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

Rio Grande LNG Project
Draft Environmental Impact Statement
Volume I

Rio Grande LNG, LLC and Rio Bravo Pipeline Company, LLC

October 2018
Docket Nos. CP16-454-000, CP16-455-000
FERC/EIS-0287D

Cooperating Agencies:

U.S. Environmental Protection Agency

U.S. Department of Transportation

U.S. Coast Guard

U.S. Department of Energy

U.S. Army Corps of Engineers

U.S. Fish and Wildlife Service

Federal Aviation Administration

National Park Service

National Oceanic Atmospheric Administration - National Marine Fisheries Service

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

In Reply Refer To:
OEP/DG2E/Gas 4
Rio Grande LNG, LLC
Rio Bravo Pipeline
Company, LLC
RG LNG Project
Docket Nos. CP16-454-000 and
CP16-455-000

TO THE INTERESTED PARTY:

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared a draft environmental impact statement (EIS) for the Rio Grande LNG Project (Project) proposed by Rio Grande LNG, LLC (RG LNG) and Rio Bravo Pipeline Company, LLC (RB Pipeline) (collectively referred to as the RG Developers) in the above-referenced dockets. RG LNG requests authorization pursuant to section 3(a) of the Natural Gas Act (NGA) to construct and operate liquefied natural gas (LNG) export facilities in Cameron County, Texas, and RB Pipeline requests a Certificate of Public Convenience and Necessity pursuant to section 7(c) of the NGA to construct, operate, and maintain a new pipeline system in Jim Wells, Kleberg, Kenedy, Willacy, and Cameron Counties, Texas.

The draft EIS assesses the potential environmental effects of the construction and operation of the Project in accordance with the requirements of the National Environmental Policy Act (NEPA). The FERC staff concludes that construction and operation of the Rio Grande LNG Project would result in some adverse environmental impacts, but these impacts would be reduced to less than significant levels. However, the Rio Grande LNG Project, combined with other projects within the geographic scope, would result in certain significant cumulative impacts.

The U.S. Army Corps of Engineers, U.S. Coast Guard, U.S. Department of Energy, U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration, the DOT's Federal Aviation Administration, the U.S. Fish and Wildlife Service, the National Park Service, the U.S. Environmental Protection Agency, and the National Oceanic and Atmospheric Administration – National Marine Fisheries Service participated as cooperating agencies in the preparation of the EIS. Cooperating agencies have jurisdiction by law or special expertise with respect to resources potentially affected by the proposal and participate in the NEPA analysis. Although the cooperating agencies provided input to the conclusions and recommendations presented in the draft EIS, the agencies will present their own conclusions and recommendations in their respective Records of Decision for the Project.

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

- six liquefaction trains at the Rio Grande LNG Terminal, each with a nominal capacity of 4.5 million tons per annum of LNG for export, resulting in the total nominal capacity of 27.0 million tons per annum;
- four LNG storage tanks, each with a net capacity of 180,000 cubic meters;
- LNG truck loading facilities with four loading bays, each with the capacity to load 12 to 15 trucks per day;
- a refrigerant storage area and truck unloading facilities;
- a condensate storage area and truck loading facilities;
- a new marine slip with two LNG vessel berths to accommodate simultaneous loading of two LNG vessels, an LNG vessel and support vessel maneuvering area, and an LNG transfer system;
- a materials off-loading facility;
- 2.4 miles of 42-inch-diameter pipeline, including 0.8 mile of dual pipeline, to gather gas from existing systems in Kleberg and Jim Wells Counties (referred to as the Header System);
- 135.5 miles of parallel 42-inch-diameter pipelines originating in Kleberg County and terminating at the Rio Grande LNG Terminal in Cameron County (referred to as Pipelines 1 and 2);
- four stand-alone metering sites along the Header System;
- two new interconnect booster compressor stations, each with a metering site;
- three new compressor stations (one at the LNG Terminal site); and
- other associated utilities, systems, and facilities (yards, access roads, etc.).

The Commission mailed a copy of the *Notice of Availability* to federal, state, and local government representatives and agencies; elected officials; environmental and public interest groups; Native American tribes; potentially affected landowners and other interested individuals and groups; and newspapers and libraries in the project area. The draft EIS is only available in electronic format. It may be viewed and downloaded from the FERC's website (www.ferc.gov), on the Environmental Documents page (https://www.ferc.gov/industries/gas/enviro/eis.asp). In addition, the draft EIS may be accessed by using the eLibrary link on the FERC's website. Click on the eLibrary link (https://www.ferc.gov/docs-filing/elibrary.asp), click on General Search, and enter the docket number in the "Docket Number" field, excluding the last three digits (i.e. CP16-454 or CP16-455). Be sure you have selected an appropriate date range. For assistance, please contact FERC Online Support at FercOnlineSupport@ferc.gov or toll free at (866) 208-3676, or for TTY, contact (202) 502-8659.

Any person wishing to comment on the draft EIS may do so. Your comments should focus on draft EIS's disclosure and discussion of potential environmental effects, reasonable alternatives, and measures to avoid or lessen environmental impacts. To ensure consideration of your comments on the proposal in the final EIS, it is important that the Commission receive your comments on or before 5:00 pm Eastern Time on **December 3, 2018**.

