gas stream. Most of the H_2S in the acid gas stream would be chemically removed by a liquid scavenger solution. The spent scavenger solution would be removed from the site by truck in accordance with applicable regulations. DWLNG states they would expect to average two trucks per week for the removal of the spent scavenger solution. 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 regenerative molecular sieve beds. The water would be recovered for use within the pre-treatment system and would not pose a significant safety hazard to the public. The dry, treated gas is then sent to the Mercury Removal Beds where mercury would be removed from the gas by beds containing non-regenerable, sulfur-impregnated carbon for mercury absorption. Replacement of these mercury adsorber beds would occur less frequently than every 4 years and would need to be conducted in accordance with applicable regulations.

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. From there, condensate would be removed from the site by truck approximately five times daily.

After removal of the heavy hydrocarbons and the other components from the natural gas feed stream, DWLNG would liquefy the natural gas. In this process, the gas would be cooled by thermal exchange with a single mixed refrigerant. The single mixed refrigerant uses a mixture of refrigerants such as propane, ethylene, butane, and pentane that would be used to achieve the liquefaction temperature. Each refrigerant component would be stored in dedicated storage vessels to provide make-up refrigerants to each liquefaction train. The refrigerant storage area would also be equipped to receive and unload refrigerant tanker trucks. DWLNG states on a periodic basis, two tanker trunks per week may be expected for replacement of refrigerants.

After cooling the natural gas into its liquid form, this LNG would be stored in the new full-containment LNG storage tanks where it would be stored and sent out through in-tank pumps and through a marine transfer line and marine transfer arms connected to LNG carriers. 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 carrier would be disconnected and leave for export. [44]

In addition, the proposed facility would have many utilities and associated processes. For example, aqueous ammonia at 19 percent by weight would be used as part of the emission control system associated with the Project. DWLNG states they would expect to receive an average of approximately one tanker truck daily. Furthermore, hot oil would be used to provide the heat demand to the plant users, which include the regenerator reboiler, the feed gas heater, the HP fuel gas superheater, the condensate stabilizer reboiler, and the regeneration gas heater, while acting as the heat rejection fluid for the Waste Heat Recovery Units on the MR Compressor Gas Turbines. Diesel would be stored in dedicated tanks for their respective equipment, which includes essential firewater pumps, stormwater pumps, and essential diesel generators. Nitrogen would be supplied to DWLNG's LNG Facility via two package systems: a Membrane Nitrogen Generation Package to supply the main utility nitrogen demand, and a Liquid Nitrogen Package for refrigerant make-up and actuation of emergency depressuring valves. DWLNG would expect to receive approximately three liquid nitrogen truck deliveries per week.

The failure of process equipment could pose potential harm if not properly safeguarded through the use of appropriate controls and operation. DWLNG 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. DWLNG would develop facility operation procedures after completion of the final design; this timing is fully consistent with accepted industry practice. DWLNG would design their control systems and human machine interfaces to the International Society for Automation (ISA) Standards 5.3, 5.5, 60.1, 60.3, 60.4, and 60.6, and other standards and recommended practices. We recommend in section 4.13.1.6 that DWLNG file more information on the operating and maintenance procedures prior to commissioning, including safety procedures, hot work procedures and permits, abnormal operating conditions procedures, and personnel training. We would evaluate these plans to assure 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, we recommend in section 4.13.1.6 that DWLNG tag and label instrumentation and valves, piping, and equipment and providing car-seals/locks to address human factor considerations and improve facility safety and prevent incidents. We also recommend in section 4.13.1.6 that DWLNG deveop and implement an alarm management program for review and approval to ensure the effectiveness of the alarms. FERC staff will evaluate the alarm management program against recommended and generally accepted good enigineering practices, such as ISA Standard 18.2.

In the event of a process deviation, ESD valves and instrumentation would be installed to monitor, alarm, shut down, and isolate equipment and piping during process upsets or emergency conditions. The plant would have plant-wide ESD and individual process unit shutdown capabilities. FERC staff evaluated

[44] DWLNG 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 DWLNG has authorization to export from DOE.

whether DWLNG's safety-instrumented systems with higher reliabilities would comply with ISA Standard 84.01 and other recommended and generally accepted good engineering practices. We also recommend in section 4.13.1.6 that DWLNG 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.

If the Project is authorized and constructed, DWLNG would install equipment in accordance with its design. FERC staff recommend in section 4.13.1.6 that DWLNG file details of a site-wide ESD button with proper sequencing and reliability in the design. FERC staff recommend in section 4.14.1.6 that project facilities be subject to construction inspections and that companies provide, for review and approval, commissioning plans and commissioning demonstration tests that would verify the performance of equipment. In addition, we recommend in section 4.14.1.6 that Project facilities be subject to regular inspections 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 Review

DWLNG provided design specifications for piping and equipment, including design codes and standards that the facilities would meet. The design specifies materials of construction and ratings suited to the pressure and temperature conditions of the process design. Piping would be designed, fabricated, assembled, erected, inspected, examined, and tested in accordance with the 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 Section VIII per 49 CFR 193 and the NFPA 59A (2001). 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 boil-off gas compression to prevent the release of boil-off to the atmosphere in accordance with NFPA 59A for an inherently safer design. Heat exchangers would be designed to ASME Boiler and Pressure Vessel Code 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, process equipment, and piping. The safety relief valves would be designed to handle process upsets and thermal expansion within piping, per NFPA 59A (2001) and ASME Section VIII; and would be designed in accordance with API Standards 520, 521, 526, 527, and 2000; ASME Standards B31.3 and B31.5; and other recommended and generally accepted good engineering practices. In addition, we recommend in section 4.13.1.6 that DWLNG file final design information on pressure and vacuum relief devices 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, DWLNG would install equipment in accordance with its design and FERC staff would verify nameplates on equipment indicating that equipment are designed accordingly in the field as part of its construction inspections and that quality assurance and quality control (QA/QC) plans are established to ensure equipment is installed to proposed specifications. In addition, we recommend in section 4.13.1.6 that DWLNG file semi-annual reports that include equipment malfunctions, and Project facilities be subject to regular inspections to verify in the field that equipment is being properly maintained during operation inspections.

Security Design Review

The security requirements for the proposed Project are governed by 33 CFR 105, 33 CFR 127, and 49 CFR 193, Subpart J – Security. 33 CFR 105, as authorized by the MTSA, requires all terminal owners and operators to submit a Facility Security Assessment and an FSP to the USCG for review and approval before commencement of operations of the proposed Project facilities. DWLNG 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, the following:

- 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 Project;
- conducting a FSA to identify site vulnerabilities, possible security threats and consequences of an attack, and facility protective measures; developing a FSP based on the FSA, with procedures for: responding to transportation security incidents; notification and coordination with federal, state, and local authorities; prevention of unauthorized access; measures to prevent or deter entrance with dangerous substances or devices; training; and evacuation;
- defining the security organizational structure with facility personnel with knowledge or training in current security threats and patterns; recognition and detection of dangerous substances and devices, recognition of characteristics and behavioral patterns of persons who are likely to threaten security; techniques to circumvent security measures; emergency procedures and contingency plans; operation, testing, calibration, and maintenance of security equipment; and inspection, control, monitoring, and screening techniques;
- implementing scalable security measures to provide increasing levels of security at increasing maritime security levels for facility access control, restricted areas, cargo handling, LNG carrier stores and bunkers, and monitoring; ensuring that the Transportation Worker Identification Credential program is properly implemented;
- ensuring coordination of shore leave for LNG carrier personnel or crew change out as well as access through the facility for visitors to the LNG carrier;
- conducting drills and exercises to test the proficiency of security and facility personnel on a quarterly and annual basis; and
- reporting all breaches of security and transportation security incidents to the National Response Center.

33 CFR 127 has requirements for access controls, lighting, security systems, security personnel, protective enclosures, communications, and emergency power. If the facility is constructed and operated, compliance with the security requirements of 33 CFR 105 and 127 would be subject to the USCG inspection and enforcement programs.

49 CFR 193 Subpart J also specifies security requirements for the onshore component of LNG terminals, including requirements for conducting security inspections and patrols, liaison with local law enforcement officials, design and construction of protective enclosures, lighting, monitoring, alternative power sources, and warning signs. If the facility is constructed and operated, compliance with the security requirements of 49 CFR 193 would be subject to the DOT inspection and enforcement programs.

FERC staff evaluated DWLNG's plans for security fencing surrounding the entire facility, with controlled access of vehicles, lighting, intrusion monitoring (e.g., camera), intrusion detection, communication systems, and emergency power. DWLNG provided preliminary information on these security features and indicated additional details would be done in final design. We recommend in section 4.13.1.6 that DWLNG file preliminary and final security drawings that show both operating and security lighting and cameras, as well as final design details of vehicular access points and their associated barriers, chicane, and/or security personnel. In addition, we recommend in section 4.13.1.6 that DWLNG file information on any changes to security plans and designs. If the Project is authorized and constructed, DWLNG would coordinate with local, state, and federal agencies on the development of an FSP. In addition, we recommend in section 4.13.1.6 that DWLNG file semi-annual reports that include any security incidents and Project facilities be subject to regular inspections to ensure updates are being made to the plans throughout the life of the facilities. In accordance with the February 2004 Interagency Agreement among FERC, DOT, and USCG, FERC staff would collaborate with USCG and DOT on the Project's security features.

Hazard Mitigation Design Review

If operational control of the facilities were lost and operational controls and ESD systems failed to maintain the Project within the design limits of the piping, containers, and safety relief valves, a release could potentially occur. FERC regulations under 18 CFR 380.12(o)(1) through (4) require applicants to provide information on spill containment; spacing; and plant layout, hazard detection, hazard control, and firewater systems. In addition, 18 CFR 380.12(o)(7) require applicants to provide engineering studies on the design approach and 18 CFR 380.12(o)(14) requires applicants to demonstrate how they comply with 49 CFR 193 and NFPA 59A. As required by 49 CFR 193 Subpart I and by incorporation of NFPA 59A (2001) Section 9.1.2, 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, and must address certain fire protection measures. NFPA 59A (2001) also requires the evaluation determine 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 LNG facilities, as defined in 49 CFR 193, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs. However, NFPA 59A (2001) also indicates the wide range in size, design, and location of LNG facilities precludes the inclusion of detailed fire protection provisions that apply to all facilities comprehensively and includes subjective performance based language on where ESD systems and hazard control are required and does not provide any additional guidance on placement or selection of hazard detection equipment and provides minimal requirements on firewater. Also, the marine facilities would be subject to 33 CFR 127, which incorporates sections of NFPA 59A (1994), which have similar performance-based guidance. Therefore, 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.

DWLNG 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. We recommend in section 4.13.1.6 that DWLNG file a final fire protection evaluation 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.

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 LNG facilities, as defined in 49 CFR 193, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs. For full-containment LNG tanks, we also consider it prudent to provide a barrier to prevent liquid from flowing to an unintended area (i.e., outside the plant property). The purpose of the barrier is to prevent liquid from flowing off the plant property and does not define containment or an impounding area for thermal radiation or flammable vapor exclusion zone calculations or other code requirements already met by sumps and impoundments throughout the site.

DWLNG proposes three full-containment LNG storage tanks for which the outer tank wall would serve as the impoundment system. DWLNG provided volumes for the capacities to demonstrate the outer tank would exceed 110 percent. In addition, DWLNG indicates that the earthen berm around the facility would prevent liquid in the storage tank area from flowing off plant property in the event the outer tank impoundment failed. We verified that each 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, DWLNG would also install a means to prevent liquid in the storage tank area from flowing off-site in the event of an outer tank impoundment failure.

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 LNG facilities, as defined in 49 CFR 193, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs. As part of our preliminary engineering review, we evaluated that impoundment systems 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, we recommend in section 4.13.1.6 that DWLNG file additional information on final design of the impoundment systems where details are yet to be determined.

FERC staff also evaluated the means to remove water and snow from impounding areas to ensure impoundment volumes would not be reduced through accumulation of rainwater or snow. In addition, FERC staff evaluated whether there are provisions to ensure that hazardous fluids are not accidentally discharged through the systems intended to remove rainwater or snow. In addition, all LNG facilities, as defined in 49 CFR 193, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs. Automatically operated sump pumps for impoundment areas must have redundant automatic shutdown controls and water removal requirements as specified in 49 CFR 193.2173. DWLNG 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. DWLNG also indicated that the LNG impoundment stormwater pumps would have two independent temperature trips, and the associated documentation (P&IDs, Cause and Effect (C&E) Diagrams, etc.) would be updated accordingly. However, while DWLNG also indicated that all below ground sumps would have pumps installed for water removal, DWLNG indicated all above ground containments would be gravity drained as required. Therefore, we recommend that DWLNG provide correspondence from DOT demonstrating the design meets DOT regulations regarding the automatic shutdown controls and water removal systems.

If the Project is authorized and constructed, DWLNG would install spill impoundments in accordance with its design and FERC staff recommend in section 4.13.1.6 that the Project facilities be subject to periodic inspections during construction to verify that the spill containment system including dimensions, and slopes of curbing and trenches, and capacity matches final design information. In addition, FERC staff recommend in section 4.13.1.6 that the 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 from each other, from ignition sources, and from 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 LNG facilities, as defined in 49 CFR 193, are approved and constructed, DWLNG must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs.

In addition, FERC staff evaluated the spacing to determine if there could be cascading damage and to inform what fire protection measures may be necessary to reduce the risk of cascading damage. In addition, all facilities, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs. The spacing and of vessels and equipment between each other, from ignition sources, and to the property line must meet the requirements of 49 CFR 193, which incorporates NFPA 59A (2001). NFPA 59A (2001) further references NFPA Standards 30, NFPA 58, and NFPA 59.

Radiant heat from impoundment fires and tank roof top fires would expose equipment to radiant heats in excess of 4,000 BTU/ft^2-hr. FERC staff recommend DWLNG provide the final design of mitigation measures to demonstrate cascading events would not occur. In addition, FERC staff recommend in section 4.13.1.6 that DWLNG file an analysis demonstrating the adjacent tank can withstand the radiant heat from which it would be exposed from a tank roof fire or adjacent tank roof fire. We also recommend in section

4.13.1.6 that DWLNG evaluate impacts for all plant buildings from external fires and explosions. To minimize risk for flammable or toxic vapor ingress into buildings, FERC would recommend in section 4.13.1.6 that DWLNG filea technical review of a facility identifying all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and verify that these areas would be adequately covered by hazard detection devices that would isolate or shut down any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency. FERC staff also recommend in section 4.13.1.6 that Project facilities be subject to periodic inspections 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 recommend in section 4.13.1.6 that Project facilities be subject to regular inspections 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, DWLNG would finalize the plot plan, and FERC staff recommend in section 4.13.1.6 that DWLNG file any changes for review and approval to ensure capacities and setbacks are maintained. If the facilities are constructed, DWLNG would install equipment in accordance with the spacing indicated on the plot plans, and FERC staff recommend in section 4.13.1.6 that Project facilities be subject to periodic inspections to verify equipment is installed in appropriate locations and the spacing is met in the field. In addition, FERC staff recommend in section 4.13.1.6 that Project facilities be subject to regular inspections to continue to verify that equipment setbacks from other equipment and ignition sources are being maintained during operation inspections.

Ignition Controls

FERC staff evaluated whether Project areas would be designated with a hazardous electrical classification commensurate with the risk of the hazardous fluids being handled in accordance with NFPA 59A (2001), 70, 497, and API RP 500. All LNG facilities, as defined in 49 CFR 193, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs, which require compliance, by incorporation by reference, with NFPA 59A (2001) and NFPA 70 (1999). The marine facilities must comply with similar electrical area classification requirements of NFPA 59A (1994) and NFPA 70 (1993), which are incorporated by reference into the USCG regulations in 33 CFR 127. Depending on the risk level, these areas would either be classified as non-classified, Class 1 Division 1, or Class 1 Division 2. Electrical equipment located in these areas would be designed such that in the event a flammable vapor is present, the equipment would have a minimal risk of igniting the vapor. FERC staff evaluated DWLNG's 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, DWLNG would finalize the electrical area classification drawings and would describes changes made from the FEED design. FERC staff recommend in section 4.13.1.6 that DWLNG file the final design of the electrical area classification drawings. If facilities are constructed, DWLNG would install appropriately classed electrical equipment, and FERC staff recommends in section 4.13.1.6 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, submerged pumps and instrumentation that have a direct interface with a flammable fluid must be provided with process seals where electrical and instrumentation cabling enters hazardous fluids in accordance with NFPA 59A (2001) and NFPA 70 (1999) at each interface between a flammable fluid system and an electrical conduit or wiring system. FERC staff recommend in section 4.13.1.6 that

DWLNG file 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 (1999). In addition, we recommend in section 4.13.1.6 that DWLNG file 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 recommend in section 4.13.1.6 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.), process seals conform to NFPA 59A and NFPA 70, and electrical equipment are appropriately de-energized and locked out and tagged out when being serviced.

Hazard Detection, Emergency Shutdown, and Depressurization Systems

DWLNG 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.

FERC staff evaluated the adequacy of the general hazard detection type and coverage to detect cryogenic spills, flammable and toxic vapors, and fires as well as the related C&E matrices that would initiate an alarm, shutdown, depressurization, or other action based on the FEED. We also reviewed the fire and gas cause and effect matrices to evaluate the detectors that would initiate an alarm, shutdown, depressurization, or other action based on the FEED. FERC staff recommends in section 4.13.1.6 that DWLNG file additional information 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, DWLNG would install hazard detectors according to its specifications, and FERC staff recommend in section 4.13.1.6 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 C&E matrixes prior to introduction of hazardous fluids. In addition, FERC staff recommend in section 4.13.1.6 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. DWLNG indicates hazard control layout and design would meet NFPA 59A; 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 evaluated whether the spacing of the fire extinguishers meet NFPA 10. In addition, FERC staff evaluated 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, we recommend in section 4.13.1.6 that DWLNG file additional information on final design of these systems where details are yet to be determined (e.g., manufacturer and model, elevations, flowrate, capacities, etc.) and where the final design could change as a result of these details or other changes in the final design of the Project. If the Project is authorized and constructed, DWLNG would install hazard control equipment, and FERC staff recommend in section 4.13.1.6 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 generally recommend project facilities be subject to regular inspections throughout the life of the facility to verify in the field that hazard control coverage and is being properly maintained and inspected.

Passive Cryogenic and Fire Protection

If a fire could not be separated, controlled, or extinguished to limit fire exposures onto plant 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[45] and that they are specified in accordance with recommended and generally accepted good engineering practices with a fire protection rating of a commensurate to the radiant heat and duration. In addition, we recommend in section 4.13.1.6 that DWLNG file additional information on the final design of these systems where details are yet to be determined (e.g., calculation of structural fire protection materials, thicknesses, etc.) and where the final design could change as a result of these details or other changes in the final design of the Project.

If the Project is authorized and constructed, DWLNG would install structural cryogenic and fire protection according to its design, and FERC staff recommend in section 4.13.1.6 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 recommend in section 4.13.1.6 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

DWLNG 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, 13, 15, 20, 22, and 24 requirements. FERC staff evaluated the adequacy of the general firewater or foam system coverage and verified the appropriateness of the associated firewater demands of those systems and worst-case fire scenarios to size the firewater and foam pumps and judge whether the reliability of the firewater pumps and firewater source or onsite storage volume are appropriate. In addition, we recommend in section 4.13.1.6 that DWLNG file an updated fire protection evaluation be performed on the final design 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

[45] Pool fires from impoundments are generally mitigated through use of emergency shutdowns, depressurization systems, structural fire protection, and firewater, while jet fires are primarily mitigated through the use of emergency shutdowns, depressurization systems, and firewater without structural fire protection.

these details or other changes in the final design of the Project. In addition, we recommend in section 4.13.1.6 that DWLNG provide specific consideration for the use of low-expansion foam and other automatic fire protection measures in the condensate and hazardous fluid storage areas. If the Project is authorized and constructed, DWLNG would install the firewater and foam systems as designed, and FERC staff recommend in section 4.13.1.6 that Project facilities be subject to periodic inspections and 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 recommend in section 4.13.1.6 that Project facilities are subject to regular inspection to ensure firewater and foam systems are being properly maintained and tested throughout the life of the facility.

Onsite and Offsite Emergency Response Plans

As part of its application DWLNG submitted a draft outline of the ERP it intends to develop with local, state, and federal agencies and emergency response officials to discuss the Facilities. DWLNG 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, DWLNG 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 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 certain 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 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 emergency response personnel 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 carriers that serve the facility. The Cost-Sharing Plan must specify what the LNG terminal operator would provide to cover the cost of the state and local resources required to manage the security of the LNG terminal and LNG carrier, and the state and local resources required for safety and emergency management, including the following:

- 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.

DWLNG provided a draft of an ERP. As part of the preliminary review, FERC staff evaluate the initial draft of the ERP procedures to assure that it covers the hazards associated with the Project. In addition, we recommend in section 4.13.1.6 that DWLNG file additional information on development and final updated ERPs prior to initial site preparation. If this Project is authorized and constructed, DWLNG would coordinate with local, state, and federal agencies on the development of an ERP and cost sharing plan. FERC staff would keep track of the development of these plans and ensure they are in place prior to introduction of hazardous fluids. In addition, FERC staff recommend in section 4.13.1.6 that Project facilities be subject to regular inspections and would continue to require updates be filed on the plans throughout the life of the facility.

4.13.1.6 Conclusions on LNG Facility Reliability and Safety

As a cooperating agency, the DOT assists the FERC by determining whether DWLNG's proposed design would meet the DOT's 49 CFR 193 Subpart B siting requirements. The DOT reviewed information submitted by DWLNG and on December 11, 2017, and as clarified on July 13, 2018, provided a letter to FERC staff stating that the DOT had no objection to DWLNG's methodology to comply with the 49 CFR 193 siting requirements for the proposed LNG liquefaction facilities. On December 18, 2018, DOT provided an LOD on the Project's compliance with 49 CFR 193, Subpart B. This is 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 Facility and the associated LNG carrier traffic. The USCG reviewed a WSA submitted by DWLNG that focused on the navigation safety and maritime security aspects of LNG carrier transits along the affected waterway. On April 25, 2017, the USCG issued an LOR to FERC staff indicating the Calcasieu 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 01-2011. If the Project is authorized and constructed, the waterfront facilities handling LNG 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 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 conclude that the DWLNG Export Terminal's 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 will 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 recommend that:

Prior to construction of final design, DWLNG should file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in Louisiana:

a. site preparation drawings and specifications;

b. LNG terminal structures and foundation design drawings and calculations;

c. seismic specifications for procured equipment prior to the issuing of requests for quotations; and

d. quality control procedures to be used for civil/structural design and construction.

In addition, DWLNG should file, in its Implementation Plan, the schedule for producing this information.

Prior to commencement of service, DWLNG should file with the Secretary a monitoring and maintenance plan, stamped and sealed by the professional engineer-of-record registered in Louisiana for the perimeter levee 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 these specific recommendations below 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, DWLNG should file an overall LNG Facility schedule, which includes the proposed stages of the commissioning plan.

Prior to initial site preparation, DWLNG should file quality assurance and quality control procedures for construction activities.

Prior to initial site preparation, DWLNG should file procedures for controlling access during construction.

Prior to initial site preparation, DWLNG 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 carrier to activate sirens and other warning devices.

DWLNG 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, DWLNG should file a Cost-Sharing Plan identifying the mechanisms for funding all LNG Facility-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. DWLNG 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, DWLNG should file information/revisions pertaining to DWLNG's response numbers 13, 14, 16, 21, 22, 23, 24, 29, 31, 33, 34, 36, 39, 43, 45, 46, 47, 48, 50, 53, 54, and 57 of its September 29, 2017 filing, which indicated features to be included or considered in the final design.

Prior to construction of final design, DWLNG should file change logs that list and explain any changes made from the front end engineering design provided in DWLNG's application and filings. A list of all changes with an explanation for the design alteration should be filed and all changes should be clearly indicated on all diagrams and drawings.

Prior to construction of final design, DWLNG should file up-to-date process flow diagrams and 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; and

i. drawing revision number and date.

Prior to construction of final design, DWLNG 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.

Prior to construction of final design, DWLNG should file a car seal philosophy and a list of all car-sealed and locked valves consistent with the P&IDs.

Prior to construction of final design, the engineering, procurement, and construction contractor should verify that the recommendations from the Front End Engineering Design Hazard Identification are complete and consistent with the requirements of the final design as determined by the engineering, procurement, and construction contractor.

Prior to construction of final design, DWLNG should file a hazard and operability review prior to issuing the P&IDs for construction. A copy of the review, a list of the recommendations, and actions taken on the recommendations should be filed.

Prior to construction of final design, DWLNG should file the safe operating limits (upper and lower), alarm and shutdown set points for all instrumentation (i.e., temperature, pressures, flows, and compositions).

Prior to construction of final design, DWLNG should include LNG tank fill flow measurement with high flow alarm.

Prior to construction of final design, DWLNG should include boil-off gas (BOG) flow, tank density profile and temperature profile measurement for each tank.

Prior to construction of final design, DWLNG should specify that all ESD valves will be equipped with open and closed position switches connected to the Distributed Control System/Safety Instrumented System.

Prior to construction of final design, DWLNG should file cause-and-effect matrices for the process instrumentation, fire and gas detection system, and emergency shutdown system. The cause-and-effect matrices should include alarms and shutdown functions, details of the voting and shutdown logic, and set points.

Prior to construction of final design, DWLNG should specify and evaluate emergency shutdown valve closure times. Include an analysis that describes the time to detect an upset condition, notify plant personnel, and close the emergency shutdown valve.

Prior to construction of final design, DWLNG should file an evaluation of dynamic pressure surge effects from valve opening and closure times and pump operations.

Prior to construction of final design, DWLNG should file a plot plan of the final design showing all major equipment, structures, buildings, and impoundment systems.

Prior to construction of final design, DWLNG should file three-dimensional plant drawings to confirm plant layout for maintenance, access, egress, and congestion.

Prior to construction of final design, DWLNG should file complete specifications for the proposed LNG tank design and installation.

Prior to construction of final design, DWLNG should file the structural analysis of the LNG storage tank and outer containment demonstrating they are designed to withstand all loads and combinations.

Prior to construction of final design, DWLNG should file an analysis of the structural integrity of the outer containment of the full containment storage tanks that demonstrates it can withstand all thermal and overpressure loads incurred from coincident and adjacent roof tank top fires and release and ignition of design spills.

Prior to construction of final design, DWLNG should file a detailed aircraft impact analysis that uses frequencies for the various surrounding aircraft operations per DOE-STD-2014-2006 or other approved methodology that demonstrates the design of the full containment LNG tanks would be able to withstand aircraft impacts using CEB 187 or other approved methodology from aircraft operations with impact frequencies equal or more frequent than 3e-5 per year or other approved frequency that would not result in a significant increase in risk to the surrounding public.

Prior to construction of final design, DWLNG should file drawings of the storage tank piping support structure and support of horizontal piping at grade including pump columns, relief valves, pipe penetrations, instrumentation, and appurtenances.

Prior to construction of final design, DWLNG 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 wind borne 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, DWLNG 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 specifications, cable specifications, other electrical and instrumentation specifications); and**

d. **security and fire safety specifications (security, passive protection, hazard detection, hazard control, firewater).**

Prior to construction of final design, DWLNG should demonstrate that, for hazardous fluids, piping and piping nipples 2 inches or less in diameter are designed to withstand external loads, including vibrational loads in the vicinity of rotating equipment and operator live loads in areas accessible by operators.

Prior to construction of final design, DWLNG should specify that piping and equipment that may be cooled with liquid nitrogen is to be designed for liquid nitrogen temperatures, with regard to allowable movement and stresses.

Prior to construction of final design, DWLNG should file the sizing basis and capacity for the final design of the flares and/or vent stacks as well as the pressure and vacuum relief valves for major process equipment, vessels, and storage tanks.

Prior to construction of final design, DWLNG should file drawings and specifications for vehicle barriers at each facility entrance for access control.

Prior to construction of final design, DWLNG 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 and cameras interior to the facility that would 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, DWLNG 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. Specific consideration should be given to the use of low expansion foam and other automatic fire protection measures in the condensate and hazardous fluid storage areas.

Prior to construction of final design, DWLNG 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, and sizing and design of the marine spill containment system that will transfer spills from the jetty back to the site's impoundment system.

<u>Prior to construction of final design</u>, DWLNG should file correspondence from DOT demonstrating the gravity drained water removal systems for impoundment areas meets DOT regulations regarding the use of sump pumps and automatic shutdown controls and water removal systems prescribed in 49 CFR 193.2173.

<u>Prior to construction of final design</u>, DWLNG should file electrical area classification drawings.

<u>Prior to construction of final design</u>, DWLNG should file drawings and details of how process seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system meet the requirements of NFPA 59A (2001 edition).

<u>Prior to construction of final design</u>, DWLNG 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>, DWLNG should file a drawing showing the location of the emergency shutdown buttons. Emergency shutdown buttons should be easily accessible, conspicuously labeled, and located in an area which would be accessible during an emergency.

<u>Prior to construction of final design</u>, DWLNG should file the details of a site-wide ESD button with proper sequencing and reliability or should include other provisions that are demonstrated through a human reliability analysis to provide a means to quickly and reliably shutdown the entire site.

<u>Prior to construction of final design</u>, DWLNG should file complete drawings and a list of the hazard detection equipment. The drawings should clearly show the location and elevation of all detection equipment. The list should include the instrument tag number, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment.

<u>Prior to construction of final design</u>, DWLNG should file a technical review of facility design that:

a. identifies all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and

b. demonstrates that these areas are adequately covered by hazard detection devices and indicates how these devices would isolate or shut down any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency.

<u>Prior to construction of final design</u>, DWLNG should file a design that includes hazard detection suitable to detect high temperatures and smoldering combustion in electrical buildings and control room buildings.

Prior to construction of final design, DWLNG should file a design that includes smoke detection in occupied buildings.

Prior to construction of final design, DWLNG should file an analysis of the localized hazards to operators from a potential liquid nitrogen release and should also provide consideration of any mitigation that may be prudent.

Prior to construction of final design, DWLNG 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 flammability limit set points for methane, ethylene, propane, n-butane, i-pentane, and condensate.

Prior to construction of final design, DWLNG 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 toxic concentration set points for condensates, ammonia, natural gas liquids and hydrogen sulfide.

Prior to construction of final design, DWLNG should file an evaluation of the voting logic and voting degradation for hazard detectors.

Prior to construction of final design, DWLNG should file facility plan drawings and a list of the fixed and wheeled dry-chemical, hand-held fire extinguishers, and other hazard control equipment. Plan drawings should clearly show the location by tag number of all fixed, wheeled, and hand-held extinguishers. The list should include the equipment tag number, type, capacity, equipment covered, discharge rate, and automatic and manual remote signals initiating discharge of the units.

Prior to construction of final design, DWLNG should file a design that includes clean agent systems in the electrical switchgear and instrumentation buildings.

Prior to construction of final design, DWLNG 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, DWLNG should file a detailed quantitative analysis to demonstrate that adequate thermal mitigation would be provided for each significant component within the 4,000 BTU/ft^2-hr zone from an impoundment, or provide an analysis that assess the consequence of pressure vessel bursts and boiling liquid expanding vapor explosions. Trucks at the truck transfer station should 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 will mitigate the heat absorbed by the vessel.

Prior to construction of final design, DWLNG should file facility plan drawings showing the proposed location of the firewater and any foam systems. Plan drawings should clearly show the location of firewater and foam piping, post indicator valves, and the location and area covered by, each monitor, hydrant, hose, water curtain, deluge system, foam system, water-mist system, and sprinkler. The drawings should also include piping and instrumentation diagrams of the firewater and foam systems.

Prior to construction of final design, DWLNG should 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.

Prior to construction of final design, DWLNG 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 Distributed Control System and recorded.

Prior to construction of final design, DWLNG should 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.

Prior to commissioning, DWLNG 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. DWLNG should file documentation certifying that each of these milestones is complete before authorization to commence the next phase of commissioning and startup will be issued.

Prior to commissioning, DWLNG should file detailed plans and procedures for: testing the integrity of onsite mechanical installation; functional tests; introduction of hazardous fluids; operational tests; and placing the equipment into service.

Prior to commissioning, DWLNG should file a plan for clean-out, dry-out, purging, and tightness testing. This plan should address the requirements of the American Gas Association's Purging Principles and Practice, and should provide justification if not using an inert or non-flammable gas for clean-out, dry-out, purging, and tightness testing.