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

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

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

3) You can file a paper copy of your comments by mailing them to the following address. Be sure to reference the Project docket numbers (CP16-454-000, CP16-455-000) with your submission: Kimberly D. Bose, Secretary, Federal Energy Regulatory Commission, 888 First Street NE, Room 1A, Washington, DC 20426

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

Date and Time	Location
Tuesday, November 13, 2018 5:00 – 8:00 pm local time	Texas A&M 700 University Blvd Kingsville, TX 78363 361-593-4173
Wednesday, November 14, 2018 5:00 – 8:00 pm local time	La Quinta 128 N Expressway 77, Raymondville, TX 78750 956-689-4000
Thursday, November 15, 2018 5:00 – 9:00 pm local time	Port Isabel Convention Center 309 E. Railroad Ave, Port Isabel, TX 78578 956-433-7195

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

The Kingsville and Raymondville scoping sessions are scheduled from 5:00 pm to 8:00 pm local time, and the Port Isabel scoping session is scheduled from 5:00 pm to 9:00 pm local time. You may arrive at any time after 5:00 pm. There will not be a formal presentation by Commission staff when the session opens. If you wish to speak, the Commission staff will hand out numbers in the order of your arrival. Comments will be taken until the closing hour for all scoping sessions. However, if no additional numbers have been handed out and all individuals who wish to provide comments have had an opportunity to do so, staff may conclude the session 30 minutes before the closing hour.

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

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

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

Questions?

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

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

TABLE OF CONTENTS

RIO GRANDE LNG PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT
VOLUME I

LIST OF TABLES

LIST OF FIGURES

VOLUME II

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

AAQS	Ambient Air Quality Standards
ACHP	Advisory Council on Historic Preservation
AEP	American Electric Power
Annova	Annova LNG Common Infrastructure, LLC, Annova LNG Brownsville A, LLC, Annova LNG Brownsville B, LLC, and Annova LNG Brownsville C, LLC
API	American Petroleum Institute
AQCR	Air Quality Control Region
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ATWS	additional temporary workspace
BA	Biological Assessment
BACT	Best Available Control Technology
Bcf/d	billion cubic feet per day
BCC	Birds of Conservation Concern
BCR	Bird Conservation Region
BGEPA	Bald and Golden Eagle Act
BLEVE	boiling liquid expanding vapor explosion
BMP	best management practice
BND	Brownsville Navigational District
BOG	boil-off gas
BSC	Brownsville Ship Channel
Btu/m^2	British thermal units per square foot
C3MR™	Air Products and Chemicals, Inc. liquefaction process
CAA	Clean Air Act
CCRMA	Cameron County Regional Mobility Authority
CAMx	Comprehensive Air Quality Model with Extensions
CEQ	Council on Environmental Quality
Certificate	Certificate of Public Convenience and Necessity
CFE	Comisión Federal de Electricidad
CFR	Code of Federal Regulations
Cheniere Corpus Christi	Cheniere Corpus Christi LNG, LLC and Cheniere Corpus Christi Pipeline, LP
CH_4	methane
CI ICE	compression ignition internal combustion engines
CIP	cast-in-place
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide-equivalent
Coast Guard	U.S. Coast Guard

COC	Certificate of Compliance
COE	U.S. Army Corps of Engineers
COI	Certificate of Inspection
Commission	Federal Energy Regulatory Commission
COPT	Captain of the Port
CP	calculation point
CPT	cone penetration test
Corpus Christi	Corpus Christi LNG, LLC
CRP	Conservation Reserve Program
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
dB	decibels
dBA	A-weighted decibel scale
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DPS	distinct population segment
EEM	estuarine emergent marsh
EFH	essential fish habitat
EIS	environmental impact statement
EI	environmental inspector
EPA	U.S. Environmental Protection Agency
EPAct 2005	Energy Policy Act of 2005
ERP	Emergency Response Plan
ESA	Endangered Species Act
ESD	emergency shutdown
ESS	estuarine scrub-shrub
EUS	estuarine unconsolidated shore
°F	degrees Fahrenheit
FAA	Federal Aviation Administration
FEED	Front End Engineering Design
FEMA	Federal Emergency Management Administration
FERC	Federal Energy Regulatory Commission
FLEX	Freeport LNG Expansion and FLNG Liquefaction, LLC
FM	farm to market
Freeport Development	Freeport LNG Development, L.P.; FLNG LNG, LLC; FLNG LNG 2, LLC; and FLNG LNG 3, LLC
FSA	Farm Service Agency
FTA	free trade agreement
Fugro	Fugro Consultants, Inc.

FWCA	Fish and Wildlife Coordination Act
FWS	U.S. Fish and Wildlife Service
g	gravity
GHG	greenhouse gases
GMFMC	Gulf of Mexico Fisheries Management Council
Golden Pass LNG	Golden Pass LNG, LLC
gpm	gallons per minute
GPP	Golden Pass Products LLC
GWP	global warming potential
H_2S	hydrogen sulfide
HAP	hazardous air pollutant
HAZID-ENVID	Hazard Identification - Environmental Hazard Identification
HAZOP	hazard and operability review
HCA	high consequence areas
HDD	horizontal directional drill
HGB	Houston-Galveston-Brazoria
hp	horsepower
HUC	hydrologic unit code
IBC	International Building Code
IBWC	International Boundaries and Water Commission
ILI	in-line inspection
IMO	International Maritime Organization
IMP	integrity management program
ISO	International Organization for Standardization
KOP	key observation point
kV	kilovolt
kW/m^2	kilowatts per square meter
L_{dn}	day-night sound level
L_{eq}	equivalent sound level
L_{max}	maximum sound level observed during a measurement period or noise event
LNG	liquefied natural gas
LOI	Letter of Intent
LOD	Letter of Determination
LOR	Letter of Recommendation
LOS	Level-of-Service
m^3	cubic meter
m^3/hr	cubic meters per hour
MAOP	maximum allowable operating pressure
MBCP	Migratory Bird Conservation Plan
MBTA	Migratory Bird Treaty Act

mcy	million cubic yards
mg/L	milligrams per liter
MLLW	mean low low water
MLV	mainline valve
MOF	material offloading facility
MOU	Memorandum of Understanding
MMPA	Marine Mammal Protection Act
MMscf	million standard cubic foot
MP	milepost
mph	miles per hour
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MTPA	million tons per annum
MTSA	Maritime Transportation Security Act
µPa	micropascal
µg	micrograms
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAVD 88	North American Vertical Datum 88
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emissions Standards for Hazardous Air Pollutant
NFPA	National Fire Protection Association
NGA	Natural Gas Act
NGL	natural gas liquid
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NNSR	Nonattainment New Source Review
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NPIL	The Williams Transco North Padre Island Lateral
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NSA	noise sensitive area
NSPS	New Source Performance Standards
NSR	New Source Review
NWI	National Wetlands Inventory
NWR	national wildlife refuge
O_3	ozone

ODMDS	Ocean Dredged Material Disposal Site
OEP	Office of Energy Projects
PA	Placement Area
Pb	lead
PEM	palustrine emergent
PFD	process flow diagram
PFO	palustrine forested
PGA	peak ground acceleration
PHMSA	Pipeline and Hazardous Materials Safety Administration
PIR	Potential Impact Radius
Plan	FERC Upland Erosion Control, Revegetation, and Maintenance Plan
PM	particulate matter
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to 10 microns
Port Arthur	Port Arthur LNG, LLC and Port Arthur Pipeline, LLC
ppb	part(s) per billion
ppm	part(s) per million
Procedures	The FERC Wetland and Waterbody Construction and Mitigation Procedures
Project	The Rio Grande LNG Project
PSD	Prevention of Significant Deterioration
psig	pounds per square inch gauge
psi	pounds per square inch
PSS	palustrine scrub-shrub
RB Pipeline	Rio Bravo Pipeline Company, LLC
RG Developers	Rio Grande LNG, LLC (RG LNG) and Rio Bravo Pipeline Company, LLC
RHA	Rivers and Harbors Act
RG LNG	Rio Grande LNG, LLC
RMP	EPA Risk Management Plan
RMS	root mean square
ROW	right-of-way
RRC	Railroad Commission of Texas
RV	recreational vehicle
SAFE	State Acres for Wildlife Enhancement
SCADA	Supervisory Control and Data Acquisition System
SCPT	seismic cone penetration test
SH	State Highway

SHPO	State Historic Preservation Office
SIL	significant impact level
SO_2	sulfur dioxide
SOLAS	safety of life at sea
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan
SSE	safe shutdown earthquake
SSURGO	NRCS Soil Survey Geographic database
SWEL	standing water elevation
SWPPP	Stormwater Pollution Prevention Plan
TAC	Texas Administrative Code
TAHC	Texas Animal Health Commission
TCEQ	Texas Commission of Environmental Quality
Texas Eastern	Texas Eastern Transmission Pipeline
Texas LNG	Texas LNG Brownsville
TDWR	Texas Department of Water Resources
The Rio Bravo Pipeline	the proposed new pipeline system and facilities in Jim Wells, Kleberg, Kenedy, Willacy, and Cameron Counties, Texas
The Rio Grande LNG Terminal	facilities necessary to liquefy and export natural gas at a proposed site along the Brownsville Ship Channel in Cameron County, Texas
TPWD	Texas Parks and Wildlife Department
TWDB	Texas Water Development Board
TGS	Texas Gas Service Company
TPG	The Perryman Group
tpy	tons per year
TWIC	Transportation Worker Identification Credential
TxDOT	Texas Department of Transportation
USC	United States Code
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VOC	volatile organic compounds
VCP	Valley Crossing Pipeline
WMA	wildlife management area
WSA	Waterway Suitability Assessment
yd^3	cubic yard

EXECUTIVE SUMMARY

On May 5, 2016, Rio Grande LNG, LLC (RG LNG) and Rio Bravo Pipeline Company, LLC (RB Pipeline), filed a joint application with the Federal Energy Regulatory Commission (Commission or FERC) for authorization pursuant to Sections 3(a) and 7(c) of the Natural Gas Act (NGA). In Docket No. CP16-454-000, RG LNG requests authorization under Section 3(a) of the NGA and Part 153 of the Commission's regulations to site, construct, and operate facilities necessary to liquefy and export natural gas at a proposed site (the Rio Grande LNG Terminal) along the Brownsville Ship Channel (BSC) in Cameron County, Texas. In Docket No. CP16-455-000, RB Pipeline requests a Certificate of Public Convenience and Necessity (Certificate) pursuant to Section 7(c) of the NGA and Part 157 of the Commission's regulations to site, construct, operate, and maintain a new pipeline system (the Rio Bravo Pipeline or Pipeline System) and related facilities in Jim Wells, Kleberg, Kenedy, Willacy, and Cameron Counties, Texas. Collectively, RG LNG and RB Pipeline are called RG Developers; the Rio Grande LNG Terminal and the Rio Bravo Pipeline are collectively called the Rio Grande LNG Project (Project).

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

The FERC is the lead agency for the preparation of the EIS. The U.S. Army Corps of Engineers (COE), U.S. Coast Guard (Coast Guard), U.S. Department of Energy (DOE), U.S. Department of Transportation's (DOT) Pipeline and Hazardous Materials Safety Administration and Federal Aviation Administration (FAA), the U.S. Fish and Wildlife Service (FWS), the National Park Service (NPS), the U.S. Environmental Protection Agency (EPA), and the National Oceanic and Atmospheric Administration – National Marine Fisheries Service (NMFS) are participating in the NEPA review as cooperating agencies.[2]

PROPOSED ACTION

RG Developers' stated purpose of the Rio Grande LNG Project is to develop, own, operate, and maintain a natural gas pipeline system and a liquefied natural gas (LNG) export facility in South Texas that provides an additional source of firm, long-term, and competitively priced LNG to the global market. The Project is intended to access natural gas from the Agua Dulce hub area and would also provide LNG for truck transport and for fueling operations. Any

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

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

exports would be consistent with authorizations from the DOE. The DOE granted an authorization to RG LNG for export to countries having a free trade agreement with the United States that includes national treatment for trade in natural gas on August 17, 2016. An application for export to non-free trade agreement nations is pending the DOE's review of RG LNG's application, which was filed on December 23, 2015.