Prior to commissioning, DWLNG should file the procedures for pressure/leak tests which address the requirements of American Society of Mechanical Engineers (ASME) VIII and ASME B31.3. The procedures should include a line list of pneumatic and hydrostatic test pressures.

Prior to commissioning, DWLNG should file the operation and maintenance procedures and manuals, as well as safety procedures, hot work procedures and permits, abnormal operating conditions reporting procedures, simultaneous operations procedures, and management of change procedures and forms.

Prior to commissioning, DWLNG should tag all equipment, instrumentation, and valves in the field, including drain valves, vent valves, main valves, and car-sealed or locked valves.

Prior to commissioning, DWLNG 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.

Prior to commissioning, DWLNG 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 commissioning</u>, DWLNG should file a plan and maintain a detailed training log to demonstrate that operating staff has completed the required training.

<u>Prior to introduction of hazardous fluids</u>, DWLNG should complete all pertinent tests (Factory Acceptance Tests, Site Acceptance Tests, Site Integration Tests) associated with the Distributed Control System and the Safety Instrumented System that demonstrates full functionality and operability of the system.

<u>Prior to introduction of hazardous fluids</u>, DWLNG 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>, DWLNG 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>, DWLNG 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.

DWLNG should file a request for written authorization from the Director of OEP <u>prior to unloading or loading the first LNG commissioning cargo</u>. <u>After production of first LNG</u>, DWLNG should file <u>weekly</u> reports on the commissioning of the proposed systems that detail the progress toward demonstrating the facilities can safely and reliably operate at or near the design production rate. The reports should include a summary of activities, problems encountered, and remedial actions taken. The weekly reports should also include the latest commissioning schedule, including projected and actual LNG production by each liquefaction plant, 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>, DWLNG 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>, DWLNG should label piping with fluid service and direction of flow in the field, in addition to the pipe labeling requirements of NFPA 59A (2001 edition).

<u>Prior to commencement of service</u>, DWLNG should develop procedures for offsite contractors' responsibilities, restrictions, and limitations and for supervision of these contractors by DWLNG staff.

<u>Prior to commencement of service</u>, DWLNG should notify the FERC staff of any proposed revisions to the security plan and physical security of the plant.

Prior to commencement of service, DWLNG should file a request for 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 Maritime Transportation Security Act of 2002, and the Security and Accountability For Every (SAFE) Port Act, that appropriate measures to ensure the safety and security of the facility and the waterway have been put into place by DWLNG or other appropriate parties.

In addition, we recommend that the following measures should apply **throughout the life** of the facilities.

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, DWLNG 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 will 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 within 24 hours and procedures for corrective action should be specified.

Significant non-scheduled events, including safety-related incidents (e.g., LNG, condensate, refrigerant, or natural gas releases; fires; explosions; mechanical failures; unusual over pressurization; and major injuries) and security-related incidents (e.g., attempts to enter site, suspicious activities) should be reported to 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 LNG plant's emergency plan. Examples of reportable hazardous fluids-related incidents include:

a. fire;

b. explosion;

c. estimated property damage of $50,000 or more;

d. death or personal injury necessitating in-patient hospitalization;

e. release of hazardous fluids for five minutes or more;

f. unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of an LNG facility that contains, controls, or processes hazardous fluids;

g. any crack or other material defect that impairs the structural integrity or reliability of an LNG facility that contains, controls, or processes hazardous fluids;

h. any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes hazardous fluids to rise above its maximum allowable operating pressure (or working pressure for LNG facilities) plus the build-up allowed for operation of pressure-limiting or control devices;

i. a leak in an LNG facility that contains or processes hazardous fluids that constitutes an emergency;

j. inner tank leakage, ineffective insulation, or frost heave that impairs the structural integrity of an LNG storage tank;

k. any safety-related condition that could lead to an imminent hazard and cause (either directly or indirectly by remedial action of the operator), for purposes other than abandonment, a 20 percent reduction in operating pressure or shutdown of operation of a pipeline or an LNG facility that contains or processes hazardous fluids;

l. safety-related incidents to hazardous fluids transportation occurring at or en route to and from the LNG facility; or

m. an event that is significant in the judgment of the operator and/or management even though it did not meet the above criteria or the guidelines set forth in an LNG facility's incident management plan.

In the event of an incident, the Director of OEP has delegated authority to take whatever steps are necessary to ensure operational reliability and to protect human life, health, property, or the environment, including authority to direct the LNG Facility to cease operations. Following the initial company notification, the FERC staff will 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.

4.13.2 Pipeline

The transportation of natural gas by pipeline involves some incremental risk to the public due to the potential for accidental release of natural gas. The greatest hazard is a fire or explosion following a major pipeline rupture.

Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic, but is classified as a simple asphyxiant, possessing a slight inhalation hazard. If breathed in high concentration, oxygen deficiency can result in serious injury or death. The natural gas in Driftwood's Pipeline would contain a chemical odorant that produces the familiar "natural gas smell."

Methane has an auto-ignition temperature of 1,000 degrees Fahrenheit and is flammable at concentrations between 5.0 percent and 15.0 percent in air. An unconfined mixture of methane and air is not explosive, however it may ignite and burn if there is an ignition source. A flammable concentration within an enclosed space in the presence of an ignition source can explode. It is buoyant at atmospheric temperatures and disperses rapidly in air.

4.13.2.1 Pipeline Safety Standards

The DOT is mandated to prescribe minimum safety standards to protect against risks posed by pipeline facilities under Title 49, U.S.C. Chapter 601. The DOT's Pipeline and Hazardous Materials Safety Administration (PHMSA) administers the national regulatory program to ensure the safe transportation of natural gas and other hazardous materials by pipeline. It develops safety regulations and other approaches to risk management that ensure safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Many of the regulations are written as performance standards which set the level of safety to be attained and allow the pipeline operator to use various technologies to achieve safety. PHMSA's safety mission is to ensure that people and the environment are protected from the risk of pipeline incidents. This work is shared with state agency partners and others at the federal, state, and local level.

Title 49, U.S.C. Chapter 601 provides for a state agency to assume all aspects of the safety program for intrastate facilities by adopting and enforcing the federal standards. A state may also act as DOT's agent to inspect interstate facilities within its boundaries; however, the DOT is responsible for enforcement actions. Section 5(a) of the Natural Gas Pipeline Safety Act provides for a state agency to assume all aspects of the safety program for intrastate facilities by adopting and enforcing the federal standards, while section 5(b) permits a state agency that does not qualify under section 5(a) to perform certain inspection and monitoring functions. The state of Louisiana has section 5(a) certification.

The DOT pipeline standards are published in 49 CFR 190-199. 49 CFR 192 specifically addresses natural gas pipeline safety issues.

Under an MOU on Natural Gas Transportation Facilities dated January 15, 1993, between the DOT and the FERC, the DOT has the exclusive authority to promulgate federal safety standards used in the transportation of natural gas. Section 157.14(a)(9)(vi) of the FERC's regulations require that an applicant certify that it will design, install, inspect, test, construct, operate, replace, and maintain the facility for which a Certificate is requested in accordance with federal safety standards and plans for maintenance and inspection. Alternatively, an applicant must certify that it has been granted a waiver of the requirements of the safety standards by the DOT in accordance with section 3(e) of the Natural Gas Pipeline Safety Act. The FERC accepts this certification and does not impose additional safety standards. If the Commission becomes aware of an existing or potential safety problem, there is a provision in the MOU to promptly alert DOT. The MOU also provides for referring complaints and inquiries made by state and local governments and the general public involving safety matters related to pipelines under the Commission's jurisdiction.

The FERC also participates as a member of the DOT's Technical Pipeline Safety Standards Committee which determines if proposed safety regulations are reasonable, feasible, and practicable.

The pipeline and aboveground facilities associated with the Pipeline must be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR 192. The regulations are intended to ensure adequate protection for the public and to prevent natural gas facility accidents and failures. The DOT specifies material selection and qualification; minimum design requirements; and protection from internal, external, and atmospheric corrosion.

The DOT also defines area classifications, based on population density near the pipeline, and specifies more rigorous safety requirements for populated areas. The class location unit is an area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline. The four area classifications are defined below.

- **Class 1**: location with 10 or fewer buildings intended for human occupancy.
- **Class 2**: location with more than 10 but less than 46 buildings intended for human occupancy.
- **Class 3**: location with 46 or more buildings intended for human occupancy or where the pipeline lies within 100 yards of any building, or small well-defined outside area occupied by 20 or more people on at least 5 days a week for 10 weeks in any 12-month period.
- **Class 4**: location where buildings with four or more stories aboveground are prevalent.

Class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. For instance, pipelines constructed on land in Class 1 locations must be installed with a minimum depth of cover of 30 inches in normal soil and 18 inches in consolidated rock. Class 2, 3, and 4 locations, as well as drainage ditches of public roads and railroad crossings, require a minimum cover of 36 inches in normal soil and 24 inches in consolidated rock.

Class locations also specify the maximum distance to a sectionalizing block valve (*e.g.*, 10.0 miles in Class 1, 7.5 miles in Class 2, 4.0 miles in Class 3, and 2.5 miles in Class 4). Pipe wall thickness and pipeline design pressures; hydrostatic test pressures; maximum allowable operating pressure (MAOP); inspection and testing of welds; and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas. The class location and high consequence areas (HCA) determination (and milepost location) for each section of the Pipeline based on Driftwood's initial assessment are summarized in table 4.13-1.

Table 4.13-1

Initial Assessment of Pipeline Class and HCA Locations

Parish	Pipeline Milepost Start	Pipeline Milepost End	Pipeline Distance (miles)	Class Location	HCA	HCA by Milepost Start	HCA by Milepost End
Calcasieu	0.0	0.80	0.8	Class 1 [a]	No	-	-
	0.80	5.50	4.7	Class 1	Yes [b]	1.50	4.09
	5.50	6.22	0.72	Class 2	Yes [a]	5.51	9.59
	6.22	6.52	0.3	Class 1	No	-	-
	6.52	9.25	2.73	Class 3	No	-	-
	9.25	11.21	1.96	Class 1	No	-	-
	11.21	11.93	0.72	Class 2	Yes [a]	11.24	11.93
	11.93	12.14	0.21	Class 3	Yes [a]	11.93	12.14
	12.14	12.76	0.62	Class 2	Yes [a]	12.14	12.76
	12.76	15.68	2.92	Class 1	Yes [a]	12.76	14.00
	15.68	17.56	1.88	Class 2	Yes [a]	15.70	17.50
	17.56	23.40	5.84	Class 1	Yes [a]	18.10	19.88
						22.70	23.40
	23.40	24.02	0.62	Class 2	Yes [a]	23.40	24.02
	24.02	25.48	1.46	Class 1	Yes [a]	24.02	24.60
	25.48	26.64	1.16	Class 2	Yes [a]	25.48	26.64
	26.64	26.79	0.15	Class 1	Yes [a]	26.64	26.79
	26.79	27.76	0.97	Class 2	Yes [a]	26.79	27.76
	27.76	29.12	1.36	Class 1	No	-	-
	29.12	29.61	0.49	Class 2	No	-	-
Calcasieu	29.61	30.66	1.05	Class 1	No	-	-
	30.66	31.50	0.84	Class 2	Yes [a]	30.70	31.50
	31.50	39.04	7.54	Class 1	No	-	-
Jefferson Davis	39.04	67.49	28.45	Class 1	No	-	-
Acadia	67.49	75.05	7.56	Class 1	No	-	-
Evangeline	75.05	95.94	20.89	Class 1	Yes [a]	92.28	93.41

[a] Piping wall thickness equal to Class 3 specification
[b] HCA based on 20 or more Buildings Intended for Human Occupancy

If a subsequent increase in population density adjacent to the right-of-way results in a change in class location for the pipeline, Driftwood would reduce the MAOP or replace the segment with pipe of sufficient grade and wall thickness, if required to comply with the DOT requirements for the new class location.

The DOT Pipeline Safety Regulations require operators to develop and follow a written integrity management program that contain all the elements described in 49 CFR 192.911 and address the risks on each transmission pipeline segment. The rule establishes an integrity management program which applies to all HCA.

The DOT has published rules that define HCAs where a gas pipeline accident could do considerable harm to people and their property and requires an integrity management program to minimize the potential for an accident. This definition satisfies, in part, the Congressional mandate for DOT to prescribe standards that establish criteria for identifying each gas pipeline facility in a high-density population area.

The HCAs may be defined in one of two ways. In the first method an HCA includes

- current Class 3 and 4 locations,
- any area in Class 1 or 2 where the potential impact radius[46] is greater than 660 feet and there are 20 or more buildings intended for human occupancy within the potential impact circle,[47] or
- any area in Class 1 or 2 where the potential impact circle includes an identified site.

An identified site is an outside area or open structure that is occupied by 20 or more persons on at least 50 days in any 12-month period; a building that is occupied by 20 or more persons on at least 5 days a week for any 10 weeks in any 12-month period; or a facility that is occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate.

In the second method, an HCA includes any area within a potential impact circle which contains

- 20 or more buildings intended for human occupancy, or
- an identified site.

Once a pipeline operator has determined the HCAs along its pipeline, it must apply the elements of its integrity management program to those segments of the pipeline within HCAs. The DOT regulations specify the requirements for the integrity management plan at section 192.911. The HCAs have been determined based on the relationship of the pipeline centerline to other nearby structures and identified sites. Of the 95.9 miles of proposed pipeline route, Driftwood has identified about 22.8 miles that would be classified as an HCA. The pipeline integrity management rule for HCAs requires inspection of the pipeline HCAs every 7 years.

The DOT prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. Each pipeline operator is required to establish an emergency plan that includes procedures to minimize the hazards of a natural gas pipeline emergency. Key elements of the plan include procedures for 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;

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[46] The potential impact radius is calculated as the product of 0.69 and the square root of: the MAOP of the pipeline in psig multiplied by the square of the pipeline diameter in inches.

[47] The potential impact circle is a circle of radius equal to the potential impact radius.

- emergency system shutdown and safe restoration of service;
- making personnel, equipment, tools, and materials available at the scene of an emergency; and
- protecting people first and then property, and making them safe from actual or potential hazards.

The DOT requires that each operator establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a natural gas pipeline emergency, and to coordinate mutual assistance. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public officials. Driftwood would provide informational meetings and training at the request of the Parish and conduct periodic safety training and mock emergency response drills (including tabletop exercises) for the emergency response teams and management organizations.

4.13.2.2 Pipeline Accident Data

The DOT requires all operators of natural gas transmission pipelines to notify the DOT of any significant incident and to submit a report within 30 days. Significant incidents are defined as any leaks that

- caused a death or personal injury requiring hospitalization, or
- involve property damage of more than $50,000 (1984 dollars)[48].

During the 20 year period from 1996 through 2015, a total of 1,265 significant incidents were reported on the more than 300,000 total miles of natural gas transmission pipelines nationwide.

Additional insight into the nature of service incidents may be found by examining the primary factors that caused the failures. Table 4.13-2 provides a distribution of the causal factors as well as the number of each incident by cause.

The dominant causes of pipeline incidents are corrosion and pipeline material, weld or equipment failure constituting 50.7 percent of all significant incidents. The pipelines included in the data set in table 4.13-2 vary widely in terms of age, diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline.

The frequency of significant incidents is strongly dependent on pipeline age. Older pipelines have a higher frequency of corrosion incidents and material failure, because corrosion and pipeline stress/strain is a time-dependent process.

[48] $50,000 in 1984 dollars is approximately $112,955.73 as of May 2015 (CPI, Bureau of Labor Statistics, 2015).

Table 4.13-2

Natural Gas Transmission Dominant Incident Causes, 1996-2015[a]

Incident [a]		Number of Incidents	Percentage
Pipeline material, weld, or equipment failure		354	27.0
Corrosion		311	23.7
Excavation [b]		210	16.0
All other causes [b]		165	12.6
Natural forces [c]		146	11.1
Outside force [d]		84	6.4
Incorrect operation		40	3.1
	Total	*1,310*	*100*

[a] DOT 2016.

[b] All other causes includes miscellaneous, unspecified, or unknown causes.

[c] Natural forces damage includes earth movement, heavy rain, floods, landslides, mudslides, lightning, temperature, high winds, and other natural force damage.

[d] Outside force damage includes previous mechanical damage, electrical arcing static electricity, fire/explosion, fishing/maritime activity, intentional damage, and vehicle damage (not associated with excavation).

The use of both an external protective coating and a cathodic protection system,[49] required on all pipelines installed after July 1971, significantly reduces the corrosion rate compared to unprotected or partially protected pipe.

Outside force, excavation, and natural forces are the cause in 33.5 percent of significant pipeline incidents. These result from the encroachment of mechanical equipment such as bulldozers and backhoes; earth movements due to soil settlement, washouts, or geologic hazards; weather effects such as winds, storms, and thermal strains; and willful damage. Table 4.13-3 provides a breakdown of external force incidents by cause.

Older pipelines have a higher frequency of outside forces incidents partly because their location may be less well known and less well marked than newer lines. In addition, the older pipelines contain a disproportionate number of smaller-diameter pipelines; which have a greater rate of outside forces incidents. Small-diameter pipelines are more easily crushed or broken by mechanical equipment or earth movement.

Since 1982, operators have been required to participate in "One Call" public utility programs in populated areas to minimize unauthorized excavation activities 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 pre-construction information to contractors or other maintenance workers on the underground location of pipes, cables, and culverts.

[49] Cathodic protection is a technique to reduce corrosion (rust) of the natural gas pipeline through the use of an induced current or a sacrificial anode (like zinc) that corrodes at faster rate to reduce corrosion.

Table 4.13-3

Outside Force Incidents by Cause (1996-2015) [a]

Cause	Number of Incidents	Percent of All Incidents [b, c]
Third party excavation damage	172	13.6
Heavy rains, floods, mudslides, landslides	74	5.7
Vehicle (not engaged with excavation)	49	3.7
Earth movement, earthquakes, subsidence	32	2.4
Lightning, temperature, high winds	27	2.1
Operator/contractor excavation damage	25	1.9
Unspecified excavation damage/previous damage	13	1.0
Natural force (unspecified and other)	13	1.0
Fire/explosion	9	0.7
Fishing or maritime activity	9	0.7
Other outside force	9	0.7
Previous mechanical damage	6	0.5
Intentional damage	1	0.1
Electrical arcing from other equipment/facility	1	0.1
Total	*440*	*33.5*

[a] DOT 2016

[b] Percentage of all incidents was calculated as a percentage of the total number of incidents natural gas transmission pipeline significant incidents (i.e., all causes) presented in table 4.13-2.

[c] Due to rounding, column does not equal 33.5 percent.

4.13.2.3 Impact on Public Safety

The service incidents data summarized in table 4.13-4 include natural gas transmission system failures of all magnitudes with widely varying consequences.

Table 4.13-4 presents the annual injuries and fatalities that occurred on natural gas transmission lines from incidents for the 5 year period between 2011 and 2015. The majority of fatalities from pipelines are due to local distribution pipelines not regulated by FERC. These are natural gas pipelines that distribute natural gas to homes and businesses after transportation through interstate natural gas transmission pipelines. In general, these distribution lines are smaller-diameter pipes and/or plastic pipes which are more susceptible to damage. Local distribution systems do not have large rights-of-way and pipeline markers common to the FERC regulated natural gas transmission pipelines. Therefore, incident statistics inclusive of distribution pipelines are inappropriate to use when considering natural gas transmission projects.

Table 4.13-4

Injuries and Fatalities - Natural Gas Transmission Pipelines [a]

Year	Injuries		Fatalities	
	Employees	Public	Employees	Public
2011	1	0	0	0
2012	3	4	0	0
2013	0	2	0	0
2014	1	0	1	0
2015	12	2	6	0

[a] DOT 2015.

The nationwide totals of accidental fatalities from various anthropogenic and natural hazards are listed in table 4.13-5 in order to provide a relative measure of the industry-wide safety of natural gas transmission pipelines. Direct comparisons between accident categories should be made cautiously, however, because individual exposures to hazards are not uniform among all categories. The data nonetheless indicate a low risk of death due to incidents involving natural gas transmission pipelines compared to the other categories. Furthermore, the fatality rate is much lower than the fatalities from natural hazards such as lightning, tornados, or floods.

Table 4.13-5

Nationwide Accidental Deaths

Type of Accident	Annual Number of Fatalities Nationwide [a]
Motor vehicles [a]	35,369
Poisoning [a]	38,851
Falls [a]	30,208
Drowning [a]	3,391
Fire, smoke inhalation, burns [a]	2,760
Floods [b]	81
Tornado [b]	72
Lightning [b]	49
Hurricane [b]	47
Natural gas distribution pipelines [c]	13
Natural gas transmission pipelines [c]	2

[a] Accident data presented for motor vehicle, poisoning, falls, drowning, fire, smoke inhalation, and burns represent the annual accidental deaths recorded in 2013 (CDC 2013)

[b] Accident data presented for floods, tornados, lightning, and hurricanes represent the 30 year average of accidental deaths between 1985 and 2014 (NOAA, 2016.

[c] Accident data presented for natural gas distribution lines and transmission pipelines represent the 20-year average between 1996 and 2015 (DOT 2016a).

The available data show that natural gas transmission pipelines continue to be a safe, reliable means of energy transportation. From 1996 to 2015, there was a national average of 65.4 significant incidents, 9.1 injuries and 2.3 fatalities per year. For Louisiana over the past 20 years there was an average of 10.6 incidents and 0.6 injury per year with only 0.3 fatality per year over that time period, well below the national average. The number of significant incidents over the more than 300,000 miles of natural gas transmission lines indicates the risk is low for an incident at any given location. The operation of the Pipeline would represent a slight increase in risk to the nearby public.

4.13.2.4 Safety Standards During Pipeline Operations and Maintenance

Public-protection Measures

Prior to the operations of the Pipeline, DWPL has committed to establishment of measures to safely operate the facilities and infrastructure, including periodic training and emergency response drills for permanent staff, compliance with PHMSA regulations (49 CFR 192), routine pipeline ground and remote surveillance and preventative maintenance activities, as well as response strategies to deal with the unlikely occurrence of an incident.

The frequency of ground surveillance patrols on the pipeline would be determined by class location (as detailed in the Continuing Pipeline Surveillance Plan), and details or findings of the inspections would be documented by DWPL. Such information can include any encroachments to the pipeline right-of-way (by construction, vandalism,. or erosion), vegetation/root maintenance, damaged/missing pipeline markers, exposed pipe, or any other areas of concern which can affect the reliability of safety of the Pipeline. As described elsewhere, DWPL would establish a regularly scheduled ground patrols, as well as leak detection by ground patrol during pipeline operations, as required in operating plans. Periodic air reconnaissance flights would occur based on class location and assessed risk to detect encroachment or damage to the Pipeline right-of-way. Any unusual situation (or condition) that is reported would be investigated immediately. These additional measures further sustain that Pipeline operations would remain highly reliable and would provide public safety.

System Reliability Design

The Pipeline would adhere to regulatory requirements through the establishment of a process safety design basis and loss prevention measures. This would enable system reliability to the Pipeline through early planning and the establishment of HAZIDs, safety studies, safety reviews, and surveillance mechanisms (e.g., gas and leak detection, alarms). Designed contingency measures (e.g., ESD, isolation systems) are also incorporated to promptly detect the unlikely the event of hazardous conditions, and able to respond to the subsequent hazards.

Emergency response techniques of shutdown and isolations would be followed without delay to prevent escalation of the event or the introduction of additional hazards. A combination of the following mitigation strategies would be incorporated into the process safety design basis to prevent and control the potential risk of escalation:

- inherently safe pipeline layout (through sufficient spacing);
- detection and notification of incidental releases/fires;
- use of emergency-shutdown and depressurizing systems to isolate, depressurize, and reduce hazardous inventories; and

- passive and active fire protection as appropriate.

System Control and Leak Detection

For system controls, DWPL would install a remote Supervisory Control and Data Acquisition system capable of operating from two independent locations. One center would be in control authority at any one time and would monitor operations in real-time. The system would provide constant surveillance and allow identification of and response to abnormal operations of the pipeline and its three compressor stations.

Implementation of these aspects of pipeline safety design requirements contribute to the continued safety of natural gas pipelines.

4.14 CUMULATIVE IMPACTS

The CEQ regulations for implementing NEPA, at 40 CFR 1508.7, define cumulative impacts as: "impacts on the environment which result from the incremental impact of the [proposed] action when added to other past, present, and reasonably foreseeable future actions…"

The Project area as it occurs today reflects a mixture of natural processes and human disturbance influenced by innumerable activities over thousands of years. Large-scale modification of the landscape began in the mid to late 18th century when the Spanish gained control of the Louisiana territory. During this time, settlers began to dig ditches for drainage and build levees to hold back river overflows (Chambers, 1925).

Following the Civil War, farmers in southwestern Louisiana turned rice into the primary cash crop. A new wave of immigrants during the late 19th century bolstered the further development of the land for rice cultivation. During this time, improvements were made in water management that allowed production of more crops in areas that were previously not suitable for farming (Fontenot and Freeland, 1976). The lumber industry within southwestern Louisiana also grew following the Civil War, with the arrival of railroads in the late 19th century.

Development and technology continued to advance the agricultural and timber industries into the 20th century. The Calcasieu Ship Channel was initially dredged in the 1920's and deepened in the late 1930's and again in the 1950's and 1960's to allow larger, deeper-draft vessels to navigate from the Gulf of Mexico to Lake Charles. Rapid growth in the oil and gas industry also began in the early 20th century. Salt domes within Calcasieu Parish were exploited and pipelines were constructed to carry oil and gas products to refineries in Beaumont and Baton Rouge. This expansion of the oil and gas industry aided the expansion of roads and other infrastructure. Today, oil and gas extraction, transport, and related services, as well as timber and rice production, remain prominent contributors to the local economy.

The continued development of the land within southwestern Louisiana for agricultural, timber, and oil and gas activities are the primary contributors to the existing baseline for natural resources in the Project area. These industries, along with the development and maintenance of the Calcasieu Ship Channel have further aided in the ongoing growth of industrial facilities, primarily associated with the Port of Lake Charles.

Overall, natural and human-induced processes continue to contribute to the baseline conditions present within southwestern Louisiana. Concerning these past activities, the CEQ issued an interpretive memorandum on June 24, 2005, regarding analysis of past actions, which stated: “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.” These activities are included herein to provide historical context.

To understand the contribution of past actions to the cumulative effects of the proposed action, this analysis relies on current environmental conditions as a proxy for the effects of past actions. Existing conditions reflect the aggregate effects of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects. In this analysis, we generally consider the effects of past projects within the resource-specific geographic scopes as part of the affected environment (environmental baseline) which was described previously. However, this analysis does consider, as applicable, the present effects of past actions.

In accordance with the CEQ regulations and guidance, we identified other actions near the Driftwood facilities and evaluated the potential for a cumulative impact on the environment. This analysis evaluates other actions that affect resources also affected by the Project, within the resource-specific geographic scopes described below. Actions outside the geographic scopes are generally not evaluated because their potential to contribute to a cumulative impact diminishes with increasing distance from the projects.

As described throughout this final EIS, constructing and operating the Project would have both temporary and permanent effects on the environment. Also as described, we find that construction and operation of the LNG Facility would permanently convert the remaining natural areas at the site to industrial areas, which would affect natural resources such as soils, surface and groundwater, wetlands, vegetation, and wildlife habitat. Operation of the Project would produce ongoing air and noise emissions. We also find that the LNG Facility would affect the human environment, including short-term contributions to the local economy during construction, and long-term contributions during ongoing operations, including additional marine and roadway traffic, additional use of public services, and additional structures in the Project viewshed. We find that most impacts of the Pipeline would be temporary and short-term during construction and restoration of the construction right-of-way. Long-term or permanent impacts would occur where the operational easement would be cleared of forest and maintained in a grassy condition, and where compressor stations would be maintained as industrial space and would produce air emissions and noise during operation. Permanent impacts also would occur at aboveground facilities and permanent new access roads.

Based on our review of the Project, we have concluded that the Project’s effects on natural resources would be generally contained within the LNG Facility site and the pipeline construction right-of-way and extra workspaces. Erosion control measures, for example, would keep disturbed soils within work areas. Consequently, most of the construction impacts on natural resources would generally be localized and are not expected to significantly contribute to regional cumulative impacts. Exceptions exist where the impacts may migrate outside of designated work areas and potentially contribute to cumulative impacts, specifically turbidity during in-water work, changes to the visual landscape, and construction and operational air emissions and noise.

For the purposes of this analysis, we considered the following natural resources: groundwater, surface water; wetlands; vegetation; wildlife; fisheries and aquatic resources; land use, recreation, and visual resources; cultural resources; and air quality and noise. In addition, we considered socioeconomic impacts including changes to marine and roadway traffic. For each resource, the potential direct and indirect impacts associated with the Project are discussed in relation to the cumulative effects that may occur when considered with other past, present, or reasonably foreseeable projects within the geographic scope of analysis, identified in table 4.14-1.

During our scoping process, we received several comments regarding the volume of traffic associated with construction of the LNG Facility and for current/ongoing projects that affect the same roads; increased pressure on housing availability and public services, such as police and emergency personnel, that would be associated with the construction workforce for the LNG Facility when combined with the construction workforces for the current and ongoing projects; and other socioeconomic resources (section 1.3.1, table 1.3-1). These impacts generally increase as the number of temporary construction personnel increases.

In addition, we received comments about the related benefit that the Project would have by increasing the number of jobs in the area. We note that the overall economy of the Lake Charles area includes several large construction projects and that workers often move to new projects as old projects are completed.

Table 4.14-1

Resource-specific Geographic Scopes

Environmental Resource	Geographic Scope
Geological Resources	Construction workspace right-of-way (ROW)
Soils	Construction workspace/ROW
Water Resources	Surface Water: Hydrologic Unit Code-12 (HUC 12) boundaries (see table 4.14-6) Groundwater: HUC 12 boundaries.
Wetlands	HUC 12 boundaries.
Vegetation	HUC 12 boundaries.
Wildlife and Aquatic Resources	HUC 12 boundaries.
Threatened, Endangered, and other Special Status Species	HUC 12 boundaries.
Land Use, Recreation, and Visual Resources	Land Use and Recreation: ROW and a 1-mile buffer; Visual Resources and Aesthetics: 2 miles from the LNG Facility; 0.25-mile from pipeline and aboveground facilities.
Socioeconomics	Socioeconomics: Parishes intersected by the Project. Environmental Justice: Census tracts within affected parishes.
Cultural Resources	Overlapping impacts within the Area of Potential Effects (APE).
Air Quality [1]	Construction: 0.25 mile from pipeline or aboveground facilities. Operation: 50-km radius surrounding Project components causing air emissions.
Noise	Construction: NSAs within 0.25 mile of the pipeline or aboveground facilities, and within 0.5 mile of HDD or direct pipe installation. Operation: Any facility that could have an impact on an NSA within 1 mile of a Project stationary facility
Reliability and Safety	Construction workspace/ROW.

[1] We note that GHGs do not have a localized geographic scope. GHG emissions from the project combine with projects all over the planet to increase CO_2, methane and other GHG concentrations in the atmosphere.