Rio Grande LNG Terminal

The Rio Grande LNG Terminal would be located on about 750.4 acres of a 984.2-acre parcel of land along the northern shore of the BSC in Cameron County, Texas,[3] approximately 9.8 miles east of Brownsville and about 2.2 miles west of Port Isabel. The Project, which is currently expected to begin operations in late 2021, would produce a nominal capacity of about 27 million tons per annum of LNG during its minimum 20-year life (which could be extended to a 50-year life). The LNG Terminal would include the following major facilities:

- six liquefaction trains, each with a liquefaction capacity of 4.5 million tons per annum of LNG for export;
- four full-containment LNG storage tanks, each with a net capacity of 180,000 cubic meters;
- docking facilities for two LNG carriers and a turning basin;
- LNG truck loading facilities with four loading bays; and
- RB Pipeline's Compressor Station 3, a metering site, and the interconnection to the Pipeline System.

Rio Bravo Pipeline System

The LNG Terminal would receive natural gas via the proposed Rio Bravo Pipeline System, which would connect the LNG Terminal to the existing infrastructure near the Agua Dulce hub[4] in Nueces County. The Pipeline System would include a 42-inch-diameter Header System, which would include dual pipelines for the first 0.8 mile of its route, and dual 42-inch-diameter mainline pipelines (individually identified as Pipeline 1 and Pipeline 2). The Header System would be about 2.4 miles of pipeline in Kleberg and Jim Wells Counties that would collect gas from six existing pipeline systems for transport into Pipelines 1 and 2. Pipelines 1 and 2 would be about 135.5 miles long, originate in Kleberg County, and transit through Kenedy, Willacy, and Cameron Counties before terminating at Compressor Station 3 within the boundaries of the LNG Terminal. RB Pipeline proposes three compressor stations and two interconnect booster compressor stations along the Pipeline System. The Pipeline System, when complete, would provide the Rio Grande LNG Terminal with about 4.5 billion cubic feet per day

---

[3] All Project locations referred to in this EIS (including towns, counties, and other municipalities) are within the state of Texas, unless specifically stated otherwise.

[4] A natural gas hub is an interconnection of two or more pipelines that allows the transfer of gas.

of firm capacity. Although the Header System and Pipeline 1 are proposed to be constructed at the same time, Pipeline 2 would be constructed on a separate schedule (approximately 18 months after the completion of Pipeline 1) to accommodate the staged construction of the LNG Terminal; therefore, RB Pipeline estimates that Pipeline 1 would begin operation in late 2021, concurrent with the LNG Train 1.

PUBLIC INVOLVEMENT

On March 20, 2015, RG Developers filed a request with the FERC to use our pre-filing review process. This request was approved on April 13, 2015, and pre-filing Docket No. PF15-20-000 was established in order to place information filed by RG Developers, documents issued by the FERC, as well as comments from the public, agencies, Native American tribes, organizations, and other stakeholders into the public record. RG Developers held open houses in Kingsville, Raymondville, and Brownsville on May 19, 20, and 21, 2015, respectively, to provide information to the public about the Rio Grande LNG Project. FERC staff participated in the meetings, describing the FERC process and providing those attending with information on how to file comments with the FERC.

On July 23, 2015, the FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Rio Grande LNG Project and Rio Bravo Pipeline Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Meetings*. This notice was sent to about 720 interested parties including federal, state, and local officials; agency representatives; conservation organizations; Native American tribes; local libraries and newspapers; and property owners in the vicinity of the proposed Project. Publication of the *Notice of Intent* established a 30-day public scoping period for the submission of comments, concerns, and issues related to the environmental aspects of the Project. In addition, in July and August 2015, we met with representatives of interested agencies, including the FWS, COE, Coast Guard, NMFS, NPS, and the Texas Parks and Wildlife Department and conducted a site visit at the LNG Terminal site.

During the scoping period, we received comments on a variety of environmental issues. Substantive environmental issues identified through this public review process are addressed in this EIS. The transcripts of the public comment meetings and all written comments are part of the FERC's public record for the Rio Grande LNG Project and are available for viewing on the FERC internet website (http://www.ferc.gov).[5]

PROJECT IMPACTS

We evaluated the potential impacts of construction and operation of the Project on geology; soils; water use and quality; wetlands; vegetation; wildlife, aquatic resources, and essential fish habitat; threatened, endangered, and other special-status species; land use, recreation, and visual resources; socioeconomics; cultural resources; air quality and noise;

---

[5] To access public documents on the FERC website, use the "eLibrary" link, select "General Search" from the eLibrary menu, and enter the docket number, excluding the last three digits, in the "Docket Number" field (i.e., PF15-20). Be sure to select an appropriate date range.

reliability and safety; and cumulative impacts. Where necessary, we recommend additional mitigation to minimize or avoid these impacts. Section 5 of the EIS contains a compilation of our recommendations.

Overall, construction and installation of facilities for the Project would require temporary disturbance of about 3,655.6 acres of land. Following construction, the LNG Terminal site and pipeline facilities would encompass about 2,147.8 acres. The remaining 1,507.8 acres would return to pre-construction conditions and uses. Based on our analysis, scoping, and agency consultations, the major issues are impacts on surface water resources; wetlands; wildlife and aquatic resources; threatened and endangered species; land use, recreation, and visual resources; socioeconomics; cultural resources; air quality; noise; reliability and safety; and cumulative impacts.

Surface Water Resources

The proposed LNG Terminal site is on the north shore of the BSC, a man-made, marine navigation channel that connects to the Gulf of Mexico. The BSC, along with its Entrance Channel and Jetty Channel, form the Brazos Island Harbor. As a separate federal action, the COE has determined that deepening the Brazos Island Harbor from its current depth of -42 feet relative to mean lower low water (MLLW) to -52 feet MLLW would be in the national interest and would not result in significant environmental impacts (COE 2014); however, the deepening has not yet begun. The western boundary of the LNG Terminal site is the Bahia Grande Channel, which was constructed in 2005 to connect the BSC to the Bahia Grande to restore tidal exchange to the Bahia Grande (FWS 2015a); this channel is proposed for future widening from its current 34-foot width to a 250-foot width to increase tidal exchange (Ocean Trust 2009, FWS 2010a).

Construction and operation of the LNG Terminal would result in permanent impacts on 174.8 acres of open water, including impacts on the BSC and an open water lagoon within the LNG Terminal site. A total of 75.8 acres of open water would be converted to industrial/commercial land for construction of the LNG Terminal, and an additional 68.7 acres of open water within the BSC would be dredged for the material offloading facility (to a maximum depth of -12 feet MLLW) and for the marine berths and turning basin (to a maximum depth of -45 feet MLLW). The remainder (30.2 acres) would be modified to create the firewater canal or marine facilities. RG LNG would be required to mitigate for the permanent loss of open water resources and proposes to preserve open water within an off-site wetland mitigation area about 1 mile south of the Project.

Dredging, which would be conducted by hydraulic cutter suction or mechanical dredge, would result in increased suspended solid and turbidity levels in the BSC. The dredged material would be dominated by cohesive clay sediments and would settle within a few hours after dredging (COE 2014). All dredging would be conducted using equipment designed to meet the Texas state water quality standards and in accordance with applicable COE permit requirements. Disposal of dredged material would be conducted in accordance with RG LNG's draft Dredged Material Management Plan, as finalized; however, the final management of dredged material would be determined by the Brownsville Navigation District and COE, in consultation with other federal, state, and local resource agencies and interested stakeholders, including the EPA, NMFS, FWS, and Texas Commission on Environmental Quality (TCEQ). Because the impacts on surface water quality would be adequately mitigated through adherence to applicable COE permits and the state water quality requirements for dredging and dredged material management, we conclude that dredging and dredged materials placement for construction of the LNG Terminal would have temporary and minor impacts on water quality.

RG LNG estimates that 880 barges and support vessels would deliver construction materials and equipment to the material offloading facility and Port of Brownsville during LNG Terminal construction. During operation, about 312 LNG carriers would call on the LNG Terminal per year (about 6 LNG carriers per week). Vessel traffic during construction and operation could increase shoreline erosion and suspended sediment concentrations due to increased wave action. To minimize these impacts, the channel embankments and slope of the LNG Terminal site along the BSC, the marine loading berths, and the turning basin would be stabilized using rip-rap. Although FERC does not have jurisdiction over the transit of LNG carriers through the BSC, final permitting for the Brazos Harbor Channel Improvement Project should account for the impacts of these larger vessels on the stability of unarmored shorelines due to vessel passage and reflective wave energy.

The Pipeline System would cross 62 waterbodies. One intermittent waterbody would be crossed by the Header System via an open cut crossing method. The centerline of Pipeline 1 would cross 62 waterbodies, including 21 perennial streams, 19 intermittent streams, 9 ephemeral streams, and 13 ponds and reservoirs. These waterbodies would be crossed using various methods, including open cut, conventional bore, and horizontal directional drill (HDD). With minor differences in crossing methods, Pipeline 2 would affect the same waterbodies. No active surface water intakes for public water supply are within 3 miles downstream of the Pipeline System or LNG Terminal. The Pipeline System may cross waterbodies regulated by the International Boundaries and Water Commission, and we recommend that RB Pipeline identify any such waterbodies, as well as any necessary mitigation for those crossings, if applicable.

RB Pipeline would minimize potential impacts on surface waters by implementing its Project-specific *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) and utilizing trenchless crossing methods for 26 of the 34 waterbodies anticipated to be flowing at the time of construction. Impacts on all waterbodies would be minimized through implementation of RB Pipeline's Procedures; however, we recommend additional justification for certain requested alternative measures. Following construction of each waterbody crossing, waterbody contours would be restored to pre-construction conditions, and riparian areas would be revegetated using native grasses, legumes, and woody species and allowed to return to pre-construction conditions. With implementation of the Procedures; Stormwater Pollution Prevention Plan; Spill Prevention, Control, and Countermeasures Plans; and our recommendations, we conclude that impacts on water resources would be adequately minimized.

Wetlands

Construction of the Project would affect a total of 334.7 acres of wetlands, of which 182.4 acres would be permanently converted to industrial land or open water within the footprint of the LNG Terminal, and 104.8 acres would be maintained in an herbaceous state within the permanent right-of-way for the pipelines. The remaining 47.5 acres would be allowed to revert to pre-construction conditions. RG Developers would implement the mitigation measures in their Procedures to control erosion and restore the grade and hydrology after construction in wetlands. However, in accordance with the Project-specific Procedures, RB Pipeline would consult with the COE to develop a Project-specific wetland restoration plan. RG LNG is also developing a plan to mitigate for wetland impacts; its Conceptual Mitigation Plan identifies the potential to acquire and preserve a portion of the Loma Ecological Preserve in perpetuity, and to transfer the land to a land manager, such as the FWS. The COE has not approved RG LNG's Conceptual Mitigation Plan and is working with RG Developers, in conjunction with the FWS, NMFS, EPA, and the Texas Parks and Wildlife Department, to revise the proposed mitigation measures as appropriate. Construction of the LNG Terminal would not commence prior to finalization of wetland mitigation plans and issuance of the COE's Clean Water Act Section 404/Section 10 permit.