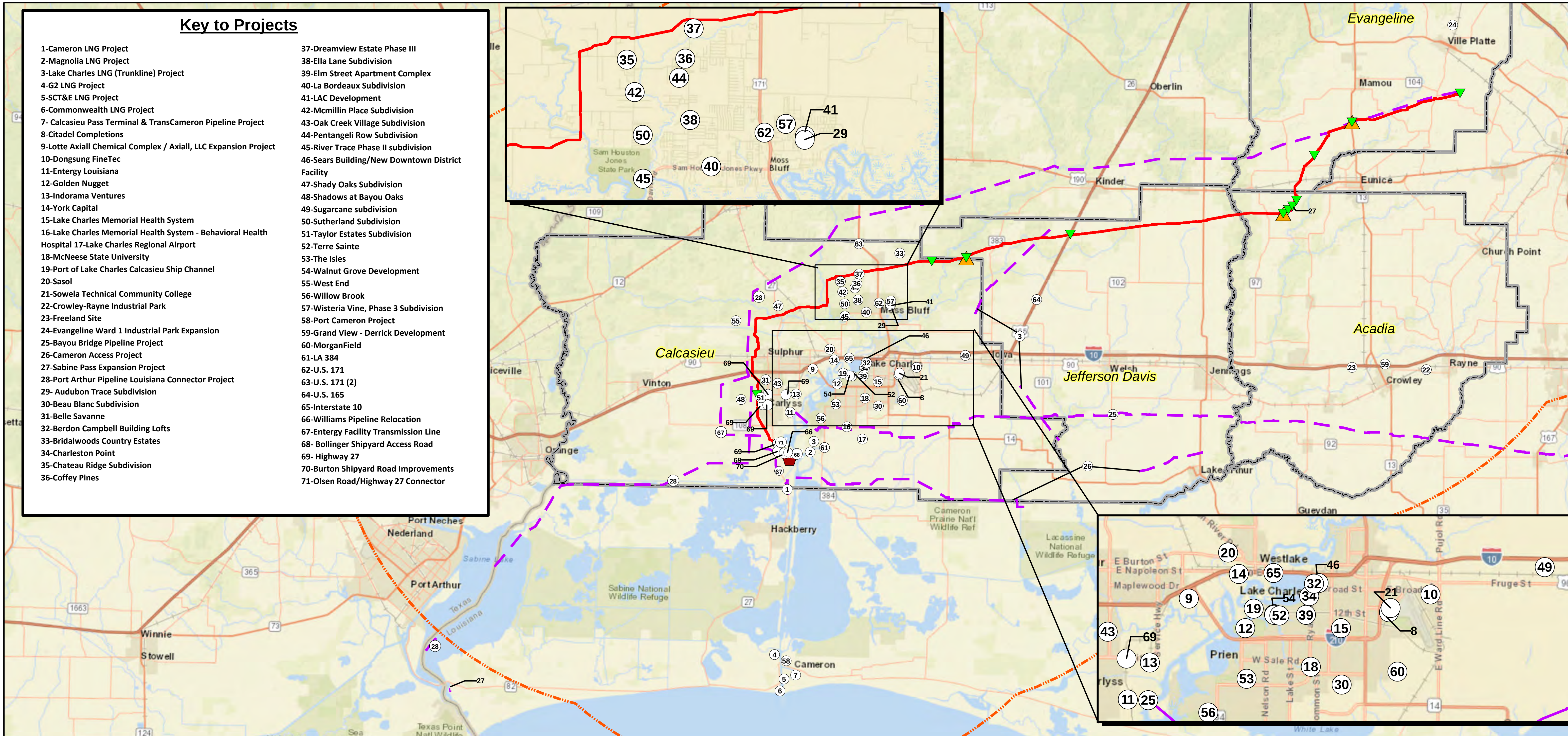
In addition to the geographic relationship between the Project and other projects in the area, we also considered temporal relationships. Past actions that currently contribute to effects on resources are considered in our analysis. Reasonably foreseeable projects that may be authorized in the near future and could be constructed at about the same time period as the Project were also included. Constructing the LNG Facility is expected to take about seven years, and construction of the Pipeline would be conducted in three phases, followed by two years of restoration monitoring

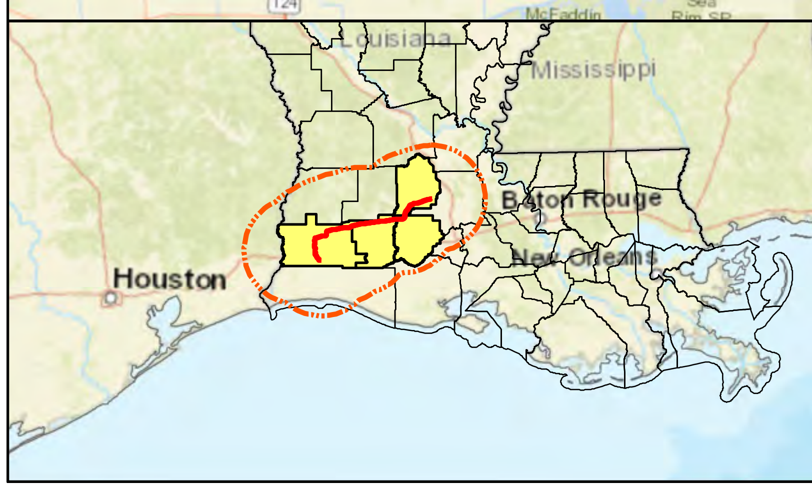
4.14.1 Projects within the Geographic Scope of Analysis

Projects within the geographic scope of analysis are shown on figure 4.14-1 and figure 4.14-2, and listed in tables in appendix A. Projects considered in this cumulative impacts analysis include industrial facilities, pipelines, housing developments, commercial developments, energy projects, and transportation/infrastructure projects. These projects were identified through an independent review of publicly available information, aerial and satellite imagery, consultations with federal agencies, information provided by the Applicant and potentially affected landowners, and comments submitted into the Commission's administrative record.

In Appendix A, the tables address the following subjects:

- Table 4.14-2 lists the other projects considered in the cumulative impacts analysis for land-disturbing and other nearby impacts that could contribute to cumulative impacts on the following resources: groundwater, surface water, wetlands, vegetation, wildlife, land use, recreation, visual resources, cultural resources, and noise. This table identifies the type of project, the distance from the Driftwood LNG Project, a short description, the construction and operation timeline, the number of workers required, and the approximate size of the action. Finally, the table identifies the relevant geographic scope for the resources listed above potentially affected by each project and whether it is associated with the cumulative analysis for the LNG Facility or the Pipeline (or both).
- Table 4.14-3 summarizes the other projects considered in the cumulative impacts analysis for land-disturbing and other nearby impacts, according to the HUC 12 watershed in which they occur and identifies their impacts on forested areas, wetlands, and waterbodies. Where the other projects span multiple watersheds, they appear multiple times within the table (i.e., under each watershed in which they occur).
- Table 4.14-4 focuses on the projects considered in the cumulative impacts analysis for socioeconomics.
- Table 4.14-5 focuses on the projects considered in the cumulative impacts analysis for air quality.





- Cumulative Project
- Meter Station
- Compressor Station
- DWLNG Facility
- DWPL Pipeline
- Other Linear Project
- Air Quality 50km Geographic Scope Radius
- Parish Boundary (socioeconomic geographic scope)

Miles
0 5 10

Figure 4.14-1

Overview Map of Cumulative Projects
Driftwood LNG Project
Driftwood LNG and Driftwood Pipeline LLC
Calcasieu, Jefferson Davis, Acadia, Evangeline Parishes, Louisiana

Page 1 of 1	Scale: 1:600,000
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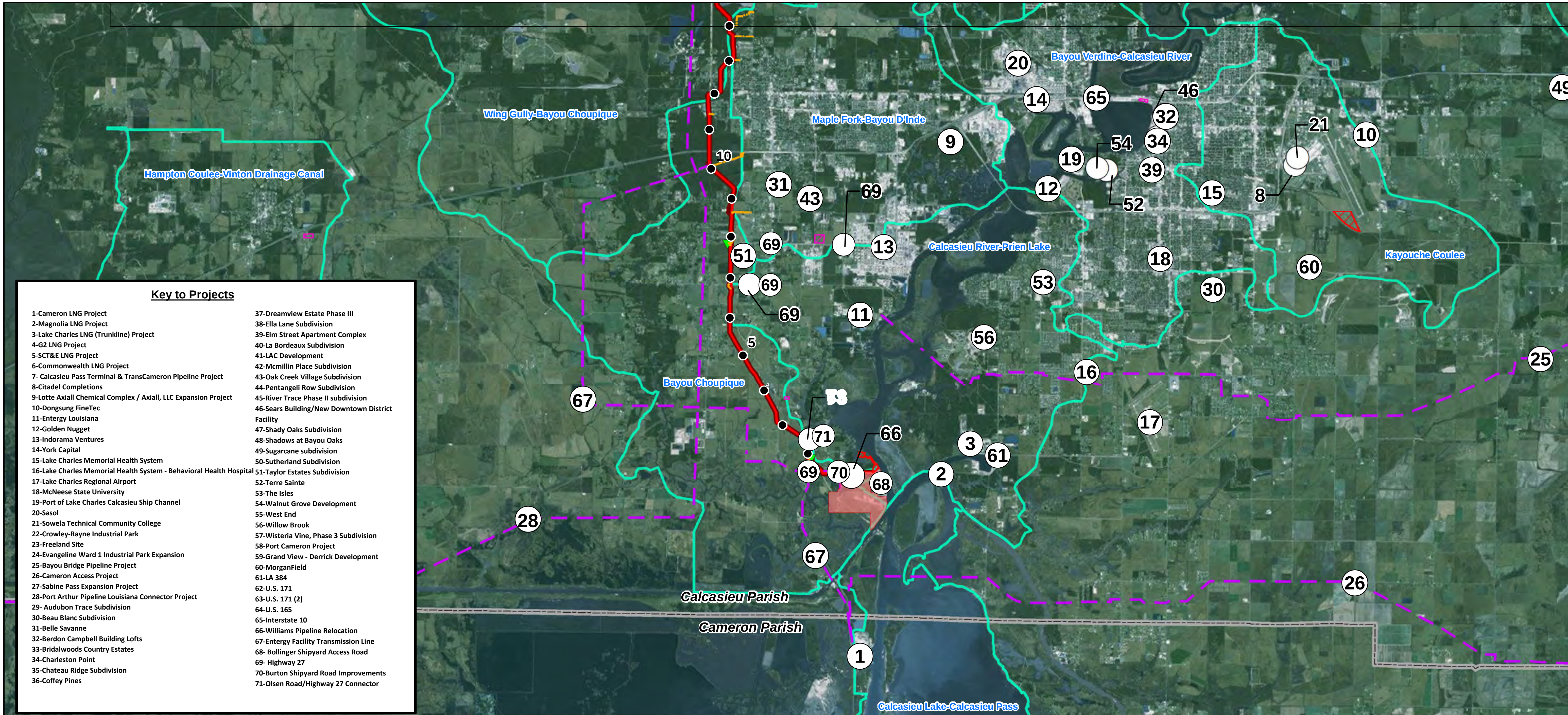

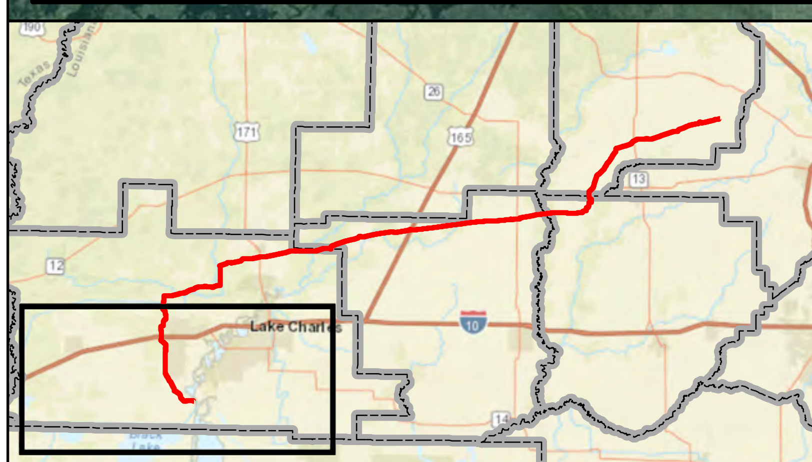

- Milepost
- Other Linear Project
- Cumulative Project
- Meter Station
- HUC 12 Boundary
- Parish Boundary
- DWPL Pipeline
- Park and Ride
- Temporary Offsite Construction Area
- Access Road
- Contractor/Pipe yard
- Compressor Station
- DWLNG Facility

Miles
0 1.5 3

Figure 4.14-2

Aerial Map of Cumulative Projects
Driftwood LNG Project
Driftwood LNG and Driftwood Pipeline LLC
Calcasieu Parish, Louisiana

Page 1 of 4	Scale: 1:150,000
NAD83 StatePlane LA S 1702	Date: November, 2017

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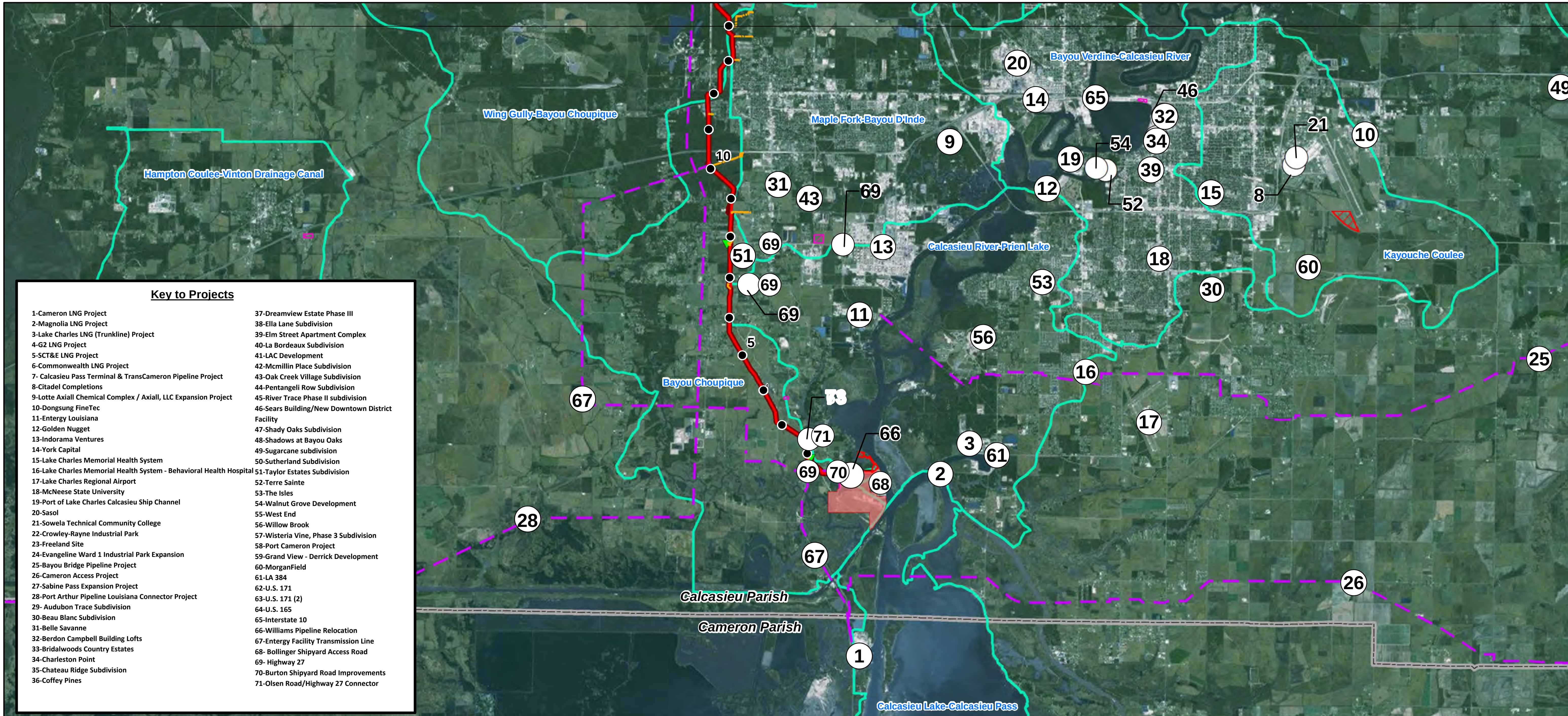

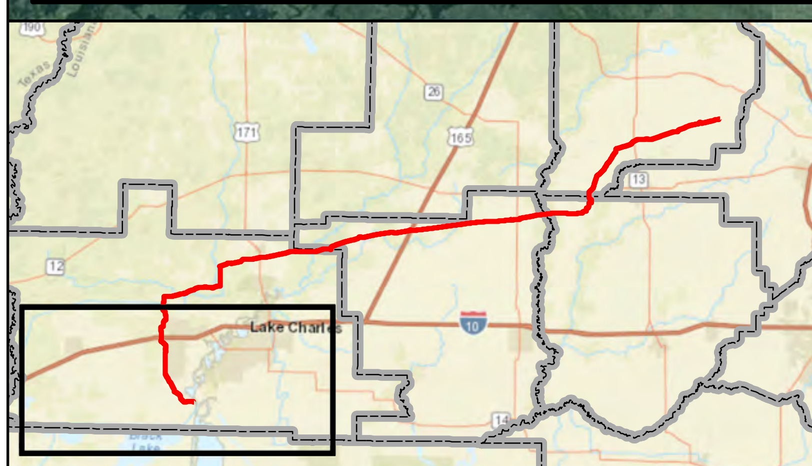

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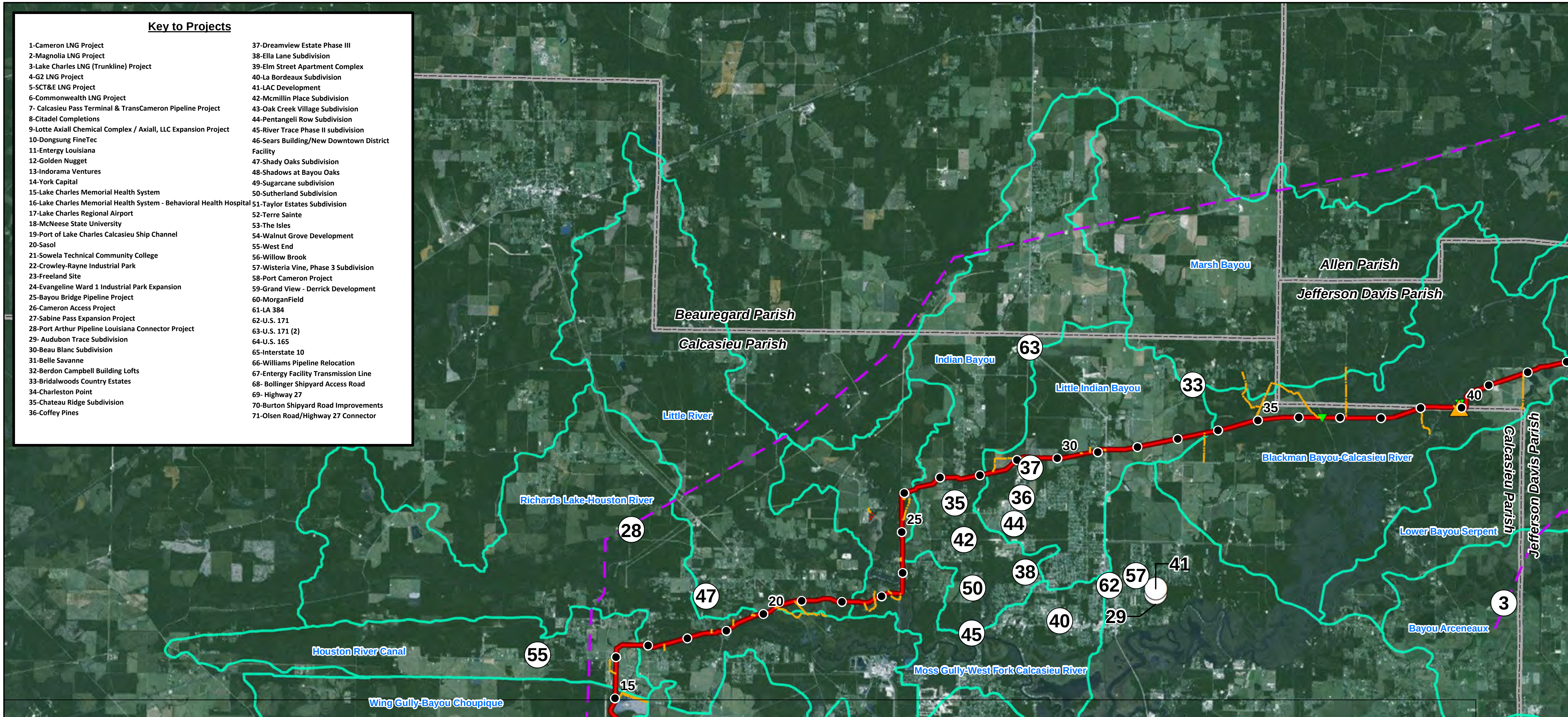
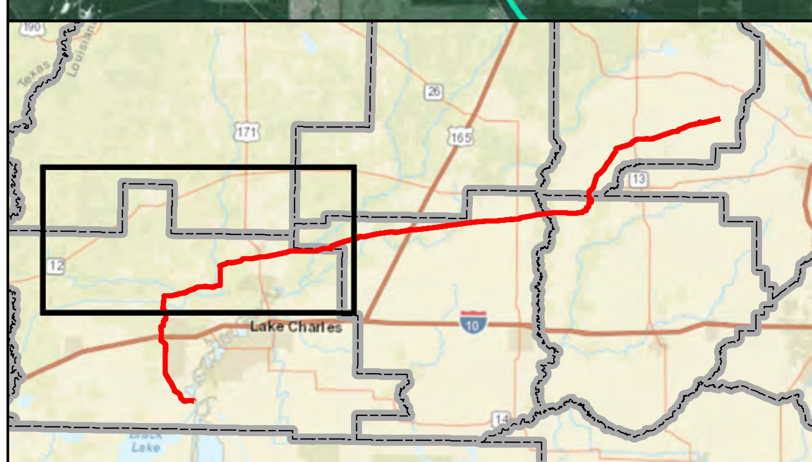
Author: CW

Key to Projects

1-Cameron LNG Project
2-Magnolia LNG Project
3-Lake Charles LNG (Trunkline) Project
4-G2 LNG Project
5-SCT&E LNG Project
6-Commonwealth LNG Project
7- Calcasieu Pass Terminal & TransCameron Pipeline Project
8-Citadel Completions
9-Lotte Axiall Chemical Complex / Axiall, LLC Expansion Project
10-Dongsung FineTec
11-Entergy Louisiana
12-Golden Nugget
13-Indorama Ventures
14-York Capital
15-Lake Charles Memorial Health System
16-Lake Charles Memorial Health System - Behavioral Health Hospital
17-Lake Charles Regional Airport
18-McNeese State University
19-Port of Lake Charles Calcasieu Ship Channel
20-Sasol
21-Sowela Technical Community College
22-Crowley-Rayne Industrial Park
23-Freeland Site
24-Evangeline Ward 1 Industrial Park Expansion
25-Bayou Bridge Pipeline Project
26-Cameron Access Project
27-Sabine Pass Expansion Project
28-Port Arthur Pipeline Louisiana Connector Project
29- Audubon Trace Subdivision
30-Beau Blanc Subdivision
31-Belle Savanne
32-Berdon Campbell Building Lofts
33-Bridalwoods Country Estates
34-Charleston Point
35-Chateau Ridge Subdivision
36-Coffey Pines
37-Dreamview Estate Phase III
38-Ella Lane Subdivision
39-Elm Street Apartment Complex
40-La Bordeaux Subdivision
41-LAC Development
42-Mcmillin Place Subdivision
43-Oak Creek Village Subdivision
44-Pentangeli Row Subdivision
45-River Trace Phase II subdivision
46-Sears Building/New Downtown District Facility
47-Shady Oaks Subdivision
48-Shadows at Bayou Oaks
49-Sugarcane subdivision
50-Sutherland Subdivision
51-Taylor Estates Subdivision
52-Terre Sainte
53-The Isles
54-Walnut Grove Development
55-West End
56-Willow Brook
57-Wisteria Vine, Phase 3 Subdivision
58-Port Cameron Project
59-Grand View - Derrick Development
60-MorganField
61-LA 384
62-U.S. 171
63-U.S. 171 (2)
64-U.S. 165
65-Interstate 10
66-Williams Pipeline Relocation
67-Entergy Facility Transmission Line
68- Bollinger Shipyard Access Road
69- Highway 27
70-Burton Shipyard Road Improvements
71-Olsen Road/Highway 27 Connector





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- Compressor Station
- DWLNG Facility

Miles
0 1.5 3

Figure 4.14-2

Aerial Map of Cumulative Projects
Driftwood LNG Project
Driftwood LNG and Driftwood Pipeline LLC
Calcasieu & Jefferson Davis Parishes, Louisiana

Page 2 of 4	Scale: 1:150,000
NAD83 StatePlane LA S 1702	Date: November, 2017

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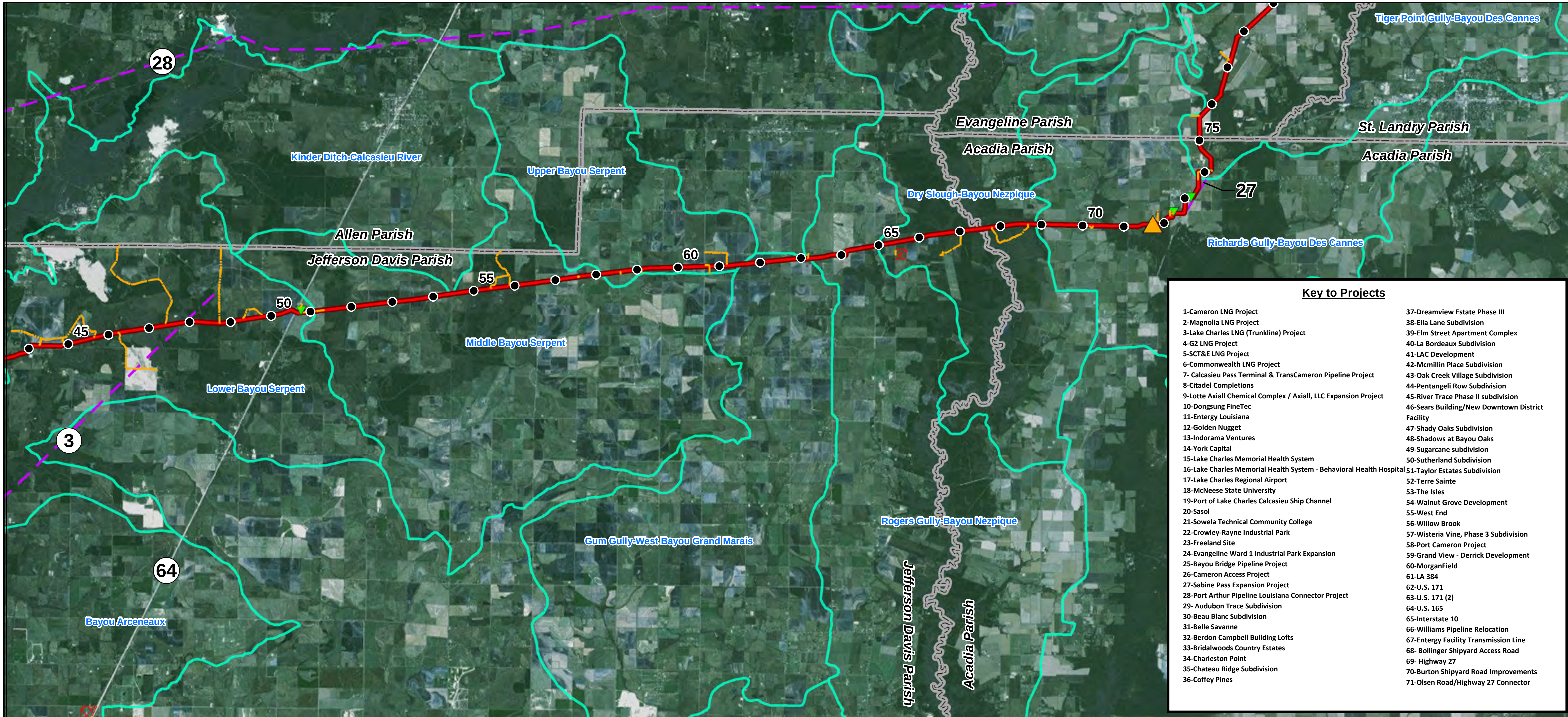

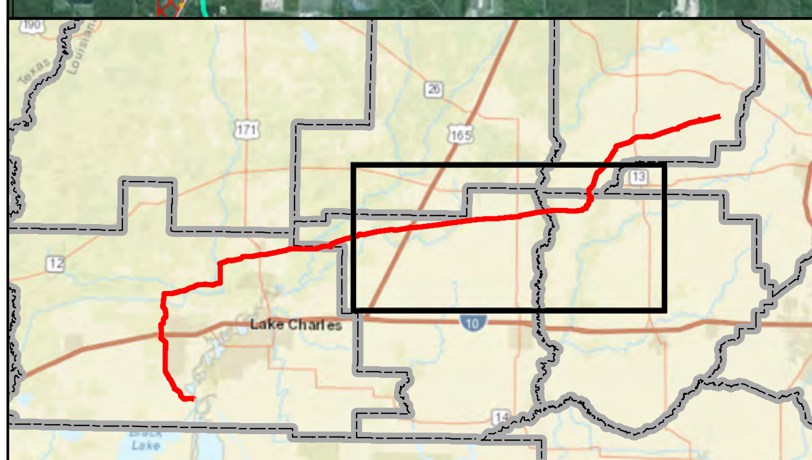

- Milepost
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- Compressor Station
- DWLNG Facility

Miles
0 1.5 3

Figure 4.14-2

Aerial Map of Cumulative Projects
Driftwood LNG Project
Driftwood LNG and Driftwood Pipeline LLC
Jefferson Davis & Acadia Parishes, Louisiana

Page 3 of 4	Scale: 1:150,000
NAD83 StatePlane LA S 1702	Date: November, 2017

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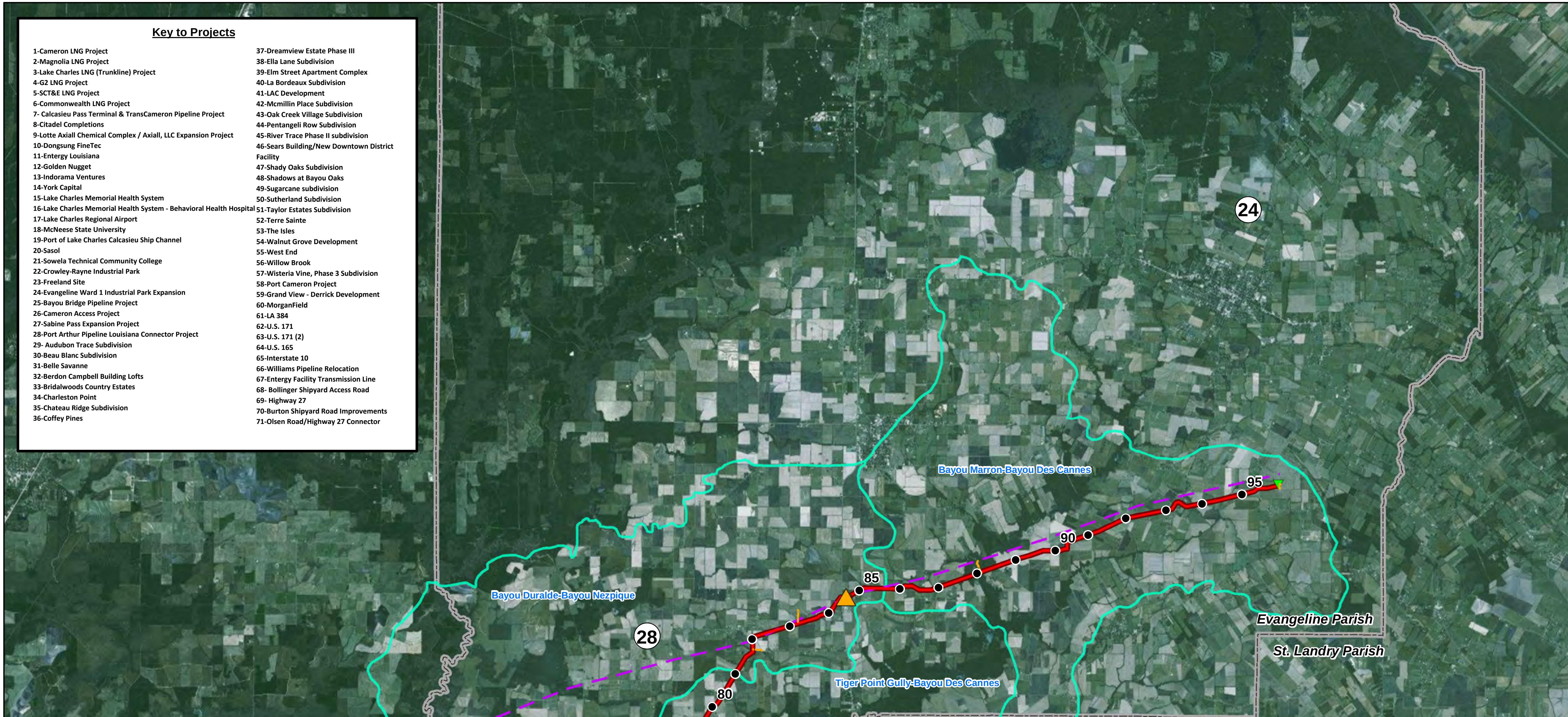