Section VI.A.6 of the FERC Procedures specifies that aboveground facilities, with few exceptions, should be located outside of wetlands. Although RG LNG proposes to construct the LNG Terminal (including Compressor Station 3) within wetlands, we determined that the proposed location is the most environmentally preferable and practical alternative that meets the Project's stated purpose. However, the placement of the LNG Terminal in wetlands must be approved by the COE prior to construction. RG Developers have requested additional alternative measures to our Procedures that we have reviewed and deem to be unacceptable; we recommend that, prior to the end of the draft EIS comment period, RG Developers file updated Project information or updated justification for their proposed use of certain workspaces in wetlands and use of a proposed haul road that would be constructed through wetlands.

With adherence to measures contained in the Project-specific Procedures, applicable COE permits, and our recommendations, impacts on wetlands would be reduced, with the majority of adverse permanent impacts occurring at the LNG Terminal site. We anticipate that the COE's Clean Water Act Section 404/Section 10 permit for the Project would be conditioned to effectively offset the Project-related adverse impacts on waters of the United States by wetland mitigation, such that impacts would be reduced to less than significant levels.

Wildlife and Aquatic Resources

A total of about 3,241.3 acres of wildlife habitat would be within the footprint of the LNG Terminal and pipeline facilities; of this, 2,054.5 acres would be within the operational footprint of the Project (including 737.8 acres that would be permanently converted to developed land at the LNG Terminal site). Wildlife would be directly displaced from the LNG Terminal footprint, and some wildlife may be indirectly displaced within a larger area due to the increase in noise and lighting during construction and operation of the LNG Terminal. The direct loss of habitat and the indirect effects associated with displacement indicate that the construction and operation of the proposed LNG Terminal would result in a minor to moderate, permanent impact on local wildlife. Construction and operation of the Pipeline System would generally be short-term and limited to the construction period.

The proposed Project is within the migratory bird Central Flyway, which generally covers the central portion of North America and into Central America. South Texas acts as a funnel for migratory birds as they try to avoid flying too far east (into open Gulf waters) or west (into desert habitat). RG LNG proposes measures to avoid or minimize impacts on migratory birds and has developed a Migratory Bird Conservation Plan outlining these measures, which it would implement, as practicable, during construction of the Project; RB Pipeline would also implement measures in this plan if vegetation clearing along the Pipeline System would take place between March 1 and August 31. Because of the high use of habitat at the LNG Terminal by migratory birds (including birds of conservation concern), we agree that the measures in RG LNG's Migratory Bird Conservation Plan are appropriate, and we recommend that the plan be finalized in consultation with the FWS. We have also determined that the overall increase in nighttime lighting during construction and operation of the proposed Project would result in permanent, but minor impacts on resident or migratory birds.

Construction of the Rio Grande LNG Project would result in minor impacts on aquatic resources due to water quality impacts and direct mortality of some immobile individuals during dredging for the LNG Terminal and installation of the Pipeline System across waterbodies. During operations, the Project would have minor impacts on aquatic resources due to maintenance dredging and increased marine vessel traffic. Permanent impacts on aquatic habitat would result where open water would be converted to industrial/commercial land within the LNG Terminal site and where dredging would convert existing wetlands and mudflats to open water. Portions of the BSC, wetlands, waterbodies, and mudflats on the LNG Terminal site, the Bahia Grande Channel, and the water column at potential dredged material disposal sites have been designated as essential fish habitat (EFH). Although the activities would result in the alteration of habitat and the mortality or displacement of individuals, the impacts on EFH and the species and life stages that utilize EFH would be permanent, but minor. We are still coordinating with the NMFS as part of the consultation under the Magnuson-Stevens Fishery Conservation and Management Act.

Threatened, Endangered, and Other Special-status Species

A total of 24 species that are federally listed as threatened or endangered, or those that are candidates, proposed, or under review for listing, may occur in counties affected by the Project. Within these counties, or offshore of them, critical habitat has been designated for two species, the piping plover and the loggerhead sea turtle. We determined that the Project would have *no effect* on one federally listed and one candidate species, is *not likely to adversely affect* 17 federally listed (or proposed) species, and would *not result in a trend towards federal listing* for two species (one candidate and one that is under review). We have also determined that the Project would not be likely to destroy or adversely modify designated critical habitat for the loggerhead sea turtle. Our *not likely to adversely affect* determinations for the West Indian manatee and federally listed plants are based on our recommendations to conduct appropriate training and complete applicable surveys, respectively.

We have determined that the Project *is likely to adversely affect* the Northern aplomado falcon, the piping plover (and its critical habitat), and the ocelot. The Northern aplomado falcon is known to nest in the vicinity of the Project (although not within the Project footprint) and would lose potential foraging habitat within the LNG Terminal site. We recommend additional mitigation related to nest identification, monitoring, and implementation of best management practices for this species.

Critical habitat for the wintering piping plover is on the south side of the BSC, directly across from the LNG Terminal, and therefore piping plovers are assumed to occur on the LNG Terminal site. Although direct impacts on piping plover and its critical habitat are not anticipated, construction and operational noise at the LNG Terminal site would raise ambient sound levels within the critical habitat, potentially decreasing the quality of the habitat and resulting in avoidance behaviors by the piping plover.

The ocelot breeds in two locations in South Texas, including the vicinity of the proposed pipelines in Kenedy and Willacy Counties, as well as in the Laguna Atascosa National Wildlife Refuge, adjacent to the LNG Terminal. Direct and indirect impacts on the ocelot's preferred habitat (upland shrub habitat, particularly with thornscrub vegetation) would result from Project construction and operation. Within the lower Laguna Atascosa National Wildlife Refuge, indirect impacts on the ocelot may occur from an increase in ambient sound levels, which may also render suitable habitat unattractive to ocelots. In addition, suitable habitat would be lost within the LNG Terminal site boundaries, and potentially along the pipeline route. The loss of suitable habitat, through either direct or indirect pathways, has the potential to result in significant impacts on ocelots and ocelot recovery. Because consultation with the FWS and NMFS is ongoing, we recommend completion of any necessary Endangered Species Act consultation with these agencies prior to construction.

Land Use, Recreation, and Visual Resources

Land use in the vicinity of the Project is generally classified into the following categories: shrub/forest land, open land, non-forested wetlands, barren, open water, industrial/commercial, and agricultural. Installation of facilities for the Project would require temporary disturbance of about 3,655.6 acres of land. Following construction, the LNG Terminal site and permanent rights-of-way would encompass about 2,147.8 acres. The remaining 1,507.8 acres would return to pre-construction conditions and uses. There are no residences within 0.25 mile of the LNG Terminal, compressor stations, or booster stations, or within 50 feet of the Pipeline System. Two residential structures are within 50 feet of proposed access roads; however, these roads are existing and would not be modified for Project use.

Twelve recreation/special use areas are within 0.25 mile of the proposed Project (two National Wildlife Refuges, one National Historic Landmark, one public boat launch/fishing pier, four birding trails, one land acquisition project, and three conservation easement areas under the Conservation Reserve Program). All of these recreation/special use areas, with the exception of the Laguna Atascosa National Wildlife Refuge, would be directly affected by construction of the pipelines. However, construction of the Pipeline System would last only a few weeks in any one area, except at 19 discrete locations (including areas adjacent to recreation/special use areas) where up to 10 weeks would be required for crossings accomplished by HDD; therefore, impacts would be temporary. To ensure proper mitigation of impacts on conservation easements, we recommend that RB Pipeline consult with the applicable agencies regarding the specific location of parcels under contract and identify appropriate mitigation measures on these easements.

In addition to the special use areas, recreational boating and fishing activities occur within the BSC, Bahia Grande Channel, and San Martin Lake (west of the LNG Terminal site) and could be affected by construction and operation of the LNG Terminal due to increased noise, restrictions on fishing in the immediate vicinity of the LNG Terminal, and vessel traffic. Increased noise associated with construction of the Project could deter recreational users from fishing in the immediate vicinity of Project activities. In particular, dredging activities, which would occur 24 hours per day, 7 days per week, during a two-week period, and land- and water-based pile-driving which would occur at discrete points during construction for periods as short as a few days to as long as five months, could result in avoidance of these areas by recreational users. In addition, construction of the Pipeline System across the Jamie J. Zapata Memorial Boat Ramp, Fishing Pier, and Kayak Launch Pad (Zapata boat launch) would be accomplished by HDD, and could take up to 10 weeks. As a result, we have determined that there would be moderate impacts on recreational use of the Zapata boat launch during construction of the Pipeline System.

The viewshed of the proposed Project includes predominately large parcels of open land with herbaceous or scrub-shrub vegetation supporting ranch and cattle operations, as well as numerous easements for oil and gas pipelines. The BSC and State Highway (SH) 48 frame the southern and northern boundaries of the LNG Terminal, respectively. The movement of domestic and foreign products on the channel and motorists on the highway contribute to the characterization of the existing viewshed. No state-designated scenic byways or roads classified under the National Scenic Byways Program (23 USC 162) would be crossed. Given the siting of the LNG Terminal, no residences are proximal to the proposed construction work areas; however, the nature of the existing landscape (e.g., open land with limited vegetation) allows for extended views from greater distances.

Permanent changes to the visual character of the area would result from operation of the aboveground structures, most notably the LNG Terminal, which would modify the viewshed. The most prominent visual features at the LNG Terminal site would be four LNG storage tanks. Daytime visibility of the LNG Terminal would be mitigated by the use of grey coloring for the tanks, horticultural plantings, and the construction of a levee that would obstruct most construction activities and low-to-ground operational facilities from view. RG LNG is also proposing the use of ground flares, which would be partially obstructed by a 67-foot-high vertical wall. To further minimize visual impacts, lighting at the LNG Terminal would be limited to that required for safety and RG LNG would use directional lighting.

Numerous public comments identified concerns with the visual impact of the LNG Terminal to surrounding communities, specifically including Port Isabel and South Padre Island. Based on our review of visual simulations conducted by RG LNG, most public vantage points (e.g., the Port Isabel lighthouse, historic battlegrounds/landmarks, Isla Grand Hotel) are at a distance far enough away from the LNG Terminal site that impacts on the viewshed would be permanent, but negligible or minor. Visual receptors within nearby waters north of the LNG Terminal site, such as Laguna Madre, would be at lower elevations and/or far enough away such that the nearby shoreline areas would obscure the LNG Terminal site. Visual receptors at locations closer to the LNG Terminal site (e.g., SH-48, the Bahia Grande Channel, and the Zapata boat launch), would be able to discern individual structures; however, these receptors would generally not be stationary and therefore would have a short viewing time (i.e., until the vehicle or vessel passes the site).

A portion of the Project is within the designated coastal zone, which is managed by the Railroad Commission of Texas through the Texas Coastal Management Program (CMP). The boundaries of the state's coastal zone include all or parts of 18 coastal counties, including Willacy and Cameron Counties. The purpose of the Texas CMP is to manage designated coastal natural resource areas. RG Developers submitted their application and request for consistency review to the Railroad Commission of Texas on April 10, 2018. We recommend that, prior to construction, RG Developers file documentation of concurrence from the Railroad Commission of Texas that the Project is consistent with the Texas CMP.

Socioeconomics

Construction of the Project would generally have a minor impact on local populations, employment, housing, provision of community services, and property values. There would not be any disproportionately high or adverse environmental and human health impacts on low-income and minority populations from construction or operation of the Project. No residences or businesses would be displaced as a result of construction or operation of the LNG Terminal or pipeline facilities.