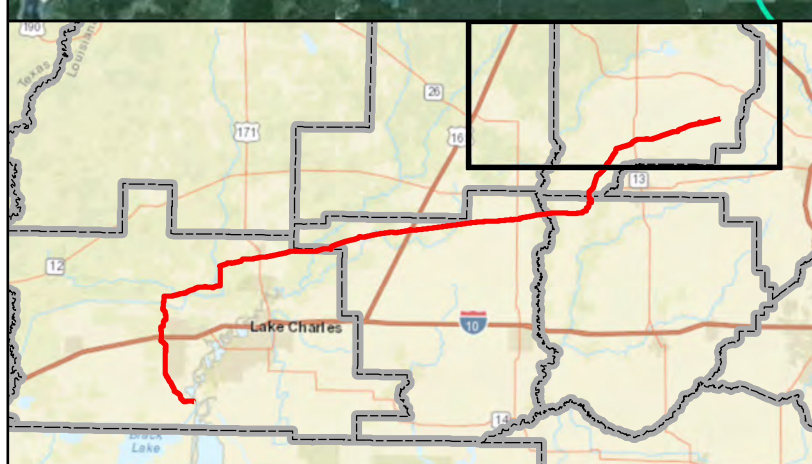

Milepost
Other Linear Project
Cumulative Project
Meter Station
HUC 12 Boundary
Parish Boundary
DWPL Pipeline
Park and Ride
Temporary Offsite Construction Area
Access Road
Contractor/Pipe yard
Compressor Station
DWLNG Facility

0 1.5 3 Miles

Figure 4.14-2

Aerial Map of Cumulative Projects
Driftwood LNG Project
Driftwood LNG and Driftwood Pipeline LLC
Evangeline Parish, Louisiana

Page 4 of 4	Scale: 1:150,000
NAD83 StatePlane LA S 1702	Date: November, 2017

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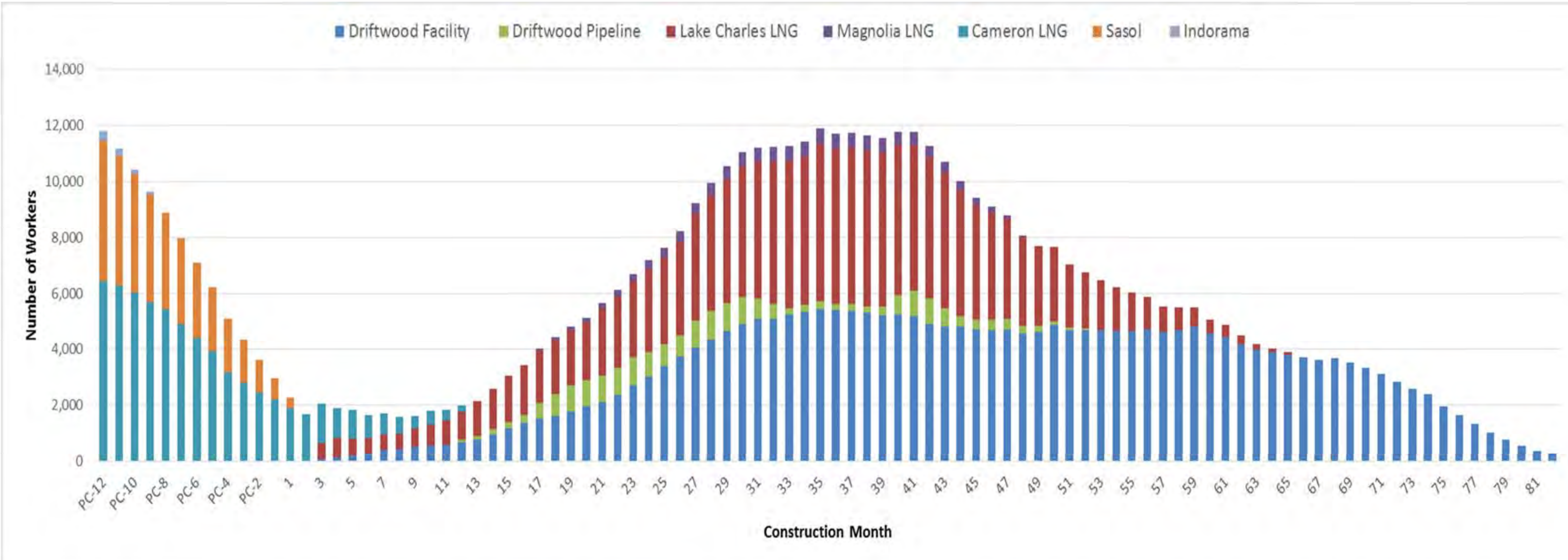

Notes:
PC: Pre-construction months
In cases where detailed project schedules were not available (Indorama, Sasol), workforce peaks were estimated to occur in the middle of the construction period and to ramp up/down linearly from the estimated start and end dates.
In cases where project start dates are not known, start dates were assumed to be such that workforce peaks align with Driftwood's, in order to estimate the worst case scenario.

Figure 4.14-3: Estimated Cumulative Construction Workforce Curve

The LNG Facility is located in three HUC 12 watersheds, and the Pipeline crosses 22 HUC 12 watersheds. Additionally, temporary workspaces supporting construction of the LNG Facility in the greater Lake Charles area would be located in an additional five HUC 12 watersheds. The 28 HUC 12 watersheds have a combined area of 803,516 acres. The Driftwood LNG Project would have a total construction area of 2,759.6 acres (about 0.34 percent of the total watershed area). The other projects within the same watersheds have a total impact area of about 6,959 acres (about 0.87 percent of the total watershed area). For the majority of the watersheds, the total acreage of the Driftwood LNG Project and other identified projects would be less than 1 percent of the watershed's area, with the exception of the Bayou Verdine-Calcasieu River watershed where the total acreage would be about 13 percent of the watershed area. Table 4.14-6 lists the watersheds crossed by the Project, along with each watershed's size in acres, the acres affected by other projects, the acres affected by the Project within each watershed, and the percent of the watershed affected by the Project and by the other projects.

Table 4.14-6

Cumulative Impact Acreage Within HUC 12 Watersheds Affected by the Driftwood LNG Project

Activity	Acres [a]	Percent of Watershed
Louisiana		
Calcasieu Lake-Calcasieu Pass	**78,126**	**0.1**
Other Identified Projects [b]	37.6	
Driftwood Pipeline and Associated Facilities	9.72	
Bayou Choupique	**26,626**	**4.2**
Other Identified Projects [b]	356.6	
Driftwood Pipeline and Associated Facilities	765.7	
Calcasieu River-Prien Lake	**29,603**	**5.1**
Other Identified Projects [b]	1363.6	
Driftwood Pipeline and Associated Facilities	158.7	
Wing Gully-Bayou Choupique	**28,632**	**0.6**
Other Identified Projects [b]	134.8	
Driftwood Pipeline and Associated Facilities	41.2	
Maple Fork-Bayou D'Inde	**22,306**	**2.6**
Other Identified Projects [b]	533.7	
Driftwood Pipeline and Associated Facilities	53.6	
Houston River Canal	**9,025**	**0.8**
Other Identified Projects [b]	47.2	
Driftwood Pipeline and Associated Facilities	26.9	
Richards Lake-Houston River	**29,725**	**0.5**
Other Identified Projects [b]	88.1	
Driftwood Pipeline and Associated Facilities	53.5	
Little River	**22,333**	**0.4**
Other Identified Projects [b]	47.5	
Driftwood Pipeline and Associated Facilities	39.4	
Moss Gully-West Fork Calcasieu River	**14,854**	**0.5**
Other Identified Projects [b]	0	
Driftwood Pipeline and Associated Facilities	67.3	

Table 4.14-6

Cumulative Impact Acreage Within HUC 12 Watersheds Affected by the Driftwood LNG Project

Activity	Acres [a]	Percent of Watershed
Indian Bayou	**19,329**	**0.2**
Other Identified Projects [b]	0	
Driftwood Pipeline and Associated Facilities	39.7	
Little Indian Bayou	**12,747**	**1.2**
Other Identified Projects [b]	56.6	
Driftwood Pipeline and Associated Facilities	90.4	
Blackman Bayou-Calcasieu River	**25,254**	**0.8**
Other Identified Projects [b]	0	
Driftwood Pipeline and Associated Facilities	208.2	
Lower Bayou Serpent	**38,185**	**1.2**
Other Identified Projects [b]	284.4	
Driftwood Pipeline and Associated Facilities	170.8	
Middle Bayou Serpent	**36,037**	**0.3**
Other Identified Projects [b]	0	
Driftwood Pipeline and Associated Facilities	109.9	
Kinder Ditch-Calcasieu River	**29,339**	**0**
Other Identified Projects [b]	0	
Driftwood Pipeline and Associated Facilities	0.3	
Upper Bayou Serpent	**13,776**	**0.4**
Other Identified Projects [b]	0	
Driftwood Pipeline and Associated Facilities	59.2	
Gum Gully-West Bayou Grand Marais	**33,805**	**0.1**
Other Identified Projects [b]	0	
Driftwood Pipeline and Associated Facilities	28.2	
Rogers Gully-Bayou Nezpique	**38,812**	**0.1**
Other Identified Projects [b]	0	
Driftwood Pipeline and Associated Facilities	30	
Dry Slough-Bayou Nezpique	**25,137**	**0.4**
Other Identified Projects [b]	0	
Driftwood Pipeline and Associated Facilities	99.5	
Richards Gully-Bayou Des Cannes	**31,831**	**0.6**
Other Identified Projects [b]	68.5	
Driftwood Pipeline and Associated Facilities	136.4	
Tiger Point Gully-Bayou Des Cannes	**27,813**	**0.5**
Other Identified Projects [b]	0	
Driftwood Pipeline and Associated Facilities	132.2	
Bayou Duralde-Bayou Nezpique	**37,789**	**0.8**
Other Identified Projects [b]	186.8	
Driftwood Pipeline and Associated Facilities	96.7	
Bayou Marron-Bayou Des Cannes	**40,724**	**0.7**

Table 4.14-6

Cumulative Impact Acreage Within HUC 12 Watersheds Affected by the Driftwood LNG Project

Activity	Acres [a]	Percent of Watershed
Other Identified Projects [b]	148.6	
Driftwood Pipeline and Associated Facilities	144.5	
Bayou Arceneaux	**29,919**	**0.8**
Other Identified Projects [b]	151.9	
Driftwood Pipeline and Associated Facilities	90.1	
Bayou Verdine-Calcasieu River	**24,542**	**13**
Other Identified Projects [b]	3,175.6	
Driftwood Pipeline and Associated Facilities	6.1	
Hampton Coulee - Vinton Drainage Canal	**34,823**	**<0.1**
Other Identified Projects [b]	0	
Driftwood Pipeline and Associated Facilities	13.4	
Kayouche Coulee	**17,057**	**2.1**
Other Identified Projects [b]	277.4	
Driftwood Pipeline and Associated Facilities	85.5	
Marsh Bayou	**25,367**	**<0.1**
Other Identified Projects [b]	0	
Driftwood Pipeline and Associated Facilities	2.5	

[a] Estimated acreage based on information provided in publicly available project mapping and on an assumed 100-foot-wide construction corridor. Projects for which disturbance estimates were not publicly available were not included in total acreage.

[b] Only impacts within HUC 12 watersheds affected by the Project are included in this table.

4.14.1.1 FERC-jurisdictional LNG and Pipeline Projects

There are nine FERC regulated natural gas projects (LNG and pipeline) within the geographic scope of analysis: Sabine Pass Expansion Project (CP17-22-000), Cameron LNG Project (CP13-25-000, CP15-560-000), Lake Charles LNG (Trunkline) Project (CP14-120-000), Magnolia LNG Project (CP14-347-000), Calcasieu Pass Terminal and TransCameron Pipeline Project (CP15-550-000, CP15-551-000), Port Arthur Pipeline Louisiana Connector Project (CP18-7-000), Commonwealth LNG Project (formerly Waller LNG) (PF17-8-000), Cameron Access Project (CP15-109-000), and Monkey Island LNG Project (formerly SCT&E LNG Project) (which is not yet in the pre-filing process at FERC). Additional details regarding each project can be obtained through our website at www.ferc.gov by using our eLibrary system and the docket number given for each project.

Sabine Pass Expansion Project

The Sabine Pass Expansion Project consists of modifications to four existing meter stations, three new compressor units, meter replacement, and pipeline laterals and interconnections to existing natural gas pipelines in Acadia, Cameron, and Evangeline Parishes. It would be about 54 miles northeast of the LNG Facility but within 120 feet of the Pipeline centerline. Proposed workspaces for both projects overlap. The Sabine Pass Expansion Project would have a peak construction workforce of 250 employees and a permanent workforce of two employees. Construction would affect about 81 acres within three watersheds including two crossed by the Project: Richards Gully-Bayou Des Cannes and Bayou Marron-Bayou Des Cannes watersheds. This project received its FERC Order in November 2017 and has a target in-service date in April 2019.

Cameron LNG Project

The Cameron LNG Terminal started operation as an LNG import terminal in 2009 and is currently constructing LNG export facilities. The import facilities include vaporization units, three LNG storage tanks, and two LNG carrier berths. In total, the Liquefaction Project (CP13-25-000) and Expansion Project (CP15-560-000) authorized five liquefaction plants and five LNG storage tanks. Additional detail is provided in section 3.4.1. The Cameron LNG Terminal is located on the Calcasieu Ship Channel, near Hackberry, Louisiana, about four miles south of the Driftwood LNG Facility site. These Cameron LNG Projects would have a peak construction workforce of 7,045 employees and a permanent workforce of 130 employees. The Liquefaction Project would permanently affect about 502 acres and the Expansion Project would affect 60 acres within the Liquefaction Project site in the Black Lake Bayou-Alkali Ditch and Calcasieu Lake-Calcasieu Pass watersheds, consisting of 70 acres within the existing terminal fenceline and 432 contiguous acres adjacent to the terminal. Construction of the liquefaction facilities began in October 2014 with operations expected to begin in 2019.

Lake Charles LNG (Trunkline) Project

The Lake Charles LNG Terminal started operation as an LNG import terminal in 1982 and is currently authorized to construct and operate liquefaction facilities. The existing facilities include vaporization units, a single LNG storage tank, and an LNG carrier berth. These existing facilities would not contribute to cumulative impacts on wetlands, land use, or similar resources but continues to contribute to air emission impacts. The authorized export facilities include three liquefaction plants and two new segments of pipeline (11.4 miles and 6.5 miles) at remote locations of the Trunkline pipeline system. The Lake Charles LNG Terminal is on an industrial canal on the east side of the Calcasieu Ship Channel, about 3 miles northeast of the Driftwood LNG Facility site. One segment of the associated pipeline crosses the Pipeline at about MP 47.9. The Lake Charles LNG Project would have a peak construction workforce of 5,600 employees and a permanent workforce of 176 employees. The export facilities would affect about 785 acres in the Calcasieu River-Prien Lake watershed, and the associated pipeline segment would affect about 244 acres in the Bayou Arceneaux and Lower Bayou Serpent watersheds. Construction began in 2016 with a target in-service date of 2019; however, progress reports indicate that construction is not currently active.

Magnolia LNG Project

The Magnolia LNG Project would include four liquefaction plants, two LNG storage tanks, and two LNG carrier berths. The project is on an industrial canal on the east side of the Calcasieu Ship Channel, about 2 miles east of the Driftwood LNG Facility site. The project has a target in-service date of 2019. The Magnolia LNG Project would have a peak construction workforce of 542 employees for the LNG terminal and 270 for the pipeline and appurtenant facilities, with a permanent workforce of 190 employees. Construction would affect about 129 acres within the Calcasieu River-Prien Lake watershed. Construction was scheduled to begin in August 2016 and require a total construction period of 45 months; however, construction has not started.

Calcasieu Pass Terminal and TransCameron Pipeline Project (formerly Liberty Services Facility / DeHyco Services / Martin Midstream Services)

The Calcasieu Pass Terminal and TransCameron Pipeline Project would include 10 liquefaction plants, two LNG storage tanks, two LNG carrier berths, and a 23.4-mile feed gas pipeline. Additional detail is provided in section 3.4.1. The site is on the east side of the Calcasieu Ship Channel near the Gulf of Mexico, about 20 miles south of the Driftwood LNG Facility site and 22 miles south of the Pipeline, in Cameron Parish, Louisiana. The feed-gas pipeline would extend to the east of the terminal, also within Cameron Parish. The Calcasieu Pass Terminal and TransCameron Pipeline Project would have a peak construction workforce of 1,810 employees and a permanent workforce of 130 employees. Construction would affect about 1,069 acres with a portion of the project occurring in the Calcasieu Lake-Calcasieu Pass watershed. The FERC review schedule is anticipated to be complete in 2018 with construction taking place shortly after that, should the Commission approve the project.

Port Arthur Pipeline Louisiana Connector Project

The Port Arthur Pipeline Louisiana Connector Project consists of about 135 miles of new 42-inch-diameter natural gas pipeline, one new compressor station, and interconnect facilities in east Texas and western Louisiana. A portion of the project in Louisiana would be in Calcasieu and Evangeline Parishes, about 3 miles west of the LNG Facility site and collocated at various locations with the Pipeline between MPs 5.6 and 16.2. The Port Arthur Pipeline Louisiana Connector Project would have a peak construction workforce of 820 employees and a permanent workforce of 20 employees. Construction would affect about 1,980 acres within 13 watersheds including seven crossed by the Driftwood LNG Project: Bayou Choupique, Bayou Duralde-Bayou Nezpique, Dry Slough-Bayou Nezpique, Bayou Marron-Bayou Des Cannes, Houston River Canal, Little River, Richards Lake-Houston River, and Wing Gully-Bayou Choupique watersheds. The anticipated construction schedule is from first quarter 2020 to third quarter 2022.

Commonwealth LNG Project (formerly Waller LNG)

The Commonwealth LNG Project would include eight liquefaction plants, six LNG storage tanks, an LNG carrier berth, and a 3.7-mile pipeline. Additional detail is provided in section 3.4.1. The terminal site is on the west side of the Calcasieu Ship Channel near the Gulf of Mexico, about 22 miles south of the LNG Facility site and Pipeline, in Cameron Parish, Louisiana. Commonwealth's feed-gas pipeline would extend north of the terminal, also within Cameron Parish. The Commonwealth Project would have a peak construction workforce of 700 employees and a permanent workforce of 100-200 employees. Construction would affect about 180 acres in the Calcasieu Lake-Calcasieu Pass watershed. The anticipated construction schedule is from 2019 to 2022.

Cameron Access Project

The Cameron Access Project includes 34 miles of new 30-inch- and 36-inch-diameter natural gas transmission pipelines and compression facilities in Jefferson Davis, Cameron, and Calcasieu Parishes. At its nearest point, the project is about 1 mile south of the LNG Facility site and 2.5 miles south of the Pipeline at its nearest point. The Cameron Access Project was placed into service in March 2018 and has a permanent workforce of three employees. Construction affected about 560 acres with a portion of the project occurring in the Calcasieu Lake-Calcasieu Pass watershed. Construction began in 2015 and was completed in 2018.

Monkey Island LNG Project (formerly SCT&E LNG Project)

The Monkey Island LNG Project, formerly the SCT&E LNG Project, is a planned facility that would include six liquefaction plants, at least one 160,000 m^3 LNG storage tank, LNG berthing facilities, and pipeline laterals and interconnections to existing natural gas pipelines. The terminal site is on Monkey Island in the Calcasieu Ship Channel, about 21 miles south of the Driftwood LNG Project. The Monkey Island LNG Project would have a peak construction workforce of 2,000 employees and a permanent workforce of 200 employees. Construction would affect about 246 acres within Calcasieu Lake-Calcasieu Pass watershed. The construction timeline has not been determined; however, operations are expected to begin in 2022.

4.14.1.2 Non FERC-jurisdictional Pipelines

Williams Pipeline Relocation

The Williams Pipeline Relocation Project would move one pipeline that currently crosses the LNG Facility site. About 7,000 feet of existing 6-inch-diameter hydrocarbon pipeline is currently in an area where Driftwood would construct permanent facilities. This pipeline would be relocated to area within the Driftwood LNG Facility footprint but away from Driftwood's permanent facilities. Construction is anticipated in 2018 and would disturb 6.2 acres.

Bayou Bridge Pipeline Project

Bayou Bridge Pipeline, LLC proposes to construct about 163 miles of new 24-inch-diameter crude oil pipeline. The pipeline route extends from Lake Charles, Louisiana, to St. James, Louisiana. The construction timeline has not been determined. The construction workforce is estimated to be 2,500, with 12 staff needed for operations. The project would disturb about 2,107 acres within 10 watersheds, including the Calcasieu River - Prien Lake watershed.

4.14.1.3 Energy Projects

Entergy Louisiana has one project under construction in the Lake Charles area and is proposing a second project to support the proposed Benoit Switching Station and the Driftwood LNG Project. The Entergy Louisiana Lake Charles area project is located about 3.8 miles from the Project. The project consists of constructing two new substations, expanding two existing substations, and adding 25 miles of high-voltage transmission line. Construction started in 2016 and operation is anticipated to commence in 2018. The transmission lines would disturb about 3,000 acres of land. Disturbance associated with the substations is not available.

The second Entergy Louisiana project is the nonjurisdictional transmission line for the Driftwood LNG Project. Transmission lines would connect the switchyard via the existing Mud Lake 230 kV substation and the planned Big Lake 230 kV substation located south of the Facility in Cameron Parish. The transmission lines from those substations would be approximately 5.6 and 5.0 miles long, respectively. Construction is scheduled for 2022 and would disturb about 333 acres.

4.14.1.4 Industrial Projects

Sasol Project

Sasol Project Ltd. is constructing a petrochemical complex with an ethane cracker and six chemical manufacturing plants. A gas-to-liquids facility may be included at the site, depending on a final investment decision that has been delayed. Construction on the Ethane Cracker complex started in 2015, with operation anticipated in 2018 (SWLA Economic Development Alliance, 2017). The construction peak workforce was estimated at 5,000, while operations would require 500 employees (SWLA Economic Development Alliance, 2017). The project is located 10 miles northeast of the LNG Facility site and about 4 miles southeast of the Pipeline. The project would disturb 3,034 acres in the Bayou Verdine-Calcasieu River watershed.

Dongsung FineTec

Dongsung FineTec Co. Ltd. is proposing a cryogenic insulation production facility for Calcasieu Parish. According to the April 2017 update of the SWLA Economic Development Alliance, the project is still pending final approval (SWLA Economic Development Alliance, 2017). The construction workforce is estimated to be 20, with an operation workforce of 200 (SWLA Economic Development Alliance, 2017). The site is located 13 miles northeast of the LNG Facility and 10 miles south of the Pipeline and does not share a watershed with the Project.

Lotte Axiall Chemical Complex / Axiall, LLC Expansion Project

Axiall Corporation in cooperation with Lotte Chemical is constructing a chemical facility to produce ethylene and a new ethane cracker for ethylene production in Lake Charles, Louisiana. Construction started in June 2016, with plans to begin operations in 2019. The site is located 8.1 miles northeast of the LNG Facility and 5.5 miles east of the Pipeline. The construction workforce is estimated to be 2,000, with an operation workforce of 215 employees. The project would be located in the Maple Fork- Bayou D'Inde watershed.

AAR Maintenance, Repair, and Overhaul facility at Chennault International Airport

AAR opened a maintenance, repair, and overhaul facility at Chennault International Airport in Lake Charles, Louisiana, in 2014. AAR occupies six hangars at the airport as part of the maintenance, repair, and overhaul facility. The project is located 13.1 miles northeast of the Project and employs an estimated 750 operational workers.

Indorama Ventures

Indorama Ventures is renovating a dormant ethane cracker facility for the production of ethylene and propylene. Renovation started in 2015-2016 and was complete in 2017. The site is located 5.6 miles north of the LNG Facility site and 3.7 miles east of the Pipeline. The construction workforce is estimated to be 600 with an operation workforce of 125 employees.

York Capital (formerly Juniper GTL)

York Capital is converting a former industrial facility into a natural gas-to-liquids plant. The project is anticipated to finish in 2018. The construction workforce is estimated at 125 with an operation workforce of 29 employees. The site is located 9.8 miles northeast of the LNG Facility site and 5.2 miles south of the Pipeline.

4.14.1.5 Transportation, Port, and Road Improvement Projects

There are multiple ongoing and planned infrastructure projects within the geographic scope of analysis (see appendix A). The Lake Charles Regional Airport is rehabilitating a runway. Several interstates, highways, bridges, and commercial and community roads will be improved, reconditioned, extended, widened, replaced, and resurfaced. Construction and planning is ongoing, with most projects disturbing less than 30 acres.

Improvements to the Port of Lake Charles Calcasieu Ship Channel facilities include rebuilding the wharf and storage facility, new administrative building, and other capital improvements. Completion of the Port of Lake Charles Calcasieu Ship Channel renovations is anticipated in 2019. A new port built on the Calcasieu Ship Channel will be named the Port Cameron Project, which would disturb 500 acres with a peak construction workforce of 9,785 and a peak operation workforce of 3,860. Construction of the Port Cameron Project is projected to begin in 2018 and last four years.

4.14.1.6 Medical and Educational Projects

Two projects for the Lake Charles Memorial Health System are planned: a new behavioral health hospital and at the existing health system facility, expanding emergency services, renovating and adding a new intensive care unit, and adding a new medical office building. Construction of the new facility began in 2016, and construction at the existing health system facility is taking place from 2014 to present. These facilities are located about 5.6 miles northeast of the Driftwood LNG Facility and 6.9 miles northeast of the Pipeline.

Planned educational projects include new buildings and renovations at McNeese State University and the Sowela Technical Community College. McNeese State University is constructing several new buildings and doing renovations to existing buildings. McNeese State University is 8.6 miles from the LNG Facility site and 9.6 miles from the Pipeline. The Sowela Technical Community College has completed construction of a new Regional Training Facility and is building a new Sycamore Student Center. The construction schedule for the new Sycamore Student Center is unknown. Sowela Technical Community College is 12.6 miles northeast of the LNG Facility site and 9.8 miles southeast of the Pipeline.

4.14.1.7 Residential and Commercial Developments

Commercial developments in the geographic scope of analysis (see appendix A, tables 4.14-2 and 4.14-3) include two industrial parks and the expansion of the Golden Nugget Casino. Crowley-Rayne Industrial Park, located off of Highway 90, and Evangeline Ward 1 Industrial Park Expansion, a 96.5 acre site north of Ville Plat, are both currently in operation and have planned expansion and redevelopment. The construction timeline for these industrial parks is unknown. The Golden Nugget Casino completed the expansion in 2017.

Thirty-one residential developments are planned in the area within the cumulative geographic scope of analysis. The majority of these developments are in the Lake Charles area. These developments include 14 subdivisions with over 1,400 homes; six residential developments with over 335 homes; five apartment/townhome/duplex development projects with an unknown number of units; and six residential and commercial projects with at least 800 residences. The projects are in various states of construction, several that have lots and homes available for purchase. Project sizes vary from about <0.5 to 200 acres, although no information on size was available for five projects.

4.14.2 Potential Cumulative Impacts by Resource

The following sections discuss the potential for impacts anticipated from the Project to interact cumulatively with impacts from past, present, and RFFAs listed in appendix A, and that are within the geographic scope for each resource.

4.14.2.1 Geological Resources

Other projects that occur within the area include three FERC-jurisdictional projects, one pipeline relocation, one transmission line, and one road project (tables 4.14-2 and 4.14-3 in appendix A).

As discussed in section 4.1.4, we conclude that the Project would not significantly affect geological resources and that the project design and mitigation measures would avoid impacts resulting from geological events. We also conclude that the Project would not significantly contribute to cumulative impacts on geological resources.

4.14.2.2 Soils

Soil resources are described in section 4.2. Other projects that occur within the soil resources geographic scope of analysis include three FERC-jurisdictional projects, one pipeline relocation, one transmission line, and one road project (tables 4.14-2 and 4.14-3 in appendix A).

Portions of the Pipeline associated with the Lake Charles LNG Project would overlap with the Pipeline at about MP 47.9. The pipeline associated with the Sabine Pass Expansion Project would be 120 feet southeast of the Pipeline centerline at about MP 72.6, with overlap between each project's workspaces. In addition, based on the preliminary route presented to FERC, the Port Arthur Pipeline Louisiana Connector Project may be collocated with the Pipeline at various points between Driftwood's MP 5.6 and 16.2. The remaining three projects listed above are non-jurisdictional facilities associated with the Project and would be within the LNG Facility workspace.

Soil effects due to the Pipeline would be temporary, localized, and limited primarily to workspaces used during construction. The greatest potential for the Pipeline in association with the other projects to cumulatively affect soil resources would be the concurrent construction of collocated pipelines. Following completion of pipeline construction, the rights-of-way would be revegetated and temporary workspaces restored to pre-construction conditions.

Based on the above assessment, we conclude that Project impacts on soils would not contribute significantly to cumulative impacts on soil resources.

4.14.2.3 Water Resources

Other projects that occur within the water resources geographic scope of analysis include 7 other FERC-jurisdictional projects, two pipeline projects, 2 energy projects, 4 industrial facilities, expansion of existing college and medical center facilities, 3 new buildings, 9 road improvement projects, and 26 residential developments (tables 4.14-2 and 4.14-3 in appendix A).

Groundwater

Project impacts on groundwater are described in section 4.3.2. The direct and indirect impacts from the Project on groundwater predominantly would be temporary and minor. Permanent localized and minor impacts would result from alterations in overland flow patterns and groundwater recharge and groundwater withdrawals from the Chicot aquifer.

As described previously, about 360,000 gpd of municipal water would be required during construction, and 260,000 gpd would be required during operations, withdrawn from the Chicot aquifer. The other projects in the water resources geographic scope also would require water from the Chicot aquifer. Groundwater requirements during construction and operations are unavailable for the majority of the projects within the geographic scope, but are available for the Magnolia LNG Project (Construction: 6,000 gpd, Operation: about 170,000 gpd), and the Lake Charles LNG Project (Construction: up to about 240,000 gpd, Operation: 160,000 gpd).

Groundwater use for Project and the above projects would be greatest during concurrent operations, totaling about 590,000 gpd based on the known water withdrawal requirements. Total groundwater withdrawals from the Chicot aquifer in 2014 were estimated at about 850 million gallons per day (USGS, 2014a). The combined anticipated groundwater use of the Project and other projects for which groundwater use information is available would account for about 0.06 percent of the total groundwater withdrawals from the Chicot aquifer. While localized, direct impacts on drawdown levels in the District's Chicot aquifer water supply wells would occur, drawdown from these projects would constitute a minor amount relative to existing water volumes used; therefore, we conclude that the cumulative impact on groundwater or municipal water systems during construction and operation of these facilities would not be significant.

The cumulative withdrawal of groundwater associated with agriculture, industry, municipal, and other water uses can influence local land subsidence. Subsidence may directly affect land elevation and contour and indirectly affect flooding/flood management and wetland loss/conversion to open water habitat. Based on the anticipated proportion of water withdrawals, and the small proportion of drawdown attributable to the LNG Facility relative to existing groundwater use, we conclude that the Project would not significantly contribute to the potential for ground subsidence.

As discussed in section 4.3.2.2, changes to groundwater quality or quantity from the Pipeline and appurtenant facilities would be limited to temporary, localized, and shallow changes due to trenching activities. Because these changes would be minor and localized, we anticipate construction or operation of the pipeline or appurtenant facilities would not have significant cumulative impacts on groundwater quality or quantity.

We conclude that the Driftwood LNG Project, when considered with other projects within the geographic scope for cumulative impacts for water resources, would not contribute significantly to cumulative impacts on groundwater resources within the geographic scope.

Surface Water

Residential developments, building expansions, industrial facilities, compressor stations, and power stations occupy relatively small point locations with localized disturbances compared to linear facilities. The majority of the other projects are in already developed areas and once complete would be maintained, thus limiting their potential to affect waterbody features.

Before any in-water activities could occur for the Project or other projects within the geographic scope for water resources, Driftwood and other project proponents are required to obtain authorization for impacts on jurisdictional waters. These authorizations include review under Section 404 of the CWA from the COE and corresponding Section 401 Water Quality Certification from LDEQ.

Dredging the Marine Facility, MOF, and Pioneer Docks at the same time as in-water activities associated with the other projects, especially those requiring dredging (e.g., Magnolia LNG Project, Lake Charles LNG Project), could exacerbate adverse impacts on surface water quality from increased turbidity and sedimentation. The turbidity and sedimentation modeling conducted by Driftwood (FERC eLibrary Accession Number 20170331-5058) used conditions from March and June 2015 as inputs to the model. Under those conditions, the model predicted offsite deposition of 5-10 mm adjacent to the dredge site for a month of dredging and less than 3 mm for a month of dredging for the channel south of the site. The increase in turbidity levels would be temporary and localized. The analysis conducted for the Magnolia LNG Project resulted in a similar conclusion of localized increases in turbidity during dredging activities, and changes to water quality associated with dredging would be short-term and limited to the time during which dredging occurs. Offsite sedimentation from other major dredging projects in the area would be anticipated to follow a similar pattern, with the potential to contribute to a cumulative impact on sedimentation within the channel. Assuming that three major dredging projects each contributed 3 mm per month of sedimentation to the four miles of channel south of the Project over the course of a year, about 100 mm of sediment or 110,000 cubic yards of sediment would be deposited within the channel. This reach of the channel (i.e., Upper Lake reach) has the greatest rate of sedimentation in the Calcasieu Ship Channel, and some portions require maintenance dredging every year (COE, 2010b). Based on these conservative estimates and three major dredging projects occurring simultaneously, this amount of deposition could increase the COE's maintenance-dredging requirements. However, because the ship channel is dredged frequently, we conclude that the environmental impacts would not be significant.

During operation of the LNG Facility, increased marine vessel traffic associated with the Project, in combination with additional vessel traffic associated with other projects, including the Magnolia LNG and Lake Charles LNG projects, would result in increased ballast-water discharge and cooling-water use. As discussed in section 4.3.3.2, ballast-water discharge and cooling-water use would have very localized impacts on water quality (salinity, temperature, pH, and dissolved oxygen) that would be quickly dissipated by tidal currents and river flow. Because the other projects with ballast-water and cooling-water activities are more than a mile away from the Driftwood LNG Project, and substantial mixing would occur over that distance, the Driftwood LNG Project, would not contribute discernably to cumulative impacts on water quality.

The increased marine vessel traffic would also contribute to shoreline erosion as the vessels transit the Calcasieu Ship Channel and/or maneuver within the turning basin. Where the shorelines have been stabilized with seawalls or armored with riprap, the impacts from wakes tend to be mitigated (Fitzgerald et al., 2011). The COE's analysis of maintenance dredging requirements for the Calcasieu Ship Channel (COE, 2010b) discusses the addition of shoreline protection between Channel Mile 16.7 and 18.7 and the monitoring of shoreline erosion and the evaluation of the need for additional shoreline protection during periodic updates of the analysis. Additionally, Ausenco (2015) noted that vessels in the Calcasieu Ship Channel are required to have a tug assist with maneuvering. With the tug assist, thrust needed to turn a vessel is reduced and the thrust from the tug is less than that from large vessels. Thus, potential impacts from the thrust would be decreased and the shoreline armoring should be sufficient to mitigate erosion. Although the Driftwood LNG Project may contribute to the cumulative shoreline erosion along the channel, this impact is being actively monitored and mitigated through the COE's maintenance of the Calcasieu Ship Channel, and we conclude that the Projects contribution to cumulative impacts on shoreline erosion would not be significant.

Construction and operation of the Pipeline and appurtenant facilities would cross 401 waterbodies; the majority by open-cut methods. Impacts associated with construction would include sedimentation, bank erosion, or uptake and discharge associated with HDD or hydrostatic testing. As discussed in section 4.3.3.2 for the Pipeline, changes to surface water from Pipeline construction would be minor, temporary, and localized, resulting from open-cut construction crossings, stormwater runoff, hydrostatic testing, and potential spills of hazardous materials. In-water activities, such as open-cut pipeline crossing techniques would have the greatest potential for cumulative effects on surface water resources.

Where other linear projects occur concurrently and affect the same surface waters as the Driftwood LNG Project, they may contribute to cumulative impacts on the waterbodies. The Port Arthur Pipeline Louisiana Connector Project would be collocated and share workspace with the Pipeline at various points between Driftwood's MP 5.6 and 16.2. Portions of the pipeline associated with the Lake Charles LNG Project would overlap with the Pipeline at about MP 47.9. The pipeline associated with the Sabine Pass Expansion Project would be 120 feet southeast of the Pipeline centerline at about MP 72.6, with overlap between workspaces.

Open-cut waterbody crossings would temporarily result in increased turbidity and sedimentation in surface waters at the crossing and downstream of the in-water construction area. Although the impacts associated with the Driftwood LNG Project would be minor and temporary (section 4.3.3.2), construction within these waterbodies occurring concurrently with and near in-water activities of the other projects considered, could cumulatively result in greater impacts on surface waters. Because the linear projects considered in this analysis are FERC-jurisdictional, they would be subject to the FERC Procedures, which limit in-water construction duration to 24 or 48 hours, depending on waterbody size, and the potential for the brief period of in-water construction activities for two or more linear projects to occur concurrently is low. We conclude that there is little potential for the Driftwood LNG Project to contribute to significant cumulative impacts on waterbodies during in-water construction. However, downstream sedimentation could accumulate from multiple crossings of the same waterbody.

Where portions of the Project are at least partially collocated with other pipeline projects, concurrent or consecutive construction could cumulatively result in a greater surface disturbance, and thus the potential for increased impacts on water quality associated with stormwater runoff. Project proponents would be required to adhere to LDEQ regulations regarding construction, hydrostatic, and industrial stormwater and wastewater discharges, and FERC-jurisdictional projects (i.e., the linear projects considered by this analysis) would be required to adhere to the FERC Procedures, which specify BMPs to ensure that no sediment leaves the approved workspaces and that no unauthorized discharges into water resources occur. Compliance with these regulations would minimize the potential for projects to cumulatively interact and affect surface water resources. Therefore, we conclude effects on surface water resources from the Project, when considered in combination with other projects occurring concurrently within the geographic scope for surface water impacts, would not significantly contribute to a cumulative impact on water quality from stormwater runoff.

Increased construction and industrial operation activities in and around surface waterbodies could result in an increased potential for spills of hazardous materials. Similar to the Project, other projects would also be required to adhere to regulations associated with the use and storage of hazardous materials, such as SPCC plans (required for onsite storage of certain volumes of fuels or other hazardous liquids) or other BMPs to minimize the potential for spills of hazardous materials to reach surface waters. Therefore, we conclude effects on surface water resources from these projects would be minimized, and the Project, when considered in combination with other projects would not cumulatively result in increases in the potential for hazardous materials affecting surface waters within the geographic scope.

Impacts from the Driftwood LNG Project to surface water resources during construction and operations, when considered cumulatively with impacts from the projects listed above, would be minor and temporary, and would not significantly contribute to cumulative impacts on surface water resources within the geographic scope of analysis.

4.14.2.4 Wetlands

Projects assessed for wetlands are the same as for waterbodies.

Residential developments, building expansions, industrial facilities, compressor stations, and power stations generally occupy areas that are already developed and once complete would be maintained, thus limiting their potential to affect wetland features. Areas disturbed for construction of pipelines and electrical transmission lines within the Projects' geographic scope would be mitigated or restored.

Construction and operation of the LNG Facility would result in the permanent loss of wetland acreage (table 4.5-1). Operation of the Pipeline would result in the permanent conversion of PFO and PSS wetlands to PEM wetlands within a 30-foot-wide corridor, while operation of Pipeline aboveground facilities would also result in permanent loss of 4 PEM, PSS, and PFO wetland acreage (table 4.5-1). The impact on wetlands for each project within the geographic scope (for which this information was publicly available) and the total cumulative impact is shown in table 4.14-3 in appendix A.

Driftwood would follow the Driftwood Plan and Procedures to avoid or minimize effects on wetlands, as well as implement mitigation measures to reduce the potential for hazardous liquids spills. Effects on wetlands would range from temporary and minor for PEM and PSS wetlands to permanent conversion of PFO wetlands to PEM/PSS wetlands within the operational right-of-way and the permanent loss of wetlands in the LNG Facility site. The terms and conditions of Driftwood's Section 404 permits require compensatory mitigation for unavoidable wetland impacts, offsetting these impacts.

The total wetland impacts are shown in table 4.14-3 in appendix A. Generally speaking, the coastal plain environments in which the projects occur contain a great deal of wetland habitat. Still, the permanent impacts of each project must be considered by the COE and mitigation, if appropriate, provided by the project proponent. Therefore, we conclude that the Driftwood LNG Project's impacts on wetlands, in combination with the impacts from these other projects, would not result in significant cumulative impacts on wetland resources.

4.14.2.5 Vegetation Resources

Project effects on vegetation resources would be minor and either temporary or permanent as discussed in section 4.5. Other projects within the geographic scope of analysis for vegetation are the same as those listed for water resources

Construction of the Project would directly affect vegetation communities as the result of compaction and grading and other removal of aboveground plant cover. Construction of the LNG Facility and aboveground facilities associated with the Pipeline would result in the permanent conversion of about 638 acres of existing upland and wetland habitat to industrial use. As discussed in Section 4.5, disturbance associated with construction of the LNG Facility would largely remain disturbed during operation. Cumulative impacts on vegetation would result from the temporary and permanent conversion of vegetation from activities associated with the construction and operation of the Project in combination with the other projects within the geographic scope for vegetation. While wetland impacts would be mitigated as determined through the 401/404 permitting process, conversion of upland vegetation to industrial use would represent a permanent cumulative loss when considered in combination with other projects within the vegetation resources geographic scope.

Changes to vegetation during Pipeline operation and maintenance activities would include the conversion of forested communities to herbaceous upland or wetland communities on the operational right-of-way and maintenance mowing of vegetation communities within the operational right-of-way. These effects would be localized but permanent. Other projects within the vegetation resources geographic scope would cause changes to vegetation communities, similar to the Project. With the exception of new aboveground facilities, construction of the Pipeline and other pipeline projects would have minimal permanent impact on non-forested vegetation, as temporary workspaces would return to pre-construction conditions and the permanent right-of-way would be revegetated; although maintained in an herbaceous state.

The greatest potential for cumulative impacts on vegetation would be construction of the Pipeline and the Port Arthur Pipeline Louisiana Connector Project. The preliminary route presented to FERC for the Port Arthur Pipeline Louisiana Connector Project indicates that there is potential for collocation with the Pipeline at various points along MP 5.6 to MP 16.2.

We received a comment on the draft EIS that the potential impacts of forest fragmentation were not sufficiently disclosed. Areas of collocation would require a wider corridor than that necessary for a single pipeline; however, collocation generally would reduce fragmentation of habitats and is environmentally preferable. From MP 82.0 to MP 95.5 are areas where the two pipelines are not collocated but may occur in proximity to each other, where additional fragmentation could occur. Following completion of these two projects, the rights-of-way would be revegetated and temporary workspaces would be restored to pre-construction conditions.

Portions of the pipeline associated with the Lake Charles LNG Project would overlap with the Pipeline at MP 47.9, and Project workspaces would overlap with the Sabine Pass Expansion Project at about MP 72.6. Similar to the Driftwood and Port Arthur Connector, following completion of these two projects, the rights-of-way would be revegetated and temporary workspaces would be restored to pre-construction conditions. The impact on forested areas for each project within the geographic scope (for which this information was publicly available) and the total cumulative impact is shown in table 4.14-3 in appendix A, and table 4.14-6 lists the percent of each HUC 12 watershed affected by the Project and by the other projects.

If construction of the Pipeline and the Port Arthur Pipeline Louisiana Connector Project, the Lake Charles LNG Project, or the Sabine Pass Expansion Project occurs concurrently, the total period for disturbance would be minimized. This could results in a minimization of cumulative impacts on vegetation compared to construction of multiple projects in short succession.

The impacts from the Driftwood LNG Project to vegetation resources, when considered cumulatively with impacts from other projects within the geographic scope, would result in permanent but minor changes to vegetation resources within the geographic scope.

4.14.2.6 Wildlife

Wildlife habitat is discussed in Section 4.6. Other projects within the geographic scope of analysis for wildlife are the same as those listed for water resources.

Wildlife habitat impacts at the LNG Facility and Pipeline aboveground facilities would result in the permanent conversion of existing upland and wetland habitat to industrial use. Cumulative impacts on wildlife would result from the temporary and permanent loss of wildlife habitat from activities associated with the construction and operation of the Project in combination with the other projects within the geographic scope for wildlife. Temporary and permanent conversion of vegetation to industrial use or different vegetation systems types from activities associated with the construction and operation of the Project and other projects identified in the geographic scope for wildlife would cause the majority of changes to wildlife habitat.

Past and present projects within the wildlife geographic scope also effect wildlife habitat, similar to the Project.

Increased development and cumulative loss of habitat in the geographic scope of analysis would cause wildlife to either adapt to new conditions (in the case of some generalist species) or relocate to undisturbed suitable habitat. Displacement of wildlife could result in additional stress and increased competition in available habitats. In addition, direct mortality of less mobile species may occur as a result of development activities.

Where construction schedules overlap, increased noise, lighting, and human activity could also disturb wildlife in the area. In general, the LNG Facility and portions of the Pipeline are within a developed industrial region where most wildlife in the area has been acclimated to human activity. While portions of the Pipeline cross less developed areas where wildlife may be less acclimated to human activities, disturbances would be temporary. In these areas, wildlife may temporarily displace to nearby suitable habitat, but would likely return following the completion of construction activities.

The greatest potential for cumulative impacts on wildlife from the Pipeline in combination with other projects would be concurrent construction of close-by projects. As previously mentioned, the Port Arthur Pipeline Louisiana Connector Project, the Sabine Pass Expansion Project, and the pipeline associated with the Lake Charles LNG Project would occur in the same of the watersheds as the Pipeline. However, following completion of these projects, the rights-of-way would be revegetated and temporary workspaces would be restored to pre-construction conditions.

If construction of the Pipeline and either the Port Arthur Pipeline Louisiana Connector Project, the Lake Charles LNG Project, or the Sabine Pass Expansion Project occurs concurrently, the total time period for disturbance would be minimized compared to construction of multiple projects in short succession, as for example, human activity would be prolonged in areas of collocation if multiple projects are constructed in short succession. Disturbance would be short-term and wildlife would likely temporarily relocate to nearby suitable habitat. In addition, because habitat crossed by the Pipeline is mostly agricultural land, wildlife in the area is likely already accustomed to human activity.

With the exception of new aboveground facilities, construction of the Pipeline, when considered in combination with other non-adjacent pipeline projects, would cumulatively result in a limited impact on wildlife, since temporary workspace would return to pre-construction conditions and the permanent right-of-way would be revegetated; although maintained in an herbaceous state. Cumulative impacts also would be ameliorated by the distances between the Project and the other past, present, and reasonably foreseeable future projects.

Impacts on migratory birds would be similar to wildlife, however artificial lighting at the LNG Facility could have permanent, but minor impacts. Other projects in the geographic scope would have similar impacts on migratory bird species.

Based on this analysis, we conclude that impacts on wildlife from the Project, when considered in combination with impacts from the other projects in the geographic scope of analysis, would cumulatively contribute to permanent and minor impacts on wildlife within the geographic scope.

4.14.2.7 Fisheries and Aquatic Resources

Project effects on fisheries and aquatic resources are discussed in Section 4.3. The other projects reviewed for cumulative impacts on fisheries and aquatic resources is the same as for water resources.

Aquatic resources would be affected during construction and operation of the LNG Facility by the loss of surface waterbodies from construction and operation and permanent facilities, dredging (including the Marine Facility, MOF, Pioneer Docks, and turning basin), pile driving, hydrostatic testing, vessel traffic, stormwater runoff, and inadvertent spills. Fishery and aquatic resource habitat would be lost by fill of waterbodies during construction of the LNG Facility. This impact would be a permanent loss but mitigation through the Section 404 process would offset this loss through restoration and/or creation of similar habitats within the affected watersheds. Other projects within the geographic scope would also be subject to the Section 404 permitting process and may be required to provide similar mitigation for impacts on these habitats. Although the mitigation for these projects would offset the overall impacts on fishery and aquatic resources, the location, configuration, type, maturity, and other aspects of these resources would be affected by the cumulative impacts of the projects.

Dredging and pile driving for other LNG facilities within the geographic scope of analysis, including the Magnolia LNG Project and Lake Charles LNG Project, would have similar impacts on the estuarine habitat, and if project activities are concurrent, could result in a cumulative increase in impacts. Dredging and sedimentation are discussed in detail in section 4.14.2.3. If three major dredging projects occurred concurrently, the cumulative impacts of sedimentation on the benthic community of the Calcasieu Ship Channel downstream of the projects would occur. As discussed in section 4.14.2.3, this reach of the Calcasieu Ship Channel is maintenance dredged every other year, and the benthic community developed under this disturbance regime and would be expected to recover to the current conditions.

Therefore, we conclude that dredging and pile driving activities associated with the LNG Facility, when considered with other projects within the geographic scope of analysis, could contribute to sedimentation impacts on the benthic community, but that these impacts would not extend beyond the timeframe of the annual maintenance dredging performed in this reach of the Calcasieu Ship Channel.

During operation of the LNG Facility, increased marine vessel traffic associated with the Project would contribute to the projected increase in vessel traffic for the Calcasieu Ship Channel (Ausenco, 2016). The vessel traffic could result in increased shoreline erosion and increased ballast-water and cooling-water discharges, as discussed in detail in section 4.14.2.3. The Calcasieu Ship Channel was originally dredged in the 1800s, has been expanded several times to its current dimensions, and continues to be dredged for maintenance on a routine basis. Although the impacts of vessel traffic on fish and aquatic resources could contribute to a cumulative impact, the fish populations and aquatic resources in the Calcasieu Ship Channel developed under similar conditions and would not be significantly affected by the continued and increased use of the channel.

Potential impacts on aquatic resources during construction and operation of the Pipeline and appurtenant facilities include those associated with open-cut crossings of waterbodies, uptake and discharge of water for HDD or hydrostatic testing, and inadvertent spills. Open-cut crossings along the Pipeline route would result in a temporary increase in turbidity and sedimentation near the crossing and immediately downstream, which could result in directly mortality of some aquatic organisms or result in temporary displacement of more mobile species.

Other linear energy projects within the fisheries and aquatic resources geographic scope of analysis also would restore disturbed areas after construction, therefore impacts on fisheries from these projects also would be temporary and minor. During operation, pipelines and transmission lines would require regular maintenance under normal operating conditions.

Maintenance activities associated with pipelines and transmission lines would predominantly involve routine vegetation maintenance, but also could include earth-moving activities, such as those associated with replacements. These activities could intermittently impact fisheries resources to varying degrees from runoff or in-stream activities that produce turbidity and sedimentation. Disturbance to fish habitat, stream banks, removal of bank vegetation, increased sedimentation, and modification of flow during dry-crossing construction would potentially affect fisheries resources, but impacts would be limited through compliance with existing or new permits. Cumulative impacts on fisheries therefore would be intermittent, temporary, and minor.

If construction of the Pipeline and other pipeline projects (Lake Charles LNG Project, Port Arthur Pipeline Louisiana Connector Project, Sabine Pass Expansion Project) occurs within the same waterbody concurrently or within a short period of time, impacts on fisheries and aquatic resources from disturbance, loss of habitat, and sedimentation would be cumulatively greater for the period of disturbance. Mobile species would likely temporarily relocate; however non-mobile species would be negatively affected.

Based on this analysis, we conclude the minor impacts from the Pipeline on fisheries and aquatic resources, when considered in conjunction with anticipated impacts from the projects listed above could contribute to a discernable cumulative impact on fisheries and aquatic resources.

4.14.2.8 Threatened, Endangered, and Other Special Status Species

As discussed in section 4.8, we identified 12 federally listed species, 6 state listed species (3 of which are also federally listed), and 7 species of concern that may occur within the Project area and/or along the marine transit route in Cameron Parish. Currently, the analysis of the project indicates *no effect* on 8 federally listed species, and the Project *may affect, but is not likely to adversely affect* 11 federally listed species. Concurrence has been received by the NMFS; however, consultation with the USFWS is ongoing.

Of the 11 federally listed species that the Project *may affect, but is not likely to adversely affect*, 10 of these species are marine species only anticipated to be affected by the LNG carriers during marine transit. Other LNG projects and large construction projects (table 4.14-2) that would use marine transit during construction and/or operation would contribute to the cumulative marine vessel traffic and the potential cumulative impact on marine species; however, Driftwood would provide NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners* (NMFS, 2008) to LNG carrier captains, and it is anticipated that other LNG projects would adhere to similar measures to minimize these impacts, and the cumulative impact of the increased marine traffic on these marine species is not anticipated to be significant.

The remaining federally listed species that the Project *may affect, but is not likely to adversely affect* is the red-cockaded woodpecker. This determination was based on the identification of potential suitable habitat during desktop studies, which was determined during field surveys to be unsuitable for this species (section 4.8.1.6). Although many of the other large construction projects listed in table 4.14-2 have impacts on forested habitat, which may contain potential habitat for the red-cockaded woodpecker, the Driftwood LNG Project would not affect suitable habitat for this species and thus would not contribute to cumulative impacts on this species.

Finally, other projects (table 4.14-2) with potential to affect federally listed species would also need to consult with the USFWS and/or NMFS regarding threatened, endangered, and other special status species to ensure that the projects to not jeopardize the continued existence of federally listed species, which includes a consideration of the cumulative impact on these species.

We conclude that although the Project would contribute to marine traffic and would include clearing of forested habitat, both activities that could affect federally protected species, the cumulative impact on federally listed species would not be significant.

4.14.2.9 Land Use, Recreation, and Visual Aesthetics Cumulative Analysis

Land Use and Recreation

Land use, recreation, and aesthetics are described in section 4.9. Other projects that occur within this geographic scope of analysis include 4 other FERC-jurisdictional projects, 1 pipeline relocation, 1 electrical transmission line, 4 road improvement projects, 5 residential housing developments, and 41 residential and commercial developments (tables 4.14-2 and 4.14-3 in appendix A).

The majority of the land surrounding the LNG Facility is undeveloped; however, portions of the LNG Facility site are previously developed industrial land. Construction of the LNG Facility would convert undeveloped lands including open water, forest/woodland, and open land to industrial use. The LNG Facility site is zoned for industrial use and is located near the Port of Lake Charles, which also is predominantly industrial land use. Several of the projects in the geographic scope for land use, recreation, and aesthetics, including the Williams Pipeline Relocation, Bollinger Ship Yard Access Road, Highway 27 Improvements, and Burton Shipyard Road Improvements, would either be located entirely within the permanent footprint of the LNG Facility or would involve only minor modifications to existing road infrastructure, with limited impacts on land use. Construction of the other projects would convert additional existing land uses to industrial commercial use within the geographic scope area for land use.

Land uses affected by construction of the Pipeline and appurtenant facilities include agriculture, open water, forest/woodland, managed tree plantations, open land, and developed lands. The portion of the Sabine Pass Expansion Project located within the cumulative impact area for land use also would disturb agricultural lands. A portion of the pipeline associated with the Lake Charles LNG Project would disturb forested land and would cross the Pipeline near a forested area. Permanent impacts on land use associated with the Pipeline would include conversion of forested communities to herbaceous upland or wetland communities on the operational right-of-way and the conversion of vegetated lands to industrial areas within aboveground ancillary footprints. Structures other than the Pipeline’s aboveground facilities would not be allowed within the permanent Pipeline right-of-way, which would restrict future use of these lands for residential or commercial purposes not associated with the Project. Where multiple existing or future pipelines are collocated on developable property, the restrictions on structures could cumulatively represent a substantial restriction to individual landowners for future uses.

For the majority of the watersheds, the total acreage of the Driftwood LNG Project and other identified projects would be less than 1 percent of the watershed's area, with the exception of the Bayou Verdine-Calcasieu River watershed where the total acreage would be about 13 percent of the watershed area (see table 4.14-6). Land use within the Bayou Verdine-Calcasieu River watershed appears to be experiencing a cumulative impact, for example conversion of undeveloped land to industrial and residential developments, which the Driftwood LNG Project would contribute to. The change in land use over time is managed through planning and zoning within municipalities, and these impacts would be balanced against public needs through this process.

As discussed in Section 4.9, under normal circumstances, the moving security zone around LNG carriers has the potential to close the channel to traffic and recreation. Recreational activity outside the channel itself is not likely to be affected, and activity within the Calcasieu Ship Channel would resume after the moving security zone passes. Ausenco (2016) projects that ship traffic in the Calcasieu Ship Channel will be nearly 3,000 ships per year, including nearly 1,500 LNG carriers per year. Because large ships, such as crude oil tankers and LNG carriers typically enter the channel in a convoy, channel closures due to the moving security zones would tend to be combined into a longer channel closure that occurs less frequently. Impacts on recreational boating would occur during channel closure, and the Driftwood LNG Project would contribute to those impacts.

Visual Aesthetics

Visual resources are discussed in section 4.9.2.10. Other projects that occur within the geographic scope for visual resources include five FERC-jurisdictional projects, one pipeline relocation, one electrical transmission line, and four road improvement projects (tables 4.14-2 and 4.14-3 in appendix A).

The primary existing receptors in the viewshed of the LNG Facility include residential areas, including recreational areas associated with the Calcasieu River, and a portion of the Creole Nature Trail All-American Road (Highway 27). The LNG Facility site was previously used for industrial purposes, and infrastructure from that previous facility currently is on site as part of the existing viewshed. Existing city and county zoning in the area is predominantly industrial with the nearby Port of Lake Charles. Visual buffers around the LNG Facility include forested and scrub-shrub habitats and vegetation and trees at Dutch Cove cemetery adjacent to the LNG Facility. Construction of the LNG Facility would increase traffic on Highway 27 and affect the views of those using the highway. Construction of the other cumulative projects, including FERC-jurisdictional projects, would result in facilities similar to the Driftwood LNG Project that would similarly affect visual resources. Once the LNG Facility was completed, the aesthetics would be consistent with other existing and proposed industrial developments along the Calcasieu Ship Channel such as Cameron LNG, Lake Charles LNG, and Magnolia LNG, and would contribute to the cumulative impact on visual resources in the area.

Nighttime viewers of the LNG Facility would see lighting and occasional natural-gas flares, which would be about 350 feet high. Flares from the other projects would be 100 to 400 feet high. If flaring at other facilities were to occur concurrently with flaring from the LNG Facility, observers would see a temporarily increased visual impact. Variability in scheduling would most likely lead to flaring occurring separately at each facility. Although the LNG Facility would be consistent with the predominant existing character of the area and with planned projects in the area, it would represent an increase to visual impact, especially to immediately neighboring residential areas.

Forest vegetation (as discussed in section 4.14.2.5) would be cleared and maintained in an herbaceous state within the permanent pipeline rights-of-way. The right-of-way is sited adjacent to existing rights-of-way for about 70 percent of the Project, predominantly in rural and open land areas. Due to the potential for concurrent construction of the Project and the pipeline associated with the Lake Charles LNG Project, the Port Arthur Pipeline Louisiana Connector Project, or the Sabine Pass Expansion Project, there is potential for a larger cumulative impact on visual resources due to increased disturbance and presence of construction equipment.

Impacts from the Driftwood LNG Project on visual resources, when considered cumulatively with the impacts from the projects listed above, would add to the permanent impacts on visual resources within the geographic scope, especially in the area around the LNG Facility.

4.14.2.10 Socioeconomics

Project effects on socioeconomics are discussed in section 4.10. Other projects occurring within the geographic scope of analysis for socioeconomics include 6 FERC-jurisdictional projects, 2 pipeline projects, 2 energy projects, 4 industrial projects, nine transportation (including port and road improvement) projects, and 34 residential and commercial developments tables 4.14-4 in appendix A.

The workforce for the Project would range from 600 to nearly 6,500 workers during construction and be about 539 new employees during operation. Driftwood estimates that 30 percent of the workforce would be from the local labor pool. The cumulative effect of the Project, in combination with other projects in the geographic scope, would be a reduction in local and perhaps regional unemployment. Construction in the Lake Charles MSA is estimated to create 3,934 new jobs per year (Scott, 2017). A number of the projects considered in the cumulative assessment are expected to overlap temporally with the Project, and there are currently concerns of worker shortages in the region due to the current industrial development boom.

Anticipated construction-worker demand in the region during the timeframe for Project construction was estimated by combining workforce curves for the Project and for other projects within the geographic scope for socioeconomics for which workforce information is available (table 4.14-4). With the exception of Lake Charles LNG, workforce needs of projects with major temporal overlaps are modest relative to Driftwood's anticipated workforce needs. Also, a number of large projects (e.g., Sasol and Axiall chemical projects, employing a peak of about 6,000 and 2,000 construction workers, respectively) are scheduled to be completed by the time the Project begins construction. Cameron LNG, which currently employs several thousand construction workers also is expected to be completed by the time the Driftwood LNG Project begins. The local workers currently employed on these three large construction projects would be available for the Driftwood LNG Project, therefore.

In addition to local workers, non-local temporary workers are anticipated to temporarily relocated to the region for a portion of the duration of construction of the Driftwood LNG Project and/or the other projects. While beneficial to the housing market, this increased demand could adversely affect those seeking housing and could result in longer commutes for workers if they are unable to obtain housing near their place of work. The cumulative effect of worker influx could lead to increases in rental prices and housing shortages, which could adversely affect local area residents. The estimated temporary worker housing need for the concurrent FERC-regulated Projects (which report workforce estimates by month) and cumulative total is summarized in table 4.14-7.

Table 4.14-7

Cumulative Temporary Worker Housing Need

Project	Temporary Workers [a]	Percent Non-Local	Temporary Non-Local Workers Requiring Housing
Driftwood LNG Facility	5,400	70%	3,780
Driftwood Pipeline	1,030	70%	721
Lake Charles LNG [b]	5,600	80%	4,480
Magnolia LNG [c]	542	40%	217
Total	***12,572***	***73%***	***9,198***

[a] The estimates conservatively assume that the Lake Charles LNG and Magnolia LNG projects peak with Driftwood. Worker estimates are for peak month. Projects scheduled to be complete prior to the peak month were not included.

[b] Lake Charles LNG Resource Report 5, FERC eLibrary Accession Number 20140325-5137

[c] Magnolia LNG Resource Report 5, FERC eLibrary Accession Number 20140430-5338

As shown in figure 4.14-3, the periods during which cumulative construction worker needs in the area are highest (above 10,000 workers) are from month 29 to month 44 of Project construction. At the time of analysis (early 2017) the currently active projects tracked in figure 4.14-3 (Sasol, Indorama, and Cameron LNG projects) were scheduled to be completed or nearing completion by the time the Project would begin. Therefore, the population of construction workers residing in the study area would not be expected to increase significantly from its current level during the Project. Based on the available housing listed in Section 4.10 and the projected number of workers for the cumulative projects, we conclude there should be sufficient housing for construction workers in the study area during the construction period for the Project. The new employees required for operation of the Project would result in a minor permanent impact on housing needs but because the much-larger temporary construction workforces for this and other projects would be subsiding as the permanent workforce is arriving, would not contribute to a significant cumulative impact.

As discussed in Section 4.10, an estimated 70 percent of the Project workforce would be non-local and therefore would represent an increase in the local population requiring public services, such as police, medical services, and schools. However, as with housing needs, this increased demand for public services would follow the reduction in demand for public services by the workforce associated with the currently active projects, which would be completed or nearing completion by the time the Project would begin. As shown on the cumulative workforce curve in figure 4.14-3, workforce numbers during the Driftwood LNG Project are similar to the workforce numbers for the currently active projects and offset by several years, resulting in a return to current workforce numbers, rather than an additive impact. We conclude that the impact of the Project, when considered cumulatively with the other concurrent projects, would not have a significant impact on demand for public services.

The overall economy of the Lake Charles area has experienced similar large construction projects and the associated workforce increases and decreases for several decades. Local organizations, such as the SWLA Economic Development Alliance, have been created to assist the community in responding and adapting to these changes, for example, by advising local schools in designing curricula to train local students in the skills in demand by these industries, which makes more skilled workers available locally and reduces the need for temporary workers to fill the jobs that are created.

The Project, in combination with the other projects within the geographic scope for socioeconomics would generate state and local government revenues through sales taxes, property taxes and income taxes, which would contribute to public services such as education, law enforcement and health programs.

The increased influx of workers and the localized nature of the Project would generate road and marine traffic during the construction and operations. The traffic volumes modeled in the Traffic Impact Study (FERC eLibrary Accession Number 20170331-5058) are based on future projections of existing traffic and therefore include traffic from existing industrial activities, including construction traffic for the Cameron LNG Project, which is anticipated to taper off during the first year of the construction schedule for the Project. Traffic from other projects in the vicinity that occur within the same timeframe, when considered in combination with traffic from the Project, could further contribute to traffic congestion problems and increased traffic safety risks. Driftwood is proposing mitigation for existing and modeled traffic congestion (FERC eLibrary Accession Number 20170621-5139). Based on these analyses and Driftwood's proposed mitigation, we conclude the Project, when considered with other projects within the geographic scope for cumulative impacts, would have minimal negative impact on road traffic.

The Port of Lake Charles Calcasieu Ship Channel Traffic Study – 2016 Update (Ausenco, 2016) considers future marine traffic from the Driftwood LNG Project and other projects in its projections of Channel traffic. Results of the study indicate that although vessel wait times may increase, the Calcasieu Ship Channel has the capacity to accommodate this cumulative increase in vessel traffic, provided that the channel is appropriately maintained at congressionally authorized dimensions. It was also determined that additional pilots and channel tugs would be required to accommodate the increase in traffic. DWLNG would continue to coordinate with the USCG to ensure Project compliance with all safety and security requirements while minimizing potential impacts on other waterway users. The moving security zones associated with LNG carriers, as required by USCG regulations (33 CFR 165.805) would prohibit other vessel traffic within the security zones during passage of the LNG carriers and during ship berthing maneuvers. The Driftwood LNG Project would contribute 365 LNG carriers per year to a total of 1,500 LNG carriers per year (Ausenco, 2016), which represents a moderate cumulative impact to marine traffic, and recreational and commercial use of the Calcasieu Ship Channel.

The Driftwood LNG Project would neither significantly affect urban or residential areas nor would there be disproportionately high and adverse human health or environmental effects on minority populations, low-income communities, or Indian Tribes; therefore, it would not contribute cumulatively to impacts on these populations within the geographic scope for environmental justice (table 4.14-1)

The cumulative impacts from the Project on socioeconomic resources, when considered in combination with the impacts from the projects listed above, would predominantly occur during construction. Based on the decrease in workforce requirements associated with currently active projects, which is anticipated to occur before the workforce requirements associated with the Driftwood LNG Project (and concurrent projects) would increase, the overall regional workforce would not change; therefore any cumulative impact on socioeconomic resources would not be significant.

4.14.2.11 Cultural Resources

Cultural resources are discussed in section 4.11. Other projects that occur within the cultural resources geographic scope area include two other FERC-jurisdictional projects, one pipeline relocation, one electrical transmission line, and one road improvement table 4.14-2 and table 4.14-3 in appendix A**).**

As stated in Section 4.11, the Louisiana SHPO and the FERC staff agree that no historic properties would be affected by the Project; therefore, the Project would not contribute to cumulative impacts within the geographic scope for cultural resources.

4.14.2.12 Air and Noise Cumulative Analysis

Air Quality

Effects on air quality are discussed in detail in Section 4.12.1. This includes a cumulative air quality model that compares the emissions of criteria pollutants to the NAAQS. This model included the LNG Facility as well as other stationary sources in the area.[50] Other projects occurring within the geographic scope during construction include three FERC-jurisdictional pipeline projects, one other pipeline relocation, one energy project, three transportation projects, and two residential projects. Other projects occurring within the geographic scope during operation include nine FERC-jurisdictional projects, two other pipeline projects (relocation and construction), two energy projects, three road-improvement projects, six industrial projects, and three residential/commercial projects (table 4.14-5 in Appendix A). Operational emissions from other projects within the operational cumulative geographic scope for air quality are generally small, dispersed, and accounted for in background concentrations used in NAAQS modelling for larger point sources (e.g., underground pipeline or electrical transmission lines with minimal emissions, residential heating, and vehicle traffic on roadways). Therefore these projects were not discussed individually.

We received a comment on the draft EIS that suggested that combined GHG emissions from LNG facilities and industry in the vicinity of the LNG Facility should be evaluated for localized impacts. As indicated previously, GHGs have no localized geographic scope, as there are little to no direct impacts from elevated CO_2 concentrations at a local level.[51] GHGs were identified by the EPA as a pollutant due to their impacts on global climate change. GHG emissions cause climate change by being transported into the atmosphere, where elevated levels of CO_2,,methane and other GHGs in the atmosphere trap heat, thus causing heat-based climate change effects. GHGs are generally well mixed and this atmospheric mixing happens on a global scale, although there is some regional and seasonal variation. For instance, 1 ton of CO_2 emitted from a project 1 mile away from the Driftwood LNG project would have the same impact on global climate change as 1 ton of CO_2 emitted on the other side of the world. Consequently, any cumulative analysis of GHG emissions would need to consider all global sources and adding a nearby project gives no additional context, as those emissions would add to global climate change impacts in the same manner as a project in another state or country.

<u>Construction</u>

Construction of the Project would result in increases in emissions of criteria pollutants, VOCs, HAPs, GHG and fugitive dust emissions from combustion of fuel in vehicles and equipment; dust generated

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[50] Other local stationary air emission sources included in the cumulative model were obtained from the LDEQ.

[51] Methane does have certain impacts at very high concentrations, but these are generally toxic effects at levels far greater than those in stack or fugitive emissions. N_2O can have local impacts but the emissions are also captured in the NO_x emisisons and controls.

from excavation, grading, and fill activities; and general construction activities (e.g., coating and welding operations). Generally, construction projects within the geographic scope for construction air quality with multiple-year overlapping construction schedules or single-year projects that occur in the same year could cumulatively contribute to air quality impacts. Construction impacts vary based on factors such as timing of the construction projects, intensity and type of construction activity underway at any given time, quantity and size of emission-producing equipment in operation, distance separating the projects, soil silt content, quantity of dust-producing material being handled, and dry or windy conditions.

Both the Driftwood LNG Project and the Lake Charles LNG Project are proposing to start pipeline construction about the same time, and site preparation for both projects could occur at the same time. Fugitive dust emissions would be at their peak during right-of-way clearing and earth moving, and if these activities occur where the two projects are within 0.25 mile (approximate MP 47.9), there would be a temporary cumulative air quality impact from fugitive dust. When construction and restoration of areas disturbed by construction is complete for a project, it would no longer contribute to construction air quality effects. Emissions of criteria pollutants from combustion of fuel in equipment and vehicle exhausts from construction of both projects could also contribute to cumulative air impacts in the region. These emissions would be minimized by typical control techniques such as the use of low-sulfur diesel fuel, proper operation of equipment, and reduction of daily emissions by daylight equipment usage as much as possible. If construction activities occur where the two projects are within 0.25 mile (MP 47.9), there would be a temporary cumulative air quality impact from emissions from equipment and vehicle exhaust.

On a larger scale there are multiple projects in the area, typically outside the geographic scope with which the Project could have a cumulative incremental impact on regional air quality during the construction period. While not permanent, the high level of construction emissions combined with the large number of construction projects in the area may have a minor to moderate impact on ambient air quality in the area. As identified in section 4.12.1, the LDEQ and the EPA has identified the both the Lake Charles and Lafayette areas are vulnerable to being re-designated as nonattainment for O_3, and the metropolitan planning districts responsible for air quality planning for these areas have applied for, and been accepted into, the EPA Ozone Advance Program. Ultimately, these numerous construction emissions have a slight possibility of causing new exceedances of the ambient Ozone NAAQS during the cumulative construction period.

Mitigation measures to minimize impacts on air quality during Project construction are outlined in Section 4.12.1. Lake Charles LNG would be required to implement similar mitigation measures. Although the Driftwood LNG Project could result in a potential significant impact on air quality in the immediate vicinity of the LNG Facility, because of the distance from the other projects considered for cumulative impacts, the implementation of mitigation, the temporary timeframe of construction activities, and the brief overlap of construction schedules for the other projects, the Driftwood LNG Project, when considered with the other projects listed above, would not contribute significantly to cumulative impacts on air quality.

Operation

Emission sources from operation of the Project would be associated with the LNG Facility and the compressor stations. Under federal and LDEQ regulations, the LNG Facility is considered a major PSD emission source and would contribute to cumulative impacts on air quality within the cumulative impact area. The potential for other projects to cumulatively interact with emissions from the Project depends on the type of project, its stage of development, and the impact of significant ongoing air pollutant emissions to overlap with either a compressor station or the LNG Facility.

The cumulative air model considered the emissions of other projects within a geographic scope of 50 km (31 miles), as shown in table 4.14-1, for purposes of PSD modeling. This cumulative model was discussed in section 4.12.1.5. In addition, emissions of NO_x and VOC may impact ambient O_3 concentrations on a regional scale.

For the LNG Facility, cumulative impacts on regional O_3 levels would also be addressed through a comparative analysis or photochemical modeling study, if required by LDEQ. For the compressor stations, cumulative impacts on regional O_3 levels are expected to be minimal given the various O_3 analyses performed for much larger sources in the area. The emissions from Driftwood's LNG Facility exceeded the SILs for SO_2, NO_2, and $PM_{2.5}$. As described in section 4.12.1.5, subsequent modeling showed that the Liquefaction facility would not contribute to a violation of the NAAQS. When all existing and planned projects are included, the concentrations of NO_2 1-hour, SO2 1-hour, and $PM_{2.5}$ 24-hour exceed the NAAQS, as shown in table 4.12-5. This indicates that there may be a potential for significant cumulative air quality impacts in the region based on the potential to emit of the large number of nearby industrial emission sources.

Construction of the other projects with operational air emissions requiring permits for point source emissions would result in air quality impacts similar to the Project. These projects that are considered to be major sources of air emission would be required to conduct a PSD analysis, and meet similar permit conditions as the Driftwood LNG Project. In addition, any other potential future projects that are considered to be major sources of air emissions would be required to conduct a PSD analysis. Should operation of a new project result in a significant impact on air quality, the LDEQ would enforce operational limitations or require emissions controls that ensure compliance with the state implementation plan and attainment with the NAAQS. In addition, the Driftwood LNG Project would be required to comply with any LDEQ permit conditions during operation. Therefore, the cumulative impacts from the Driftwood LNG Project to air quality, when considered in conjunction with the impacts from the projects listed above, would not be significant.

Climate Change

Climate change is the change in climate over time, and cannot be represented by single annual events or individual weather anomalies. While a single large flood event; a particularly cold summer; or a warm winter are not necessarily strong indications of climate change; 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 [USGCRP], 2018).

Climate change has already resulted in a wide range of impacts across every region of the United States, and those impacts extend beyond atmospheric climate change alone and include changes to water resources, agriculture, ecosystems, and human health. As climate change is currently happening, the United States and the world are warming; global sea level is rising and acidifying; and certain extreme weather events are becoming more frequent and more severe. These changes are driven by accumulation of GHG in the atmosphere primarily through combustion of fossil fuels (coal, petroleum, and natural gas), combined with agricultural emissions and clearing of forests. These impacts have accelerated throughout the end of the 20th century (USGCRP, 2018).

Climate change is a global concern; however, for this analysis, we will focus on the potential cumulative climate change impacts on the Project area. The following are observations of existing environmental impacts, as well as predicted climate change impacts with a high or very high level of confidence in the Southwestern Louisiana region (NOAA, 2017; USGCRP, 2017 and 2018; Kloesel et al., 2018):

- Global average temperature has increased by about 1.8°F from 1901 to 2016.
- Increases in illness and death due to greater summer heat stress.
- Destructive potential of Atlantic hurricanes has increased since 1970 and the intensity (with higher peak wind speeds, rainfall intensity, and storm surge height and strength) is likely to increase during this century.
- Declines in dissolved oxygen in streams and lakes have caused fish kills and loss of aquatic species diversity.
- Moderate to severe spring and summer drought areas have increased 12 percent to 14 percent (with frequency, duration and intensity also increasing also projected to increase).
- Longer periods of time between rainfall events may lead to declines in recharge of groundwater and decreased water availability.
- Responses to decreased water availability, such as increased groundwater pumping, may lead to stress or depletion of aquifers and strain on surface water sources.
- Increases in evaporation and plant water loss rates may alter the balance of runoff and groundwater recharge, which would likely to lead to saltwater intrusion into shallow aquifers.
- Coastal water warming may lead to the transport of invasive species through ballast water exchange during ship transit.
- Along the Louisiana coastline, sea levels have risen at a rate of 5.8 mm per year since 1958, depending on local topography and subsidence.
- During the 2010s, the number of nights with minimum temperatures greater than 75°F was nearly double the long-term average for 1901–1960.
- Ocean heat content has increased at all depths, and surface waters have warmed by a rate of about 1.3°F per century.
- As sea levels have risen, the number of tidal floods each year that cause minor impacts have increased 5- to 10-fold since the 1960s in several U.S. coastal cities.

The GHG emissions associated with construction and operation of the Project are identified in section 4.12.1. Current LDEQ and EPA regulations require a GHG BACT analysis to ensure the Project employs the best available technologies to address the impacts of GHG emissions. BACT would be implemented to reduce the emissions of GHGs from the LNG Facility and CS-01. The proposed BACT for the LNG Facility, specifically for the MR Compressor GTs, hot oil heaters, and thermal oxidizers includes the use of low carbon fuel, energy efficiency measures, and good combustion practices. The proposed BACT for the compressor turbines includes the use of natural gas, energy efficiency measures, and good combustion practices. BACT for the emergency generators includes the use of natural gas, energy efficiency measures, good combustion practices, and limiting operating hours. BACT for fugitive GHG emissions includes implementing a leak management program and good work practices to minimize methane leaks. GHG BACT for the flares includes the use of low carbon fuel and proper operating practices. Proper operating practices ensure the necessary amount of heat required to maintain adequate VOC and methane destruction, which reduces the overall global warming potential of the process vent streams by converting methane (GWP CO_{2e} = 25) to CO_2 (GWP CO_{2e} = 1).

The construction and operation, as well as downstream emissions, would increase the atmospheric concentration of GHGs, in combination with past and future emissions from all other sources, and contribute incrementally to future climate change impacts. There is no generally accepted methodology to estimate what extent, a project's incremental contribution to greenhouse gas emissions would result in physical effects on the environment for the purposes of evaluating the Project's impacts on climate change, either locally or nationally.

In addition, state of Louisiana has not set any GHG reduction or climate goals. Because we cannot determine the Project's incremental physical impacts due to climate change on the environment, we cannot determine whether or not the Project's contribution to cumulative impacts on climate change would be significant.

We received a comment on the draft EIS that suggested that combined emissions from LNG facilities and industry in the vicinity of the LNG Facility should be evaluated for localized impacts. As stated above, there is no model that evaluates local impacts of GHG emissions. Further, we cannot find a suitable method to attribute discrete environmental effects to GHG emissions. We have looked at atmospheric modeling used by the Intergovernmental Panel on Climate Change, EPA, National Aeronautics and Space Administration, and others and we found that these models are not reasonable for project-level analysis for a number of reasons. For example, these global models are not suited to determine the incremental impact of individual projects, due to both scale and overwhelming complexity. We also reviewed simpler models and mathematical techniques to determine global physical effects caused by GHG emissions, such as increases in global atmospheric CO_2 concentrations, atmospheric forcing, or ocean CO_2 absorption. We could not identify a reliable, less complex model for this task and we are not aware of a tool to meaningfully attribute specific increases in global CO_2 concentrations, heat forcing, or similar global impacts to project-specific GHG emissions. Similarly, the ability to determine localized or regional impacts from GHGs by use of these models is not possible at this time.

Noise

Project activities anticipated to contribute to noise are discussed in detail in section 4.12.2. Other projects occurring within the geographic scope for construction noise includes three FERC-jurisdictional pipeline projects, one other pipeline relocation, one energy project, three transportation projects, and two residential projects. Only two FERC-jurisdictional pipeline projects were identified within the geographic scope for operational noise and were considered in the cumulative impacts analysis (tables 4.14-2 and 4.14-3 in appendix A).

<u>Construction</u>

Construction activity and associated noise levels associated with the Project or with other projects within the geographic scope for cumulative impacts would vary depending on the construction activities. The highest level of construction noise typically occurs during earth-moving and pile-driving work. The sound level impacts on NSAs due to construction activities would depend on the type of equipment used, the duration of use for each piece of equipment, the number of construction vehicles and machines used simultaneously, and the distance between the sound source and receptor. Near the LNG Facility site, two NSAs within 1 mile have the potential to be affected by simultaneous construction of non-jurisdictional facilities associated with the Driftwood LNG Project: Burton Shipyard Road improvements, Williams

Pipeline Relocation, Highway 27 Improvements, and Entergy Transmission Line. The first three of these non-jurisdictional projects would occur near the beginning of construction of the LNG Facility, using similar equipment, and would be perceived as a somewhat increased intensity of construction activity during that period. The Entergy Transmission Line would be installed around year three of construction of the LNG Facility and again would be perceived as increased intensity of construction activity during that period. Construction noise impacts were modeled using impact pile driving as the highest noise emitter with earth-moving equipment at a relatively lower intensity. The additional earth-moving and other similar equipment associated with the non-jurisdictional projects would not result in a cumulative interaction when considered together at project-specific NSAs.

The Port Arthur Pipeline Louisiana Connector Project may be collocated and share workspace with the Pipeline at various points along MP 5.6 to 16.2. In addition, the Project would use the HDD method at several locations within this area (e.g., HDD Nos. A1, A2, A3, and HDD1), and although it is unlikely, should the Port Arthur Pipeline Louisiana Connector Project use the HDD method at the same locations during the same period, there is a potential for cumulative noise impact. Should this occur, additional mitigation or compensation for temporary relocation at these locations would be necessary. Based on this analysis, we have determined construction of the Project has the potential to contribute to temporary cumulative noise impacts at locations where the pipeline is collocated with other pipelines, but that these impacts would be temporary.

<u>Operation</u>

Operation of the LNG Facility would generate noise throughout the life of the Project. Driftwood, as well as other FERC-related projects in the vicinity, would be required to be compliant with the 55 dBA L_{dn} criterion, which would minimize regional noise impacts from aboveground facilities. Buried pipelines are not anticipated to cause operational noise. The two pipeline projects identified within the geographic scope for noise resources would be along the Pipeline, which would not have the potential to cumulatively interact with the LNG Facility for noise.

The existing compressor stations at the various Project compressor station locations were considered in the noise analysis in section 4.12.2. Projects that could cumulatively affect NSAs associated with Driftwood compressor stations includes construction of CS-760 as part of the Lake Charles Expansion Project, as well as the addition of horsepower to CS-760 as part of the Sabine Pass Expansion Project. These activities would be located slightly more than 1 mile northeast of the Project's CS-02. The operational noise from both stations would increase the existing noise levels by 2.2 dBA, to a total of 55.2 dBA. The total noise contribution for these projects is estimated at 49.8 dBA L_{dn} (FERC eLibrary Accession Number 20170703-5162). The Project would be required to perform a full-load noise survey following commencement of operation and employ noise mitigation to avoid significant increases in noise above ambient conditions. No other projects were identified that would contribute to noise impacts during operations within the cumulative impact area for the other compressor stations.

4.14.2.13 Safety and Reliability

Potential impacts on public safety would be mitigated through implementation of applicable federal, state, and local rules and regulations for the proposed Project. These rules and regulations, described in section 4.13.1 and 4.13.2, would ensure appropriate standards would be applied to design and engineering, construction, operation, and maintenance to protect the public and avoid or minimize the potential for accidental or intentional incidents. The other LNG projects listed in table 4.14-2 would be required to follow the same rules and regulations, and other large industrial projects listed in table 4.14-2 would be subject to similar rules and regulations. These rules and regulations are intended to protect the public from the potential impacts of industrial projects singularly and cumulatively, and no significant cumulative impact on public safety is anticipated.

Public services, including emergency services, would need to be appropriately sized to accommodate the population at the time the Project was constructed and operated. The other large projects listed in table 4.14-2 would contribute to the overall population; however, as shown on the cumulative workforce curve in figure 4.14-3, workforce numbers during the Driftwood LNG Project are similar to the workforce numbers for the currently active projects and offset by several years, resulting in a return to current workforce numbers, rather than an additive impact. In addition, the Driftwood LNG Project and the other LNG projects listed in table 4.14-2 would be required to prepare a comprehensive ERP (per 49 CFR 192.615) and identify the cost sharing mechanisms for funding these emergency response activities. These plans would minimize the potential for impacts on public safety from individual projects or when considered cumulatively with the other concurrent projects. In the unlikely event that major incidents occur at multiple facilities concurrently, the acute cumulative demand on emergency services would likely be significant; however, assistance from emergency service providers from neighboring parishes and communities would serve to mitigate the demand. We conclude that the impact of the Project, when considered cumulatively with the other concurrent projects, would not have a significant impact on demand for public services.

4.14.2.14 Summary of Cumulative Analysis

Construction of the Driftwood LNG Project, in addition to other projects identified within the geographic scopes for each resource, would contribute to cumulative impacts on those resources, as discussed above. Specific information about these projects, where available, is included in appendix A. Federal and state laws, regulations, and permitting requirements that apply to these projects limit their impact on environmental resources such as air, water, wetlands, vegetation, and protected species. Where the Driftwood LNG Project would affect a natural resource and the other projects have the potential to affect the same natural resource in a similar timeframe, there is the potential for cumulative impacts.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS OF THE ENVIRONMENTAL ANALYSIS

The conclusions and recommendations presented in this section are those of the FERC environmental staff. Our conclusions and recommendations are based on input from the COE, USCG, DOE, DOT, and EPA as cooperating agencies in the preparation of this final EIS. However, the cooperating agencies will present their own conclusions and recommendations in their respective Records of Decision or determinations. The cooperating agencies can adopt this final EIS consistent with 40 CFR 1501.3 if, after an independent review of the document, they conclude that their requirements have been satisfied. Otherwise, they may elect to conduct their own supplemental environmental analyses.

We reviewed the Project-specific Construction Environmental Control Plan, Driftwood Plan, Driftwood Procedures, construction SPCC Plan, Unanticipated Discoveries Plan (appendix H), HDD Contingency and Fluid Monitoring Plan, ESCP; and Fugitive Dust Management Plan. We determined that the proposed plans are acceptable.

We conclude that construction and operation of the Driftwood LNG Project would result in mostly temporary and short-term environmental impacts. However, the Project would result in permanent impacts on soils, water, wetlands, vegetation, wildlife, visual resources, land use, socioeconomics, air quality, and noise. In addition, there would be short-term impacts on traffic on Highway 27 near the LNG Facility during construction; however, these impacts would be positive due to mitigation measures proposed by Driftwood.

We reviewed alternatives to Driftwood's proposals based on our independent analysis and comments received. Based on our analysis, the MP 12.9 Route Variation would affect fewer landowners, reduce the total land impact by about 16.6 acres, and reduce disturbance to wetlands, but would have a greater potential to affect visual resources from Kim Road. Overall, we conclude the MP 12.9 Route Variation offers a significant environmental advantage. The Port Arthur Pipeline Variation would require about 7.0 miles of route variations in order to shift DWPL's centerline and workspaces to accommodate construction and operation of the Port Arthur Pipeline immediately adjacent to its existing utility right-of-way. Based on our analysis, the overall environmental impact when considered cumulatively with the proposed Port Arthur Pipeline would be reduced. Therefore, we are recommending that DWPL adopt the MP 12.9 route variation and the Port Arthur Route Variation as the proposed route. We conclude that the proposed Project, as modified by our recommended mitigation measures and route variations noted above, is the preferred alternative than can meet the Project objectives.

As part of our analysis, we developed specific mitigation measures that are practical, appropriate, and reasonable for the construction and operation of the Project. We are, therefore, recommending that these mitigation measures be attached as conditions to any authorization issued by the Commission. We conclude that implementation of the mitigation proposed by Driftwood and our recommended mitigation would ensure that impacts in the Project area would be avoided or minimized and would not be significant. A summary of the Project impacts and our conclusions are presented below by resource.

5.1.1 Geological Resources

Construction and operation of the Project would not alter the geologic conditions of the Project area, and the Project would not affect extraction of geologic resources during construction or operation.

The LNG Facility Site Specific Seismic Analysis completed by Bechtel recommended Driftwood complete a field reconnaissance and a detailed fault detection study to provide confidence in the presence or absence of a growth fault at the LNG Facility (Bechtel, 2016). We have determined that the LNG Facility would be designed to minimize the risk to structures from seismic activity.

The Pipeline would not cross any significant geologic hazards including areas of geologic activity or subsidence. Blasting is not anticipated during construction of either the LNG Facility or the Pipeline, and no paleontological resources are anticipated within the Project area.

Based on Driftwood's proposal, including implementation of the Driftwood Plan and Procedures, we conclude that impacts on geological resources would be adequately minimized and would not be significant, and the potential for impacts on the Project from geologic hazards also would be minimal.

5.1.2 Soils

Construction and operation of the Project would disturb soils, with a resulting increase in the potential for erosion, compaction, and mixing topsoil and subsoil. Soils in the Project area generally are not erodible, but are compaction prone. Driftwood's proposed mitigation measures, such as the use of the Driftwood Plan and Procedures, would minimize overall soil erosion.

Although about 385 acres of land within the LNG Facility site can be characterized as prime farmland, the site is zoned as industrial, and therefore is not consistent with the designation of prime farmland, and the NRCS does not consider the soils at the LNG Facility site to be prime farmland. The majority of soils associated with the Pipeline and aboveground facilities are characterized as prime farmland. Disturbance associated with the Pipeline would be short-term and would not affect the use of prime farmland for future agricultural purposes. Construction and operation of aboveground facilities would permanently impact about 135 acres of prime farmland, but would not result in a significant reduction of usable prime farmland soils in the area.

An area of known soil, sediment, and groundwater contamination has been identified adjacent to the LNG Facility along the northern shore of the existing North Slip. It is possible, but not confirmed, that groundwater contamination has extended into the soil/sediments underlying the existing North Slip and the adjacent shoreline area of the Calcasieu River, both areas where dredging operations would occur during construction and operation of the Marine Facility berths. Based on the Phase I Environmental Site Assessment performed at the site, the remainder of the LNG Facility site is unlikely to contain contaminated soils, sediments, or groundwater.

As part of construction of the Marine Facility, DWLNG would dredge about 6.8 million yd^3 from the berthing area, which would be pumped in a slurry form to BUDM areas west of the LNG Facility. Management of BUDM is the responsibility of the COE and LDNR through permitting. Based on compliance with permit requirements, we conclude that there is little risk of disturbance and distribution of contamination.

5.1.3 Water Resources

5.1.3.1 Groundwater

The entire Driftwood LNG Project lies within the Chicot Aquifer System, which is designated as a sole-source aquifer. Withdrawal of large volumes of water could minimally lower the water table.

Driftwood does not plan to use direct withdrawal of groundwater during construction or operation of the LNG Facility and would instead use municipal water to supply the 360,000 gallons per day required during peak construction periods and the 260,000 gallons per day required for operations. The municipal supply is withdrawn from groundwater, but the proposed volumes are less than one-tenth of a percent of the about 850 million gallons per day of the current withdrawal rate. Driftwood does not plan to use groundwater during construction of the Pipeline but may use up to 40 gallons per day from onsite wells or from municipal supplies for sanitary water at each compressor station. We have determined that the Project would not have a significant effect on groundwater drawdown in the Chicot Aquifer System.

As previously discussed for soil resources, an area of known soil, sediment, and groundwater contamination has been identified adjacent to the LNG Facility along the northern shore of the existing North Slip. Also as noted for soils resources, final monitoring and mitigation requirements for mobilization of contaminated groundwater would be subject to review and approval by LDEQ under the Section 401 Water Quality Certification process. As required by federal law, Driftwood submitted a Section 404/10 Joint Permit Application in March 2017, which is under review by the COE; the LDNR issued the CUP on May 29, 2018, and LDEQ issued the CWA Section 401 Water Quality Certification on September 7, 2018. We are recommending that DWLNG and DWPL obtain authorization from us prior to commencing construction, for which they must file documentation that they have received all applicable authorizations required under federal law.

There are no public water supply wells within a mile of the LNG Facility, and the LNG Facility does not fall within a designated wellhead protection area. There are six active private water wells with 0.25 mile of the LNG Facility. The Pipeline would cross through five wellhead protection areas in Calcasieu Parish and one wellhead protection area in Evangeline Parish. There are eight active private water wells within 150 feet of Pipeline disturbance. Because the recharge area for these wells is larger than the Project area, any changes to groundwater recharge areas resources are not expected to be significant.

5.1.3.2 Surface Water

Twenty-two onsite surface waterbodies would be filled during the construction of the LNG Facility. Most are open waterbodies without direct connection to the Calcasieu River or Bayou Choupique, but general site drainage is toward Bayou Choupique. As also discussed in section 5.1.5, Driftwood would contribute dredged material to Louisiana's BUDM Program to build and restore degraded coastal wetlands, which would offset the majority of the wetland impacts at the LNG Facility site. In addition, Driftwood would purchase compensatory wetland mitigation credits at an established wetland mitigation bank or banks to offset remaining wetland impacts at the LNG Facility site and the Pipeline, according to mitigation guidelines prescribed by the COE New Orleans District. Final compensatory mitigation requirements would be subject to review and approval by the COE New Orleans District as part of the Section 404/10 permit process. Driftwood submitted a Joint Permit Application to the COE and LDNR in March 2017, which is currently under review by the COE. We conclude that with the proposed mitigation, these impacts would not be significant.

Land disturbing activities would be conducted according to the Driftwood Plan and Procedures, and ESCP. Stormwater runoff from the disturbed portions of the site would be routed through a series of construction ditches according to the ESCP. These ditches would discharge into the stormwater discharge locations that would contain appropriate sediment barriers, or similar, equivalent structures, to collect the sediment. We conclude that with these measures, stormwater runoff would not have significant impact on surface waters.

Dredging of the Marine Berth would be by cutterhead suction dredge, which would minimize turbidity at the dredge site.

During construction, marine vessels would call on the Pioneer Docks, the MOF, and the Marine Berths, as well as the existing barge slip prior to construction of the MOF. Driftwood has proposed armoring and other protections for the shoreline at the MOF and Marine Facility, as well as limiting the use of propellers within the facilities. With these measures, we conclude that shoreline erosion due to the Project would not be significant.

Prior to commencement of operation, hydrostatic testing of the LNG Facility piping and LNG storage tanks would occur. Once installation and backfilling are completed and before the Pipeline begins operation, the pipeline would be hydrostatically pressure tested according to DOT safety standards (49 CFR 192) to verify its integrity and ability to withstand the MAOP. DWLNG and DWPL would obtain all hydrostatic test water from nearby surface water sources, and it would be discharged according to the Driftwood Plan and the LDEQ LPDES General Permit for discharges of hydrostatic test water. Use of the hydrostatic testing program according to the requirements of the LDEQ LPDES General Permit for discharges of hydrostatic test water should ensure that water quality impacts associated with withdrawal and discharge of hydrostatic test water would be minor, temporary, and localized.

Inadvertent spills or leaks of hazardous materials used during construction and operation of the LNG Facility and Pipeline pose a potential risk of contamination to groundwater and surface waters near the Project. Given the impact minimization measures, we conclude that impacts on groundwater and surface waters due to potential spills or leaks during construction and operation of the LNG Facility and Pipeline would not be significant.

The Pipeline route would have 317 separate waterbody crossings, including 88 crossings of perennial streams, 80 crossings of intermittent streams, 136 crossings of ephemeral streams, and the remainder are crossings of open waterbodies (lakes, ponds, etc.). Open cut construction methods would be used at 281 crossings. In-stream construction using open-cut methods in flowing streams cause temporary suspension of sediments. In-stream construction also could cause the dislodging and transport of channel bed sediments and the alteration of stream contours, which can alter stream dynamics and result in increased deposition and/or erosion in the downstream reach of the stream. Increased light penetration caused by bank clearing and increased turbidity can potentially result in diminishment of photosynthetic oxygen production and decreased dissolved oxygen concentration. The Pipeline would be installed using 12 HDD crossings. Two of HDD crossings do not cross waterbodies. Five of the HDD crossings avoid more than one waterbody. In total, 15 waterbodies are avoided by the HDD crossing method. The conventional-bore method would be used at 2 crossings.

Use of the Driftwood Plan and Procedures, HDD Plan, our mitigation recommendations, and performance of the work according to applicable permits should ensure that impacts described above would be minor and, with the exception of permanent filling of waterbodies at the LNG Facility that would be mitigated through contribution to Louisiana's BUDM program, would be temporary.

5.1.4 Fisheries and Aquatic Resources

Dredging of the marine facilities occurring during construction and during routine maintenance would temporarily increase noise, turbidity, and suspended solid levels within the water column, reducing light penetration and primary production (creation of organic compounds from carbon dioxide), adversely affecting fish eggs and juvenile fish survival, benthic community diversity and health, foraging success, and suitability of spawning habitat. Engine noise from LNG vessels during operation would continue throughout the lifespan of the project. Aquatic resources present near the LNG Facility are likely accustomed to regular fluctuations in noise and turbidity levels from shipping, industrial activity, and maintenance dredging (which occurs every other year within this reach of the Calcasieu Ship Channel).

Driftwood would use a cutterhead suction dredge for the Marine Berth, which minimizes turbidity at the dredging site compared to mechanical dredging methods such as clamshell and dragline dredges.

Construction of the LNG Facility would require 48,420 piles, installed by driving conducted over about 20 months. Potential impacts on aquatic resources include injury or trauma to fish, sea turtles, and other animals with gas-filled cavities, such as swim bladders, lungs, sinuses, and hearing structures. As mitigation for the potential injury to fish near the pile-driving source, we are recommending that Driftwood develop an In-water Pile Driving Plan in consultation with the NMFS that, when implemented, would reduce peak noise levels below 206 dB (re: 1 μPa). Based on the incorporation of this mitigation measure, we have determined that underwater noise emissions would not significantly impact fish, sea turtles, or marine mammals.

The cooling water intake associated with LNG carriers would result in impingement and entrainment of early life stages (ichthyoplankton) and other small organisms. Driftwood conducted a 48-hour sampling and analysis effort in October 2017 to measure ichthyoplankton density and abundance. Based on the results of the study and anticipated volumes of cooling water for LNG carriers, about 19,500 fish and shrimp would be entrained by each DFDE LNG carrier visit and about 23,500 fish and shrimp would be entrained by each Steam Turbine LNG carrier visit. At full capacity, Driftwood anticipates receiving one LNG carrier per day. LNG carriers could therefore affect between 7 million and 8.5 million fish and shrimp per year by cooling water intake. Compared to the high abundance of fish and shrimp in estuarine waters, we conclude that these impacts would not be significant.

Freshwater fish and aquatic species could potentially be within waterbodies crossed by the Pipeline. Open cut construction of perennial and intermittent streams and open waterbodies would result in temporary and minor impacts on fish and aquatic species due to temporary increases in turbidity and sedimentation and temporary decreases in dissolved oxygen.

We have determined that, with Driftwood's proposed mitigation measures and our recommended mitigation, the Project would not have significant effects on aquatic resources.

5.1.5 Wetlands

Construction and operation of the LNG Facility would result in the permanent loss of approximately 319 acres of wetland. Of the wetlands affected, about 99 percent would be converted to industrial lands and the remaining 1 percent would be converted to open water associated with the marine berth and MOF or filled for shoreline stabilization. No wetlands would be affected by the Temporary Offsite Construction Areas.

A total of 425.9 acres of wetlands would be affected during construction of the Pipeline, as indicated in table 4.5-1. Following construction, 344.9 acres of wetlands would be restored according to the Driftwood Procedures and allowed to revegetate naturally. Within one to three years, areas of PEM and PSS wetlands would transition back into a community with a function similar to that of the wetland prior to construction. Areas of PFO wetlands would require additional time to recover.

Ten of the twelve proposed HDD installations would cross wetlands, which would minimize disturbance between entry and exit points. To further minimize impacts we are recommending Driftwood file a revised crossing plan that removes an HDD exit location from PFO wetlands at the Calcasieu River crossing.

As also discussed in section 5.1.3.2, Driftwood would contribute dredged material to Louisiana's BUDM Program to build and restore degraded coastal wetlands, which would offset the majority of the wetland impacts at the LNG Facility site. Final mitigation requirements would be subject to review and approval by the COE New Orleans District as part of the Section 404/10 permit process. Driftwood submitted a Joint Permit Application to the COE and LDNR, which is currently under review by the COE.

Based on Driftwood's proposal and proposed mitigation measures, implementation of the Driftwood Procedures during construction to minimize impacts on wetlands, we conclude that impacts on wetlands would not be significant.

5.1.6 Vegetation

Vegetation would be cleared for the construction of the LNG Facility, including temporary use areas for equipment laydown, parking, and staging during construction. Following construction, table 4.6-2 describes the acres of vegetation affected at the LNG Facility site that would be permanently converted to industrial use associated with operation of the LNG Facility, resulting in the permanent loss of upland vegetation and palustrine and estuarine wetlands, as discussed above. The temporary offsite construction area, including park-and-rides (about 137.7 acres) would be released to their owners in their developed condition.

Vegetation would be cleared for the construction of the Pipeline, including workspaces and access roads. Following construction, table 4.6-2 describes the acres of vegetation that would be maintained as permanent easement or converted to permanent access roads, as well as the acres of vegetation that would be cleared for construction of the aboveground facilities, and the acres that would be converted to industrial use associated with operation of the compressor stations and meter stations. The remaining areas would be restored in accordance with the Driftwood Plan and Procedures and returned to their pre-construction land use.

Two longleaf pine savannah habitat communities (8.1 acres) would be crossed by the Pipeline. The final compensatory mitigation plan under COE jurisdiction would include offsets for all wetland communities, including longleaf pine. Based on the abundance of similar vegetated areas in the region and the use of the Driftwood Plan and Procedures to restrict impacts on the Project site, we determined that impacts on vegetation from construction and operation of the Project would be permanent but minor.

5.1.7 Wildlife Resources

Construction of the LNG Facility would affect vegetated wildlife habitat and open water habitat (see table 4.6-2). Following construction, 551.3 acres of vegetated habitat would be permanently converted to industrial land use (including land permanently converted to open water habitat for the marine berths and MOF) and 137.7 acres of vegetated habitat would be restored and maintained as herbaceous open land (see table 4.6-2). Open water habitat within the Calcasieu Ship Channel affected during construction would remain open water during operation of the LNG Facility, although water depth would increase.

Construction and operation of the Pipeline would result in both temporary and permanent alteration of wildlife habitat (see table 4.6-2). Within the Pipeline right-of-way, temporary wildlife impacts would be those associated with the disturbance and disruption to habitats during the construction period (e.g., vegetation clearing, human activity, noise), whereas permanent impacts generally would be associated with the conversion of habitat to maintained right-of-way, in particular, conversion of forested habitat to early successional habitats due to the periodic maintenance of the permanent Pipeline right-of-way.

The greatest effect on wildlife habitat would result from cutting, clearing, and/or removal of existing vegetation, which would reduce the amount of available wildlife habitat in the area and may result in direct mortality of less mobile wildlife (e.g., small rodents and reptiles). Following construction, 86.2 acres of wildlife habitat (primarily agricultural lands and upland forest) would be permanently converted to an industrial land use associated with the operation of the aboveground facilities. The remaining 41.4 acres would be allowed to revert to pre-construction conditions.

To minimize and mitigate impacts on wildlife species and their associated habitats, Driftwood would follow the Driftwood Plan and Procedures, ESCP, Revegetation and Invasive Species Management Plan, and construction SPCC Plan. With the implementation of these measures, and because abundant similar habitat is available for wildlife adjacent to the affected areas, we conclude that construction and operation of the Pipeline would have minor and temporary impacts on local wildlife populations and habitat and the aboveground facilities would have minor, permanent impacts on local wildlife populations and habitat.

The vegetation communities within the Project area provide suitable habitat for migratory birds. During field surveys conducted by Driftwood in 2016 and 2017, a total of 41 migratory bird species were observed within the LNG Facility area, and 71 migratory bird species were observed along the Pipeline alignment. However, no colonies or rookeries associated with wading birds (including herons, egrets, night herons, ibis, and roseate spoonbill), anhingas, or cormorants were documented within the Project area. Impacts on migratory birds and their habitat due to construction and operation of the Project would be similar to impacts on general wildlife resources.

We are recommending that Driftwood consult with the USFWS and file a final set of mitigation measures to minimize impacts on migratory birds with the Secretary prior to construction. Once vegetation is removed from the construction area, migratory birds arriving in the area would be unlikely to choose to nest within the disturbed habitat and in the presence of human activities and instead would select the abundant undisturbed habitat outside the construction area.

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. Driftwood would follow the National Bald Eagle Management Guidelines for the LNG Facility and would continue to consult with the USFWS and LDWF to ensure compliance under the MBTA and establish avoidance and mitigation measures, as necessary. Based on Driftwood's proposal and their commitment to continued consultations, we conclude that impacts on migratory birds as a result of operational lighting would be permanent, but minor.

5.1.8 Special Status Species

Based on information obtained from the USFWS and NMFS, 16 federally listed species may occur within the parishes affected by the Project. Of these, 12 are marine species (five sea turtle species, four whale species, two fish species, and the West Indian manatee) that may occur in the Calcasieu Ship Channel in Cameron Parish, Louisiana, or off the Gulf Coast. Therefore, potentially suitable habitat for these species is limited to the portion of the marine transit in Cameron Parish and the Gulf of Mexico.

The primary threat to these marine species occurring along the marine transit routes would be an increased risk of vessel strikes during construction and operation. Barges and LNG carriers would use established and well-traveled shipping lanes. Driftwood proposes to provide LNG carrier captains with the NMFS-issued document *Vessel Strike Avoidance Measures and Reporting for Mariners*, which outlines collision-avoidance measures. Based on Driftwood's proposed use of existing, highly traveled shipping lanes and proposed mitigation measures during marine transit, we have determined that construction and operation of the LNG Facility *may affect, but is not likely to adversely affect* these marine species. This finding also applies to the protected marine mammals in the Gulf of Mexico.

Of the four remaining federally protected species, only the red-cockaded woodpecker has potential habitat, loblolly pine, within the Project area. Therefore we have determined the Project *may affect, but is not likely to adversely affect* the red-cockaded woodpecker. For the other three species, we have determined, based on the range, habitat requirements, and Project activities, that the Project would have no effect on the piping plover, red knot, and American chaffseed.

Because consultation with the USFWS and NMFS is ongoing, we are recommending that the FERC staff complete any necessary Section 7 ESA consultation prior to construction.

5.1.9 Land Use, Recreation, and Visual Resources

5.1.9.1 Land Use

Land use in, adjacent to, and surrounding the LNG Facility consists of undeveloped lands, rural residential lands, and developed lands including other industrial facilities. The acreage required for construction of the facilities is displayed in table 4.9-1. About 300 acres of the LNG Facility and 12 acres of maintenance buildings and warehouses would be surrounded with security fence.

There are eight structures within 25 feet of the construction right-of-way, two of which would be purchased by DWPL. DWPL has developed site-specific plans for the remaining six locations.

We reviewed these site-specific plans, and have concluded Driftwood's mitigation measures would lessen impacts on the affected residences. Overall, impacts on residential land would be minor and temporary, and therefore would not be significant.

DWPL's Pipeline construction workspaces would abut two parcels that are designated as NRCS WRP easements; no other public conservation easements or other private conservation lands or land trusts, including NRCS Conservation Reserve Program easements are within 0.25 mile of the LNG Facility and Pipeline route or within 0.5 mile of aboveground facilities. No portion of DWPL's temporary or permanent easements would cross onto either of the identified WRP easements. Therefore, there would be no impacts on public or conservation easements from the Project.

5.1.9.2 Recreation

There are no designated natural, recreational, scenic areas, or wildlife refuges within or adjacent to the LNG Facility site. The recreational areas closest to the LNG Facility include the Intracoastal Park (about 1.3 miles southwest) and Calcasieu Point Landing (about 1.4 miles east) that is associated with use of the Calcasieu River and Calcasieu Lake for boating, fishing, and birding. Portions of two NWRs are near the Calcasieu Ship Channel and offer a variety of recreational activities. The Sabine NWR is 8 miles south of Hackberry, Louisiana, and the refuge extends to the ship channel between river miles 9 and 12. The East Cove Unit of the Cameron Prairie NWR extends along a portion of the southeastern shore of Calcasieu Lake. The Cameron Prairie NWR is distant from the Calcasieu Ship Channel, and there is a strip of land on the eastern side of the channel that blocks views from the refuge.

Construction and operation of the LNG Facility would increase the number of vessels using the Calcasieu Ship Channel. LNG carriers are required by USCG regulations (33 CFR 165.805) to maintain a moving security zone two miles ahead and one mile behind from channel edge to channel edge. These regulations prohibit vessel traffic within the security zone, except moored vessels or vessels within a designated anchorage area. Users of the NWRs, recreational areas adjacent to the channel, and boat slips associated with the Driftwood Community would be subject to channel closure during passage of the LNG carriers (approximately 20-25 minutes at a typical speed of 8 knots) and during maneuvering in the turning basin (approximately one hour). Based on one LNG carrier per day and channel closure duration of 20-25 minutes at locations outside the turning basin, the impact on recreational boating would not be significant. The Creole Nature Trail All-American Road includes the portion of Highway 27 that extends from Sulphur to the Gulf Coast, including the highway near the LNG Facility. During construction of the LNG Facility, there would be a substantial increase in traffic on Highway 27 between Sulphur and the Project site, potentially causing impacts on access for the Creole Nature Trail All-American Road. We conclude the impacts of construction and operation of the LNG Facility on the Creole Nature Trail All-American Road would be minor to moderate with implementation of Driftwood's Traffic Management Plan and the Driftwood Plan and Procedures.

One state-managed Scenic River, the Calcasieu River, would be crossed by the Pipeline near MP 37.5 using the HDD construction method. DWPL would set the HDD entry and exit workspaces back at least 400 feet from the edge of the waterbody, and visual and noise impacts would be minimal and temporary.

5.1.9.3 Visual Resources

The primary existing receptors in the viewshed of the LNG Facility include residential areas, recreational areas associated with the Calcasieu River, and a portion of the Creole Nature Trail All-American Road (Highway 27). Residences along the shores of Calcasieu Lake, Calcasieu Ship Channel, and recreational boaters and fishermen would also be within the viewshed of the LNG Facility and the associated ship traffic. No schools or churches would be within the viewshed of the LNG Facility.

Prominent features visible within the LNG Facility would include the three LNG storage tanks, flare stacks, the LNG plants, and LNG carriers. To minimize visual impacts on residences near the LNG Facility, DWLNG would maintain vegetation and trees at a height of 25-30 feet southeast of the Driftwood Community, as well as vegetation and trees at Dutch Cove cemetery adjacent to the LNG Facility as natural screening. The LNG Facility would require outdoor lighting for safety and security that would be visible to nearby residences at night. Once the LNG Facility is completed, the aesthetics would be consistent with other existing industrial developments along the Calcasieu Ship Channel such as Cameron LNG and Lake Charles LNG. Based on the updated visual renderings of the LNG Facility as seen from the Driftwood Community, as well as Driftwood's commitment to plant trees to the south of the Driftwood Community to provide for additional screening between the LNG Facility and the residences, we have determined the LNG Facility would not be a significant visual impact on the Driftwood Community.

The visual impacts of the underground pipeline would be primarily due to DWPL's right-of-way vegetation clearing. About 70 percent of the proposed right-of-way would parallel existing permanent rights-of-way, limiting the changes in viewshed.

Compressor stations would be visible during operation. DWPL would not disturb intervening vegetation present at Compressor Stations 01 and 03. In addition, there is an existing compressor station between Compressor Station 03 and the nearest residence. Compressor Station 02 is about 1,850 feet from the nearest residence. Following construction of the compressor stations, DWPL would maintain existing vegetation on the property outside of the fenced area, paint all buildings and outdoor equipment to be maintained throughout the life of the asset, install fencing and, if necessary, plant local vegetation to further shield the station from neighboring structures.

Outdoor lighting of compressor stations would be designed to minimize visual effects at night, including directional shielding and downward direction where practicable. Additional lighting would only be necessary when active maintenance operations at the compressor stations require nighttime work. As a result, the nighttime appearance of the compressor stations would not have a significant impact on visual resources. Although the visual impacts during operation would be permanent, they would not be significant due to the mitigation proposed by DWPL, distance from visual receptors, presence of similar industrial facilities in the viewshed, and the use of downlighting to shield aboveground facility lighting at night.

5.1.10 Socioeconomics

Construction of the Driftwood LNG Project would require an estimated peak workforce in month 35 of 5,400 personnel for the LNG Facility and 1,030 for the Pipeline. Driftwood anticipates hiring about 30 percent of required workers locally. Operation of the LNG Facility and Pipeline would require a permanent workforce of 539 new employees, with an estimated 64 percent to be hired locally. Housing of construction workers and family members would result in a moderate, temporary impact on housing availability in the Project area that would last about 6 years.

Driftwood estimates spending a total of $14.5 billion to construct the LNG Facility, of which $3.8 million would be spent within the Lake Charles MSA, generating increased local, state, and federal sales tax revenue in the Project Area.

After construction, Driftwood would pay parish property taxes on its LNG Facility and associated equipment. There also would be long-term increases in sales tax revenue from expenditures on materials, goods, and services by Driftwood and the operational workforce. On December 14, 2018, DWLNG received approval to participate in the State of Louisiana's Industrial Tax Exemption Program. This program waives property taxes for five years with the potential for an extension for another five years, and will decrease the accrual of Project property taxes to Calcasiu Parish over the life of the Project.

DWPL estimates spending $45 million on construction goods and services in Louisiana during construction of the Pipeline, generating increased local, state, and federal sales tax revenue in the Project area. This increase in tax revenue would be a minor, temporary, positive impact on the tax revenue in the parishes crossed by the Pipeline. Operation of the Pipeline would also have a positive effect on local property tax revenue based on Driftwood's tax projections of about $407 million over the life of the Pipeline.

During operation, the Project would have a positive economic effect on the general community, as well as on minority and economically disadvantaged populations through job creation, economic activity, and tax payments. The Project would not significantly affect urban or residential areas nor would there be disproportionately high and adverse human health or environmental effects on minority populations, low-income communities, or Indian Tribes. Therefore, we conclude that construction and operation of the Project would not disproportionately affect any population group, and no environmental justice or protection of children issues are anticipated as a result of construction or operation of the Project.

During construction of the LNG Facility, local roadway traffic volume would increase, creating additional delays at several of the intersections analyzed. Driftwood has committed to coordinating improvements to Burton Shipyard Road, including a right-hand turn lane to the north onto Highway 27 and a left-hand turn lane on Highway 27 for traffic turning onto Burton Shipyard Road, and connecting Olsen Road directly to Highway 27 to allow local traffic to avoid Burton Shipyard Road. These projects would help alleviate traffic concerns near the LNG Facility.

5.1.11 Cultural Resources

Cultural surveys were performed for the LNG Facility and Pipeline, consisting of about 718 acres to address the direct APE for the Facility in Calcasieu Parish, Louisiana, and about 3,474.1 acres to address part of the direct APE for the Pipeline in Calcasieu, Jefferson Davis, Acadia, and Evangeline Parishes, Louisiana. The SHPO has accepted reports on these surveys with no additional comments. Due to restricted access, survey of approximately 400 acres for the Project remains. The indirect APE reviewed for the LNG Facility was 0.5 mile; however, the height of the structures at the LNG Facility has been revised since previous consultation on the Project was submitted to the SHPO. Given the height of some structures, we are recommending that DWLNG increase the indirect APE to a radius of 1.0 mile for the LNG Facility and request comment from the SHPO. We are also recommending that construction not begin until DWLNG and DWPL file complete survey reports and SHPO comments, and the Section 106 consultation process for cultural resources is complete.

5.1.12 Air Quality and Noise

Construction emissions for the LNG Facility would be temporary, comparable to other types of infrastructure projects or industrial facilities, and represent a small portion of the overall annual emissions in the region. During the three years of concurrent commissioning, construction, and operation of the LNG Facility, emissions levels may result in exceedances of the NAAQS in the immediate vicinity of the LNG Facility; however, these emissions would not be persistent at any one time during these years due to the dynamic and fluctuating nature of construction activities. The construction emissions would not have a long-term effect on air quality in the area.

The LNG Facility would be a PSD major source and a Title V major source for NO_x, CO, PM_{10}, $PM_{2.5}$, VOC, and HAP emissions. The LNG Facility SO_2 and CO_2e emissions would be above the PSD significant emission rate. Driftwood has submitted analyses that demonstrate compliance with the NAAQS and PSD increment for NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$, and compliance with the O_3 NAAQS. It is also required to comply with the federal requirements for major sources of CO_2e.

Residents near the Pipeline and compressor station construction areas may experience elevated emission levels during the period of construction, primarily from fugitive dust. The magnitude of emissions from compressor station construction would be much lower that the emissions from construction of the

LNG Facility. The pipeline construction emissions would occur at any given location for only a short period, as pipeline construction moves along the route.

CS-01 and CS-02 would be a PSD minor source, a Title V major source for NO_x and CO; and an area (minor) source of HAPs. CS-03 would be a PSD minor source, a Title V major source for CO; and an area (minor) source of HAPs. For all pollutants, the predicted impact plus the background concentration is less than it's relevant NAAQS. Therefore, we conclude that the operation of CS-01, CS-02, and CS-03 would not cause or significantly contribute to an exceedance of the NAAQS.

Through use of construction work practices, analysis of the estimated emissions from construction and operation, and an analysis of the modeled air quality impacts from operation of the LNG Facility and Pipeline, we find there would be no regionally significant impacts on air quality.

Noise levels associated with construction activity would vary depending on the phase of construction in progress at any time. The highest level of construction noise at the LNG Facility typically occurs during earth-moving and pile-driving work. The loudest equipment sources typically generates up to 95 dBA (decibels on an A-weighted scale) at 50 feet. Driftwood has indicated that it plans to construct at the LNG Facility 24 hours per day. Should this occur, we are recommending Driftwood file additional information to ensure nearby residents are not exposed to excessive noise.

Pile driving, which would occur for three years at the LNG Facility, was calculated to produce L_{eq} sound levels that are below our noise criterion of 55 dBA. However, calculated maximum sound levels or L_{max} of pile driving (i.e., each hammer strike) would be well above the existing ambient levels. Although pile driving would be clearly audible at nearby residences when ambient sound levels are low, it would only occur during between 7 a.m. and 7 p.m. The impulsive noise of pile driving would be clearly audible outside of residences, and potentially indoors in the numerous homes near the LNG Facility. Therefore, to ensure that impacts due to maximum pile driving noise levels at the LNG Facility would be minimized, we are recommending that DWLNG prepare and follow a pile-driving noise management plan including sound level monitoring, and evaluation and use of noise mitigation to limit L_{max} levels to no greater than 60 dBA at the nearest NSA. Additionally, as described for fisheries and aquatic resources, we are recommending that Driftwood develop an In-water Pile Driving Plan in consultation with the NMFS that would identify mitigation measures that, when implemented, would reduce peak noise levels below 206 dB (re: 1 μPa).

Sound-level increases during Pipeline construction would be intermittent and generally would occur between 7:00 a.m. and 7:00 p.m., with the potential exception of HDD activity. HDD is proposed at 11 locations (two of the 12 HDD crossings would be installed at a single location where the mainline and a lateral pipeline run parallel), seven of which have NSAs within 0.5 mile. Driftwood has proposed sound mitigation measures at these sites, including compensation for temporary relocation of nearby residents during planned nighttime work. We are recommending that DWPL prepare and follow a noise mitigation plan for HDD entry and exit locations at six of those seven HDDs.

During operation, the LNG Facility would generate noise levels that would occur throughout the life of the Project. Noise would be produced continually by a number of sources that include various types of compressors, combustion turbines, cooling fans, pumps and piping. The LNG Facility would ultimately consist of 5 LNG plants that would be sequentially brought online as they are completed. Operational noise levels were modeled for plants 1 and 2, and then incrementally for the remaining three plants. Driftwood has proposed noise mitigation measures to achieve compliance with our 55 dBA L_{dn} criterion. Because the noise levels identified for plants 4 and 5 without mitigation exceeded our threshold, DWLNG has committed to developing an as-built noise model of plant 1. The resulting information would be used to model anticipated noise from plants 2 to 5 as they are constructed and phased into operation and identify mitigation measures to reduce the noise generated by plants 4 and 5 to meet our thresholds.

In addition to Driftwood's commitment to a post-construction noise survey of Plant 1 while it is operating under full load, we are recommending that DWLNG file full-load noise surveys at the LNG Facility no later than 60 days after placing Plants 2 through 5 into service, as well as installing additional noise controls, if actual conditions exceeds an L_{dn} of 55 dBA at any nearby NSAs.

During operation, the compressor stations would contain combustion turbines, compressors, cooling fans, and other noise generating sources. The meter stations would contain control valves and ultrasonic meters. Noise analyses predict that the noise attributable to each compressor station would be within our threshold of an L_{dn} of 55 dBA at each of the NSAs within 0.5 mile of each compressor station. Similarly, noise attributable to meter stations would be within our threshold.

We are recommending that DWPL file full-load noise surveys at MS-2, MA-4, MS-7, MS-9, MS-12, and MS-13, and at each of the compressor stations no later than 60 days after placing these meter stations and each compressor station in service and installing additional noise controls, if actual conditions exceeds an L_{dn} of 55 dBA at any nearby NSAs.

Based on the noise analyses above and our recommendations, we conclude that operation of the Project would not have a significant impact on the noise environment near the LNG Facility, any of the compressor stations, or other aboveground facilities.

5.1.13 Reliability and Safety

We evaluated the safety of the Driftwood LNG Project, including the LNG Facility, Pipeline, and associated facilities.As part of the NEPA review, Commission staff assesses the potential impact to the human environment in terms of safety, based on whether the facilities would operate safely, reliably, and securely.

As a cooperating agency, the DOT assists the FERC by determining whether DWLNG's proposed design would meet the DOT's 49 CFR 193 Subpart B siting requirements. The DOT reviewed information submitted by DWLNG and on December 11, 2017, and as clarified on July 13, 2018, provided a letter to FERC staff stating that the DOT had no objection to DWLNG's methodology to comply with the 49 CFR 193 siting requirements for the proposed LNG liquefaction facilities. 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 Facility and the associated LNG carrier traffic. The USCG reviewed a WSA submitted by DWLNG that focused on the navigation safety and maritime security aspects of LNG carrier transits along the affected waterway. On April 25, 2017, the USCG issued an LOR to FERC staff indicating the Calcasieu 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 01-2011. If the facility is authorized and constructed, the facility would be subject to the USCG's inspection and enforcement program to ensure compliance with the requirements of 33 CFR 105 and 33 CFR 127.

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 conclude that the DWLNG LNG Facility's 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, we are recommending additional meaures to be implemented prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout the life of the facility to enhance the reliability and safety of the facility and to mitigate the risk of impact on the public.

The Pipeline and associated aboveground facilities would be constructed, operated, and maintained in compliance with DOT standards published in 49 CFR 192. These regulations are intended to minimize the potential for natural gas facility accidents and protect the public and environment. The DOT specifies material selection and qualification; minimum design requirements; and protection from internal, external, and atmospheric corrosion. We conclude that the Pipeline would have a small increase in the risk of a pipeline accident, however, this risk would be minimized based on compliance with DOT regulations. Therefore, the Pipeline would not have a significant impact on public safety.

5.1.14 Cumulative Impacts

Other past, present, or reasonably foreseeable projects that could cumulatively interact with the LNG Facility and Pipeline to impact environmental resources include industrial facilities, pipelines, housing developments, commercial developments, energy projects, and transportation/infrastructure projects. We assessed those projects that occurred within the time and space as the either or both the LNG Facility or the Pipeline for the potential for the LNG Facility and Pipeline, when considered with these other projects, to cumulatively contribute to impacts on those resources.

As discussed in detail in section 4.14 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 Driftwood LNG Project and other projects, the potential for the LNG Facility and Pipeline to significantly contribute to cumulative impacts is not anticipated for the following environmental resources: geological, soils, groundwater, special status species, cultural, air, and safety. Cumulative impacts for the remaining resources are further summarized below.

The greatest potential for cumulative impacts associated with surface water resources for the LNG Facility is associated with dredging activities in the Calcasieu River. Changes to water quality associated with dredging would be short-term and limited to the time in which dredging occurs. Overall, we conclude the potential of the LNG Facility to significantly contribute to cumulative impacts on surface water is not significant. Impacts on surface water from Pipeline installation across waterbodies using open-cut methods has the potential to interact with other projects, and should they occur concurrently with and near in-water activities of the other projects considered, would cumulatively result in greater effects on those surface waters. We conclude there is no potential for significant cumulative impact on surface water from other construction activities or from operation of the LNG Facility or Pipeline. Impacts on wetlands from construction and operation of the LNG Facility and Pipeline would be minimized through implementation of the Driftwood Procedures and mitigation through BUDM or purchase of compensatory mitigation. We conclude the LNG Facility and Pipeline would cumulatively result in minor, mitigated, impacts on wetlands.

Impacts on vegetation would be permanent where vegetated areas are converted to industrial use for the LNG Facility or Pipeline aboveground facilities. Construction of other projects, should they occur concurrently with and adjacent to construction of the Pipeline, also has the potential to cumulatively be larger than construction of either project separately. We conclude the LNG Facility and Pipeline would result in permanent but minor changes to vegetation resources within the geographic scope.

Construction and operation of the LNG Facility and Pipeline aboveground facilities would convert existing wildlife habitat to industrial use. Concurrent construction of projects close to the Pipeline has the greatest potential to cumulatively impact wildlife through habitat disturbance, noise, lighting, and human presence. We conclude the LNG Facility and Pipeline, when considered in combination with impacts from the other projects in the geographic scope of analysis, would cumulatively contribute to permanent and minor impacts on wildlife within the geographic scope.

Construction impacts from in-water work, such as dredging and pile driving for the LNG Facility and open-cut waterbody crossings during Pipeline construction, could cumulatively contribute to impacts on fisheries and aquatic resources, should disturbance associated with other projects occur within the same time frame and waterbody. Increased marine vessel traffic from construction and operation of the LNG Facility also could result in minor cumulative impacts on fisheries and aquatic resources. We conclude the minor impacts anticipated from the LNG Facility and Pipeline to fisheries and aquatic resources, while minor, would cumulatively be larger than those described for either the LNG Facility or Pipeline alone.

The LNG Facility and Pipeline aboveground facilities would convert existing land uses to industrial use. Future construction on lands within the permanent Pipeline right-of-way would be eliminated. Where other facilities or pipeline are adjacent to the proposed Project, these changes and restrictions could represent a substantial cumulative impact on affected landowners. While the LNG Facility would not result in significant impact to visual resources, it would cumulatively contribute to the impact on visual resources in the area.

Construction of the LNG Facility and Pipeline, along with other projects in the region, could result in short-term shortages in available local workers. Should this occur, additional non-local workforce could temporarily cause a reduction in available housing. The LNG Facility and Pipeline would also, in combination with other projects, generate state and local government revenues through sales taxes, property taxes and income taxes, which would contribute to public services such as education, law enforcement and health programs. The LNG Facility would generate road and marine traffic during construction and operation. Existing road traffic due to current other projects in the area would likely be improved by mitigation measures DWLNG has proposed; therefore the impact of the LNG Facility, when considered with other projects within the geographic scope for cumulative impacts, would have minimal negative impact on road traffic and may improve area road traffic. We conclude the cumulative impacts from the Project to socioeconomic resources, when considered in combination with the impacts from the projects listed above, would predominantly occur during construction and would be minor and temporary.

Fugitive emissions and dust resulting from construction of the LNG Facility and Pipeline have the potential to cumulatively interact with other projects in the area should construction schedules overlap. Cumulative impacts from construction would be minor and temporary. During operation, the LNG Facility and Pipeline, as well as other projects qualifying as major sources of emissions would be required to meet similar permit conditions as the LNG Facility and Pipeline aboveground facilities, and ensure compliance with the state implementation plan and attainment with the NAAQS. Therefore, the cumulative impacts from the LNG Facility and Pipeline aboveground facilities to air quality, when considered in conjunction with the impacts from the projects listed above, would not be significant.

Construction and operation of the LNG Facility and Pipeline would employ the best available technologies based on a GHG BACT analysis. There is no generally accepted methodology to estimate what extent a project's incremental contribution to GHG emissions would result in physical effects on the environment for the purposes of evaluating the Project's impacts on climate change, either locally or nationally. The construction and operation of the Project, as well as downstream emissions, would increase the atmospheric concentration of GHGs, in combination with past and future emissions from all other sources, and contribute incrementally to future climate change impacts. Because we cannot determine the Project's incremental physical impacts due to climate change on the environment, we cannot determine whether or not the Project's contribution to cumulative impacts on climate change would be significant.

The amount of noise generated by construction of the LNG Facility and Pipeline, as well as by other projects, would vary depending on the activity in progress, as well as proximity and timing of the activity. Concurrent construction of projects close to the Pipeline, especially concurrent waterbody crossings using HDD, would have the greatest potential to cumulatively result in noise impacts on NSAs. Although it is unlikely, should the Pipeline and another project construct using HDD at a location concurrently, additional mitigation or compensation for temporary relocation for nearby NSAs would be necessary. We conclude that construction of the Project has the potential to contribute to temporary cumulative noise impacts at locations where the Pipeline is collocated with other pipelines, but that these impacts would be minimal.

5.2 FERC STAFF'S RECOMMENDED MITIGATION

If the Commission authorizes the Driftwood LNG Project, we recommend that the following measures be included as specific conditions in the Commission's Order. These measures would further mitigate the environmental impacts associated with construction and operation of the proposed Project. These measures may apply to DWLNG, DWPL, or to both Applicants collectively, referred to as "Driftwood." The section number in parentheses at the end of a condition corresponds to the section number in which the measure and related resource impact analysis appears in the EIS.

1. Driftwood 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. Driftwood 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 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 DWPL Pipeline. This authority shall allow:

    a. the modification of conditions of the Order,

    b. stop-work authority, and

    c. the imposition of any additional measures deemed necessary to ensure continued compliance with the intent of the conditions of the Order as well as the avoidance or mitigation of unforeseen adverse environmental impact resulting from project construction and operation.

3. For the LNG Facility, the Director of OEP, or the Director's designee, has delegated authority to address any requests for approvals or authorizations necessary to carry out the conditions of the Order, and take whatever steps are necessary to ensure the protection of life, health, property, and the environment during construction and operation of the Project. This authority shall allow:

    a. the modification of conditions of the Order,

    b. stop-work authority and authority to cease operation, and

    c. the imposition of any additional measures deemed necessary to ensure continued compliance with the intent of the conditions of the Order as well as the avoidance or mitigation of unforeseen adverse environmental impact resulting from project construction and operation.

4. **Prior to any construction**, Driftwood shall file an affirmative statement with the Secretary, certified by a senior company official, that all company personnel, EIs, and contractor personnel will be informed of the EI's authority and have been or will be trained on the implementation of the environmental mitigation measures appropriate to their jobs **before** becoming involved with construction and restoration activities.

5. The authorized facility locations, including both the MP 12.9 Route and Port Arthur Route Variations, 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**, Driftwood 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.

    DWPL'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. DWPL's right of eminent domain granted under NGA section 7(h) does not authorize it to increase the size of its natural gas pipeline or aboveground facilities to accommodate future needs or to acquire a right-of-way for a pipeline to transport a commodity other than natural gas.

6. Driftwood shall file with the Secretary detailed alignment maps/sheets and aerial photographs at a scale not smaller than 1:6,000 identifying all route realignments or facility relocations, and staging areas, pipe storage yards, new access roads, and other areas that would be used or disturbed and have not been previously identified in filings with the Secretary. Approval for each of these areas must be explicitly requested in writing. For each area, the request must include a description of the existing land use/cover type, documentation of landowner approval, whether any cultural resources or federally listed threatened or endangered species would be affected, and whether any other environmentally sensitive areas are within or abutting the area. All areas shall be clearly identified on the maps/sheets/aerial photographs. Each area must be approved in writing by the Director of OEP **before construction in or near that area**.

   This requirement does not apply to extra workspace allowed by the Commission's *Upland Erosion Control, Revegetation & Maintenance Plan* and/or minor field realignments per landowner needs and requirements which do not affect other landowners or sensitive environmental areas such as wetlands.

   Examples of alterations requiring approval include all route realignments and facility location changes resulting from:

   a. implementation of cultural resources mitigation measures,

   b. implementation of endangered, threatened, or special concern species mitigation measures,

   c. recommendations by state regulatory authorities, and

   d. agreements with individual landowners that affect other landowners or could affect sensitive environmental areas.

7. **Within 60 days of the acceptance of the authorization and before construction begins**, DWLNG and DWPL shall each file an Implementation Plan with the Secretary, for review and written approval by the Director of OEP. DWLNG and DWPL must file revisions to the plans as schedules change. The plans shall identify the following:

   a. how DWLNG and DWPL 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 DWLNG and DWPL will incorporate these requirements into the contract bid documents, construction contracts (especially penalty clauses and specifications), and construction drawings so that the mitigation required at each site is clear to onsite construction and inspection personnel;

   c. the number of EIs assigned per spread and aboveground facility sites, and how the company will ensure that sufficient personnel are available to implement the environmental mitigation;

   d. company personnel, including EIs and contractors, who will receive copies of the appropriate material;

e. the location and dates of the environmental compliance training and instructions Driftwood will give to all personnel involved with construction and restoration (initial and refresher training as the project progresses and personnel change), with the opportunity for OEP staff to participate in the training session(s);

f. the company personnel (if known) and specific portion of DWLNG's and DWPL's organization having responsibility for compliance;

g. the procedures (including use of contract penalties) DWLNG and DWPL will follow if noncompliance occurs; and

h. for each discrete facility, a Gantt or PERT chart (or similar project scheduling diagram), and dates for:

(1) the completion of all required surveys and reports;

(2) the environmental compliance training of onsite personnel;

(3) the start of construction; and

(4) the start and completion of restoration.

8. DWLNG shall employ at least one EI for the LNG Facility and DWPL shall employ at least one EI per construction spread for the Pipeline. Each EI shall be:

a. responsible for monitoring and ensuring compliance with all mitigation measures required by the Order and other grants, permits, certificates, or other authorizing documents;

b. responsible for evaluating the construction contractor's implementation of the environmental mitigation measures required in the contract (see condition 7 above) and any other authorizing document;

c. empowered to order correction of acts that violate the environmental conditions of the Order, and any other authorizing document;

d. a full-time position, separate from all other activity inspectors;

e. responsible for documenting compliance with the environmental conditions of the Order, as well as any environmental conditions/permit requirements imposed by other federal, state, or local agencies; and

f. responsible for maintaining status reports.

9. Beginning with the filing of its Implementation Plan, DWLNG shall file updated status reports with the Secretary on a **monthly** basis for the LNG Facility, and DWPL shall file updated status reports on a **biweekly** basis for the Pipeline, until all construction and restoration activities are complete. Problems of a significant magnitude shall be reported to the FERC **within 24 hours**. On request, these status reports will also be provided to other federal and state agencies with permitting responsibilities. Status reports shall include the following:

a. an update on Driftwood's efforts to obtain the necessary federal authorizations;

b. Project schedule including the current construction status, work planned for the following reporting period, and any schedule changes for stream crossings or work in other environmentally-sensitive areas;

c. a listing of all problems encountered, contractor nonconformance/deficiency logs, and each instance of noncompliance observed by the EIs during the reporting period (both for the conditions imposed by the Commission and any environmental conditions/permit requirements imposed by other federal, state, or local agencies);

d. a description of the corrective and remedial actions implemented in response to all instances of noncompliance, nonconformance, or deficiency;

e. the effectiveness of all corrective and remedial actions implemented;

f. a description of any landowner/resident complaints which may relate to compliance with the requirements of the Order, and the measures taken to satisfy their concerns; and

g. copies of any correspondence received by Driftwood from other federal, state, or local permitting agencies concerning instances of noncompliance, and Driftwood's response.

10. Driftwood must receive written authorization from the Director of OEP **before commencing construction of any Project facilities.** To obtain such authorization, Driftwood must file with the Secretary documentation that it has received all applicable authorizations required under federal law (or evidence of waiver thereof).

11. DWLNG must receive written authorization from the Director of OEP **prior to introducing hazardous fluids into the LNG Facility.** 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. DWPL must receive written authorization from the Director of OEP **before placing the Pipeline facilities into service**. Such authorization will only be granted following a determination that rehabilitation and restoration of the right-of-way and other areas affected by the Pipeline are proceeding satisfactorily.

13. DWLNG must receive written authorization from the Director of OEP **before placing each phase of the LNG Facility into service**. Such authorization will only be granted following a determination that the facilities have been constructed in accordance with the FERC approval, can be expected to operate safely as designed, and the rehabilitation and restoration of the areas affected by the LNG Facility are proceeding satisfactorily.

14. **Within 30 days of placing the authorized facilities in service**, Driftwood 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 conditions in the Order Driftwood has complied with or will comply with. This statement shall also identify any areas affected by the Project where compliance measures were not properly implemented, if not previously identified in filed status reports, and the reason for noncompliance.

15. **Prior to construction**, DWPL shall adopt the MP 12.9 Route Variation into the Pipeline route. DWPL shall file with the Secretary, for review and written approval by the Director of OEP, revised alignment sheets that show its modified route and workspaces in the area, an HDD site-specific plan, and the results of geotechnical investigations (or indicate timing of when this will be provided). *(section 3.6.2.2)*

16. **Prior to construction**, DWPL shall adopt the Port Arthur Route Variation into the Pipeline route and file with the Secretary, revised alignment sheets that show its modified route and workspaces in the area, for review and written approval by the Director of OEP. *(section 3.6.2.4)*

17. **Prior to the start of in-water pile driving activities,** DWLNG shall file with the Secretary, for review and written approval by the Director of OEP, an In-Water Pile Driving Plan, developed in consultation with the NMFS. This plan shall identify mitigation measures that when implemented will reduce in-water peak noise levels associated with vibratory and hammer pile driving to levels below 206 dB (re: 1 μPa). *(section 4.4.3.1)*

18. **Prior to construction**, DWPL shall file with the Secretary, for review and written approval by the Director of OEP, a revised crossing plan for the Calcasieu River HDD that relocates the exit location and associated workspace to the adjacent upland area, outside of the PFO wetland complex (WJEB009F). *(section 4.5.2.2)*

19. **Prior to construction,** Driftwood shall consult with the USFWS and file with the Secretary a final set of mitigation measures for migratory birds and evidence of consultation with the USFWS. *(section 4.7.3.1)*

20. **<u>Driftwood shall not begin construction activities until</u>:**

    a. Driftwood consults with the USFWS to determine whether proposed Project activities could affect the eastern black rail or its habitat and files copies of all correspondence with the Secretary;

    b. FERC staff completes its conference with the USFWS, if required; and

    c. Driftwood has received written notification from the Director of OEP that construction may begin. *(section 4.8.2.4)*

21. **Prior to construction,** DWLNG shall increase the indirect APE to a radius of 1.0 mile for the LNG Facility. The revised indirect APE and associated addendum report shall be sent to the SHPO for comments. *(section 4.11.3)*

22. Driftwood **shall not begin construction** of facilities and/or use of all staging, storage, or temporary work areas and new or to-be-improved access roads **until**:

    a. Driftwood files with the Secretary:

(1) remaining cultural resources survey report(s);

(2) site evaluation report(s) and avoidance/treatment plan(s), as required; and

(3) comments on the cultural resources reports and plans from the Louisiana State Historic Preservation Office (and interested Indian Tribes).

b. The Advisory Council on Historic Preservation is afforded an opportunity to comment if historic properties would be adversely affected.

c. The FERC staff reviews and the Director of OEP approves the cultural resources reports and plans, and notifies Driftwood 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 4.11.6)*

23. **Prior to construction,** DWLNG shall file with the Secretary, for review and approval by the Director of OEP, a Nighttime Noise Mitigation and Monitoring Plan that details the noise mitigation that it will install (such as the berm, equipment limitations, low-noise back-up alarms, etc.) and shows the noise impacts at the NSAs. The Plan shall include predictions of the noise impacts at the NSAs and demonstrate how the proposed mitigation will reduce noise to no more 55 dBA L_{dn} at occupied residences. The Plan shall also provide for advance notification of nighttime construction to nearby NSAs/residents and noise monitoring. *(section 4.12.2.3)*

24. **Prior to construction**, DWLNG shall file with the Secretary, for review and written approval by the Director of OEP, a Pile Driving Noise Management Plan. The plan shall outline a monitoring plan for sound levels (L_{eq} and L_{max}) during pile driving, and evaluation and use of noise mitigation to reduce noise attributable to pile driving L_{max} levels to no greater than 60 dBA at any NSAs. *(section 4.12.2.2)*

25. **Prior to construction of the Pipeline at HDD locations A1, A2, A4, and A6**, DWPL shall file with the Secretary, for review and written approval by the Director of OEP, an HDD Noise Mitigation Plan to reduce noise levels attributable to the drilling operations at NSAs near their respective entry and exit points to below 55 dBA L_{dn} or 10 dBA over existing sound levels. During drilling operations, DWPL shall implement the approved plan, monitor noise levels, and make all reasonable efforts to meet these noise levels attributable to the drilling operations at the NSAs. *(section 4.12.2.2)*

26. DWLNG shall file a full power load noise survey with the Secretary for the LNG Facility **no later than 60 days** after each liquefaction plant is placed into service. If the noise attributable to operation of the equipment at the LNG Facility exceeds an L_{dn} of 55 dBA at the nearest NSA, **within 60 days** DWLNG shall modify operation of the liquefaction facilities or install additional noise controls until a noise level below an L_{dn} of 55 dBA at the NSA is achieved. DWLNG shall confirm compliance with the above requirement by filing a second noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls. *(section 4.12.2.4)*

27. DWLNG shall file a noise survey with the Secretary **no later than 60 days** after placing the entire LNG Facility into service. If a full-load noise survey is not possible, DWLNG shall provide an interim survey at the maximum possible horsepower load **within 60 days** of placing the LNG Facility into service and provide the full-load noise survey **within 6 months**. If the noise attributable to operation of the equipment at the LNG Facility exceeds an L_{dn} of 55 dBA at the nearest NSA under interim or full horsepower load conditions, DWLNG 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. DWLNG shall confirm compliance with the above requirement by filing an additional full-load noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls. *(section 4.12.2.4)*

28. DWPL shall file noise surveys with the Secretary **no later than 60 days** after placing MS-2, MS-4, MS-7, MS-9, MS-12, and MS-13 facilities in service. If the noise attributable to the operation of the metering facilities at maximum flow exceeds an L_{dn} of 55 dBA at any nearby NSA, DWPL shall install additional noise controls to meet that level **within 1 year** of the in-service date. DWPL shall confirm compliance with the L_{dn} of 55 dBA requirement by filing a second noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls. (*section 4.12.2.4*)

29. DWPL shall file a noise survey with the Secretary **no later than 60 days** after placing CS-01, CS-02, and CS-03 in service. If a full load condition noise survey is not possible, DWPL shall provide an interim survey at the maximum possible horsepower load and provide the full load survey **within 6 months**. If the noise attributable to the operation of all of the equipment at the compressor stations under interim or full horsepower load conditions exceeds an L_{dn} of 55 dBA at any nearby NSAs, DWPL 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. DWPL shall confirm compliance with the above requirement by filing a second noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls. *(section 4.12.2.4)*

30. **Prior to construction of final design**, DWLNG shall file with the Secretary the following information, stamped and sealed by the professional engineer-of-record, registered in Louisiana:

    a. site preparation drawings and specifications;

    b. LNG terminal structures and foundation design drawings and calculations;

    c. seismic specifications for procured equipment prior to the issuing of requests for quotations; and

    d. quality control procedures to be used for civil/structural design and construction.

    In addition, DWLNG shall file, in its Implementation Plan, the schedule for producing this information. *(section 4.13.1)*

31. **Prior to commencement of service**, DWLNG shall file with the Secretary a monitoring and maintenance plan, stamped and sealed by the professional engineer-of-record registered in Louisiana for the perimeter levee which ensures the crest elevation relative to mean sea level will be maintained for the life of the facility considering berm settlement, subsidence, and sea level rise. *(section 4.13.1)*

Conditions 32 through 108 shall apply to the Driftwood LNG Facility. Information pertaining to these specific conditions below shall be filed with the Secretary for review and written approval by the Director of OEP, or the Director's designee, within the timeframe indicated by each condition. Specific engineering, vulnerability, or detailed design information meeting the criteria specified in Order No. 833 (Docket No. RM16-15-000), including security information, shall be 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.

32. **Prior to initial site preparation**, DWLNG shall file an overall LNG Facility schedule, which includes the proposed stages of the commissioning plan. *(section 4.13.1)*

33. **Prior to initial site preparation**, DWLNG shall file quality assurance and quality control procedures for construction activities. *(section 4.13.1)*

34. **Prior to initial site preparation**, DWLNG shall file procedures for controlling access during construction. *(section 4.13.1)*

35. **Prior to initial site preparation**, DWLNG 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, the following:

    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.

    DWLNG 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 4.13.1)*

36. **Prior to initial site preparation**, DWLNG shall file a Cost-Sharing Plan identifying the mechanisms for funding all LNG Facility-specific security/emergency management costs that would be imposed on state and local agencies. This comprehensive plan shall include funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base. DWLNG 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 4.13.1)*

37. **Prior to construction of final design**, DWLNG shall file information/revisions pertaining to DWLNG's response numbers 13, 14, 16, 21, 22, 23, 24, 29, 31, 33, 34, 36, 39, 43, 45, 46, 47, 48, 50, 53, 54, and 57 of its September 29, 2017 filing, which indicated features to be included or considered in the final design. *(section 4.13.1)*

38. **Prior to construction of final design**, DWLNG shall file change logs that list and explain any changes made from the front end engineering design provided in DWLNG's application and filings. A list of all changes with an explanation for the design alteration shall be filed and all changes shall be clearly indicated on all diagrams and drawings. *(section 4.13.1)*

39. **Prior to construction of final design**, DWLNG shall file up-to-date process flow diagrams 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; and

    i. drawing revision number and date. *(section 4.13.1)*

40. **Prior to construction of final design**, DWLNG 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 4.13.1)*

41. **Prior to construction of final design**, DWLNG shall file a car seal philosophy and a list of all car-sealed and locked valves consistent with the P&IDs. *(section 4.13.1)*

42. **Prior to construction of final design**, the engineering, procurement, and construction contractor shall verify that the recommendations from the Front End Engineering Design Hazard Identification are complete and consistent with the requirements of the final design as determined by the engineering, procurement, and construction contractor. *(section 4.13.1)*

43. **Prior to construction of final design**, DWLNG shall file a hazard and operability review prior to issuing the P&IDs for construction. A copy of the review, a list of the recommendations, and actions taken on the recommendations shall be filed. *(section 4.13.1)*

44. **Prior to construction of final design**, DWLNG 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 4.13.1)*

45. **Prior to construction of final design**, DWLNG shall include LNG tank fill flow measurement with high flow alarm. *(section 4.13.1)*

46. **Prior to construction of final design**, DWLNG shall include boil-off gas (BOG) flow, tank density profile and temperature profile measurement for each tank. *(section 4.13.1)*

47. **Prior to construction of final design**, DWLNG shall specify that all ESD valves will be equipped with open and closed position switches connected to the Distributed Control System/Safety Instrumented System. *(section 4.13.1)*

48. **Prior to construction of final design**, DWLNG shall file cause-and-effect matrices for the process instrumentation, fire and gas detection system, and emergency shutdown system. The cause-and-effect matrices shall include alarms and shutdown functions, details of the voting and shutdown logic, and set points. *(section 4.13.1)*

49. **Prior to construction of final design**, DWLNG shall specify and evaluate emergency shutdown valve closure times. Include an analysis that describes the time to detect an upset condition, notify plant personnel, and close the emergency shutdown valve. *(section 4.13.1)*

50. **Prior to construction of final design,** DWLNG shall file an evaluation of dynamic pressure surge effects from valve opening and closure times and pump operations. *(section 4.13.1)*

51. **Prior to construction of final design**, DWLNG shall file a plot plan of the final design showing all major equipment, structures, buildings, and impoundment systems. *(section 4.13.1)*

52. **Prior to construction of final design**, DWLNG shall file three-dimensional plant drawings to confirm plant layout for maintenance, access, egress, and congestion. *(section 4.13.1)*

53. **Prior to construction of final design**, DWLNG shall file complete specifications for the proposed LNG tank design and installation. *(section 4.13.1)*

54. **Prior to construction of final design**, DWLNG shall file the structural analysis of the LNG storage tank and outer containment demonstrating they are designed to withstand all loads and combinations. *(section 4.13.1)*

55. **Prior to construction of final design**, DWLNG shall file an analysis of the structural integrity of the outer containment of the full containment storage tanks that demonstrates it can withstand all thermal and overpressure loads incurred from coincident and adjacent roof tank top fires and release and ignition of design spills. *(section 4.13.1)*

56. **Prior to construction of final design**, DWLNG shall file a detailed aircraft impact analysis that uses frequencies for the various surrounding aircraft operations per DOE-STD-2014-2006 or other approved methodology that demonstrates the design of the full containment LNG tanks would be able to withstand aircraft impacts using CEB 187 or other approved methodology from aircraft operations with impact frequencies equal or more frequent than 3e-5 per year or other approved

frequency that would not result in a significant increase in risk to the surrounding public. *(section 4.13.1)*

57. **Prior to construction of final design**, DWLNG 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 4.13.1)*

58. **Prior to construction of final design**, DWLNG 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 wind borne projectiles. The analysis shall detail the projectile speeds and characteristics and method used to determine penetration or perforation depths. *(section 4.13.1)*

59. **Prior to construction of final design**, DWLNG 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, safety instrument system specifications, cable specifications, other electrical and instrumentation specifications); and

    d. security and fire safety specifications (security, passive protection, hazard detection, hazard control, firewater). *(section 4.13.1)*

60. **Prior to construction of final design**, DWLNG shall demonstrate that, for hazardous fluids, piping and piping nipples 2 inches or less in diameter are designed to withstand external loads, including vibrational loads in the vicinity of rotating equipment and operator live loads in areas accessible by operators. *(section 4.13.1)*

61. **Prior to construction of final design**, DWLNG 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 4.13.1)*

62. **Prior to construction of final design**, DWLNG 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 4.13.1)*

63. **Prior to construction of final design**, DWLNG shall file drawings and specifications for vehicle barriers at each facility entrance for access control. *(section 4.13.1)*

64. **Prior to construction of final design**, DWLNG 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 and cameras interior to the facility that would 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 4.13.1)*

65. **Prior to construction of final design**, DWLNG 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. Specific consideration shall be given to the use of low expansion foam and other automatic fire protection measures in the condensate and hazardous fluid storage areas. *(section 4.13.1)*

66. **Prior to construction of final design**, DWLNG shall file spill containment system drawings with dimensions and slopes of curbing, trenches, impoundments, and capacity calculations considering any foundations and equipment within impoundments, as well as the sizing and design of the down-comer that would transfer spills from the tank top to the ground-level impoundment system, and sizing and design of the marine spill containment system that will transfer spills from the jetty back to the site's impoundment system. *(section 4.13.1)*

67. **Prior to construction of final design**, DWLNG shall file correspondence from DOT demonstrating the gravity drained water removal systems for impoundment areas meets DOT regulations regarding the use of sump pumps and automatic shutdown controls and water removal systems prescribed in 49 CFR 193.2173. *(section 4.13.1)*

68. **Prior to construction of final design**, DWLNG shall file electrical area classification drawings. *(section 4.13.1)*

69. **Prior to construction of final design**, DWLNG shall file drawings and details of how process seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system meet the requirements of NFPA 59A (2001 edition). *(section 4.13.1)*

70. **Prior to construction of final design**, DWLNG 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 4.13.1)*

71. **Prior to construction of final design**, DWLNG shall file a drawing showing the location of the emergency shutdown buttons. Emergency shutdown buttons shall be easily accessible, conspicuously labeled, and located in an area which would be accessible during an emergency. *(section 4.13.1)*

72. **Prior to construction of final design**, DWLNG shall file the details of a site-wide ESD button with proper sequencing and reliability or shall include other provisions that are demonstrated through a human reliability analysis to provide a means to quickly and reliably shutdown the entire site. *(section 4.13.1)*

73. **Prior to construction of final design**, DWLNG shall file complete drawings and a list of the hazard detection equipment. The drawings shall clearly show the location and elevation of all

detection equipment. The list shall include the instrument tag number, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment. *(section 4.13.1)*

74. **Prior to construction of final design**, DWLNG shall file a technical review of facility design that:

    a. identifies all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and

    b. demonstrates that these areas are adequately covered by hazard detection devices and indicates how these devices would isolate or shut down any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency. *(section 4.13.1)*

75. **Prior to construction of final design**, DWLNG shall file a design that includes hazard detection suitable to detect high temperatures and smoldering combustion in electrical buildings and control room buildings. *(section 4.13.1)*

76. **Prior to construction of final design**, DWLNG shall file a design that includes smoke detection in occupied buildings. *(section 4.13.1)*

77. **Prior to construction of final design**, DWLNG shall file an analysis of the localized hazards to operators from a potential liquid nitrogen release and shall also provide consideration of any mitigation that may be prudent. *(section 4.13.1)*

78. **Prior to construction of final design**, DWLNG 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 flammability limit set points for methane, ethylene, propane, n-butane, i-pentane, and condensate. *(section 4.13.1)*

79. **Prior to construction of final design**, DWLNG 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 toxic concentration set points for condensates, ammonia, natural gas liquids and hydrogen sulfide. *(section 4.13.1)*

80. **Prior to construction of final design**, DWLNG shall file an evaluation of the voting logic and voting degradation for hazard detectors. *(section 4.13.1)*

81. **Prior to construction of final design**, DWLNG 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 of all fixed, wheeled, and hand-held extinguishers. The list shall include the equipment tag number, type, capacity, equipment covered, discharge rate, and automatic and manual remote signals initiating discharge of the units. *(section 4.13.1)*

82. **Prior to construction of final design,** DWLNG shall file a design that includes clean agent systems in the electrical switchgear and instrumentation buildings. *(section 4.13.1)*

83. **Prior to construction of final design**, DWLNG shall file drawings and specifications for the structural passive protection systems to protect equipment and supports from cryogenic releases. *(section 4.13.1)*

84. **Prior to construction of final design**, DWLNG shall file a detailed quantitative analysis to demonstrate that adequate thermal mitigation would be provided for each significant component within the 4,000 BTU/ft^2-hr zone from an impoundment, or provide an analysis that assess the consequence 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 will mitigate the heat absorbed by the vessel. *(section 4.13.1)*

85. **Prior to construction of final design**, DWLNG shall file facility plan drawings showing the proposed location of the firewater and any foam systems. Plan drawings shall clearly show the location of firewater and foam piping, post indicator valves, and the location and area covered by, each monitor, hydrant, hose, water curtain, deluge system, foam system, water-mist system, and sprinkler. The drawings shall also include piping and instrumentation diagrams of the firewater and foam systems. *(section 4.13.1)*

86. **Prior to construction of final design**, DWLNG 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 4.13.1)*

87. **Prior to construction of final design**, DWLNG 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 Distributed Control System and recorded. *(section 4.13.1)*

88. **Prior to construction of final design**, DWLNG 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 4.13.1)*

89. **Prior to commissioning**, DWLNG 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. DWLNG shall file documentation certifying that each of these milestones is complete before authorization to commence the next phase of commissioning and startup will be issued. *(section 4.13.1)*

90. **Prior to commissioning**, DWLNG 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 4.13.1)*

91. **Prior to commissioning**, DWLNG 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 4.13.1)*

92. **Prior to commissioning**, DWLNG shall file the procedures for pressure/leak tests which address the requirements of American Society of Mechanical Engineers (ASME) VIII and ASME B31.3. The procedures shall include a line list of pneumatic and hydrostatic test pressures. (section *4.13.1)*

93. **Prior to commissioning**, DWLNG shall file the operation and maintenance procedures and manuals, as well as safety procedures, hot work procedures and permits, abnormal operating conditions reporting procedures, and management of change procedures and forms. *(section 4.13.1)*

94. **Prior to commissioning**, DWLNG shall tag all equipment, instrumentation, and valves in the field, including drain valves, vent valves, main valves, and car-sealed or locked valves. *(section 4.13.1)*

95. **Prior to commissioning**, DWLNG 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 4.13.1)*

96. **Prior to commissioning**, DWLNG 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 4.13.1)*

97. **Prior to commissioning**, DWLNG shall file a plan to maintain a detailed training log to demonstrate that operating staff has completed the required training. *(section 4.13.1)*

98. **Prior to introduction of hazardous fluids**, DWLNG shall complete all pertinent tests (Factory Acceptance Tests, Site Acceptance Tests, Site Integration Tests) associated with the Distributed Control System and the Safety Instrumented System that demonstrates full functionality and operability of the system. *(section 4.13.1)*

99. **Prior to introduction of hazardous fluids**, DWLNG shall develop and implement an alarm management program to reduce alarm complacency and maximize the effectiveness of operator response to alarms. *(section 4.13.1)*

100. **Prior to introduction of hazardous fluids**, DWLNG 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 4.13.1)*

101. **Prior to introduction of hazardous fluids**, DWLNG 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 4.13.1)*

102. DWLNG shall file a request for written authorization from the Director of OEP **prior to unloading or loading the first LNG commissioning cargo**. **After production of first LNG**, DWLNG 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 plant, 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 4.13.1)*

103. **Prior to commencement of service**, DWLNG shall provide plans for any preventative and predictive maintenance program that performs periodic or continuous equipment condition monitoring. *(section 4.13.1)*

104. **Prior to commencement of service**, DWLNG shall label piping with fluid service and direction of flow in the field, in addition to the pipe labeling requirements of NFPA 59A (2001 edition). *(section 4.13.1)*

105. **Prior to commencement of service**, DWLNG shall develop procedures for offsite contractors' responsibilities, restrictions, and limitations and for supervision of these contractors by DWLNG staff. *(section 4.13.1)*

106. **Prior to commencement of service**, DWLNG shall notify the FERC staff of any proposed revisions to the security plan and physical security of the plant. *(section 4.13.1)*

107. **Prior to commencement of service**, DWLNG shall file a request for 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 Maritime Transportation Security Act of 2002, and the Security and Accountability For Every (SAFE) Port Act, that appropriate measures to ensure the safety and security of the facility and the waterway have been put into place by DWLNG or other appropriate parties. *(section 4.13.1)*

In addition, conditions 108 through 111 shall apply **throughout the life** of the Driftwood LNG Facility.

108. 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, DWLNG 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 4.13.1)*

109. **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 4.13.1)*

110. 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 4.13.1)*

111. Significant non-scheduled events, including safety-related incidents (e.g., LNG, condensate, refrigerant, or natural gas releases; fires; explosions; mechanical failures; unusual over pressurization; and major injuries) and security-related incidents (e.g., attempts to enter site, suspicious activities) shall be reported to the FERC staff. In the event that an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification shall be made **immediately**, without unduly interfering with any necessary or appropriate emergency repair, alarm, or other emergency procedure. In all instances, notification shall be made to the FERC staff **within 24 hours**. This notification practice shall be incorporated into the LNG plant's emergency plan. Examples of reportable hazardous fluids-related incidents include the following:

a. fire;

b. explosion;

c. estimated property damage of $50,000 or more;

d. death or personal injury necessitating in-patient hospitalization;

e. release of hazardous fluids for five minutes or more;

f. unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of an LNG facility that contains, controls, or processes hazardous fluids;

g. any crack or other material defect that impairs the structural integrity or reliability of an LNG facility that contains, controls, or processes hazardous fluids;

h. any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes hazardous fluids to rise above its maximum allowable operating pressure (or working pressure for LNG facilities) plus the build-up allowed for operation of pressure-limiting or control devices;

i. a leak in an LNG facility that contains or processes hazardous fluids that constitutes an emergency;

j. inner tank leakage, ineffective insulation, or frost heave that impairs the structural integrity of an LNG storage tank;

k. any safety-related condition that could lead to an imminent hazard and cause (either directly or indirectly by remedial action of the operator), for purposes other than abandonment, a 20 percent reduction in operating pressure or shutdown of operation of a pipeline or an LNG facility that contains or processes hazardous fluids;

l. safety-related incidents to hazardous fluids transportation occurring at or en route to and from the LNG facility; or

m. an event that is significant in the judgment of the operator and/or management even though it did not meet the above criteria or the guidelines set forth in an LNG facility's incident management plan.

In the event of an incident, the Director of OEP has delegated authority to take whatever steps are necessary to ensure operational reliability and to protect human life, health, property, or the environment, including authority to direct the LNG Facility to cease operations. Following the initial company notification, the FERC staff will 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. *(section 4.13.1)*

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