Construction of the LNG Terminal would require an average monthly construction workforce of 2,950 workers (peak of 5,225 workers) over the 7-year construction period; RG LNG anticipates that 30 percent of these workers would be hired locally. Construction of the pipeline facilities would require an average workforce of between 760 and 1,240 workers (peak of 1,500 workers) over two, non-consecutive 12-month periods, of which 90 percent would be non-local. Vehicular traffic associated with these workers would result in considerable increases in local traffic, specifically along SH-48 during construction of the LNG Terminal, but traffic levels would remain well within the capacity of the roadway. Permanent, moderate increases in marine traffic within the BSC would occur as the addition of six LNG carriers per week would double the current volume of large vessel traffic within the BSC; however, the Coast Guard has determined that the waterway is suitable for Project use.

Construction of the Rio Grande LNG Project would stimulate the economy through an estimated $22.4 billion in direct expenditures by RG Developers and annual operating direct expenditures of $2.1 billion. Indirect and induced effects of the Project, including additional demands for goods and services and the spending of disposable income by workers at local businesses, would also occur. Further, RG LNG estimates that the LNG Terminal would generate about $92.9 million in property taxes in the affected counties over the first 22 years of operation (inclusive of applicable tax abatements). These expenditures and taxes would result in a moderate, permanent, and positive impact on the local economy.

Construction of the Project could impact local tourism through an increase in noise, changes in the visual landscape, and heavier traffic along SH-48. However, given the extent of tourism areas (including birding areas, National Wildlife Refuges, National Historic Landmarks, and beaches) and the distance of many of the recreational portions of the areas from the LNG Terminal site and Pipeline System, neither construction nor operation would be expected to significantly impact tourism at these locations. Waterborne tourism (e.g., fishing), in portions of South Bay, the Zapata boat launch, and within the Bahia Grande would likely experience moderate increases in ambient noise during certain construction activities at the LNG Terminal, potentially changing visitation patterns immediately adjacent to the LNG Terminal but likely not the total number of visits to the general Project area. In addition, boaters may experience minor impacts resulting from potential delays in launching during periods of LNG carrier transit.

Cultural Resources

Two National Historic Landmarks are located within or near the extended 12-mile study area, including the Palmito Ranch Battlefield (4.1 miles from the LNG Terminal site) and the Palo Alto Battlefield (about 12 miles from the LNG Terminal site). Viewshed and noise assessments conducted by RG Developers indicated that visual impacts on the battlefields would be moderate (Palmito Ranch) and minor (Palo Alto) and that noise from construction and operation would not be audible. On March 19, 2018, the State Historic Preservation Office (SHPO) commented that visibility of the Project from identified historic resources in the area is limited, and that the proposed lighting design should help limit the Project impacts on the Palmito Ranch Battlefield National Historic Landmark. The NPS is reviewing the results of these assessments. In addition, about 30 miles of the Pipeline System would cross the King Ranch National Historic Landmark.

RG Developers have not yet completed cultural resources surveys for the Project, including the portion crossing King Ranch National Historic Landmark. Once complete, if any historic properties would be adversely affected by the Project, we recommend that a treatment plan be prepared and the SHPO and the Advisory Council on Historic Preservation are afforded an opportunity to comment, if applicable. We recommend that RG Developers file documentation of consultation with the SHPO, NPS, and Advisory Council on Historic Preservation prior to construction to ensure the FERC's responsibilities under Section 106 of the National Historic Preservation Act are met.

Air Quality

Construction of the Project would result in temporary impacts on air quality associated with the emissions generated from fossil-fuel fired construction equipment and fugitive dust. Air quality impacts due to construction of the Project would generally be localized, and are not expected to cause or contribute to a violation of applicable air quality standards. The LNG Terminal and pipeline facilities would be located in areas currently classified as being in attainment for all criteria pollutant standards. Fugitive dust emissions would be limited or mitigated through implementation of RG Developers' Fugitive Dust Control Plans. In addition, transport of construction materials associated with the Project could occur within the Houston-Galveston-Brazoria (HGB) area, which is a marginal nonattainment area for the 2015 8-hour ozone standard. Construction emissions from the Project occurring within the HGB area would not be expected to result in an exceedance of applicable general conformity thresholds for the HGB area.

Long-term impacts on air quality would result from operation of the LNG Terminal, Compressor Stations 1, 2, and 3, and Booster Stations 1 and 2. On March 21, 2017, RG Developers submitted a revised application to the TCEQ for a Prevention of Significant Deterioration (PSD) permit for the LNG Terminal and Compressor Station 3. RG Developers plan to submit the Title V permit application for the LNG Terminal and Compressor Station 3 prior to beginning construction. Compressor Stations 1 and 2 and Booster Stations 1 and 2 would require state minor source permits, and RB Pipeline submitted state permit applications for these facilities on March 24, 2017. The annual emissions of greenhouse gases (GHG) for the LNG Terminal (including Compressor Station 3) and Compressor Stations 1 and 2 would exceed 25,000 metric tons per year, thus these facilities would be subject to mandatory GHG reporting.

RG Developers estimated pollutant concentrations in the vicinity of the Project for comparison with the National Ambient Air Quality Standards (NAAQS). The analysis for all pollutants at the LNG Terminal (including Compressor Station 3, mobile LNG carrier, and support vessel emissions) showed that the facility would not cause or significantly contribute to an exceedance of the NAAQS. RG LNG also performed an ozone modeling analysis to quantify the potential impacts of the Project on ozone concentrations in the surrounding area. The analysis determined that the addition of the modeled Project impacts on background concentrations would not exceed the 70 parts per billion 2015 ozone NAAQS. Further, the results the State Health Effects modeling evaluation required by the TCEQ for the LNG Terminal indicate that the Project emissions are below applicable effects screening levels, and therefore adverse health effects are not expected. Similarly, ambient pollutant concentration modeling for Compressor Stations 1 and 2 and the booster stations showed that these facilities would not cause or significantly contribute to an exceedance of the NAAQS.

RG Developers would minimize operational impacts on air quality by adhering to applicable federal and state regulations as required in their air permit applications to the TCEQ. However, concurrent emissions from staged construction, commissioning and start-up, and operation of the LNG Terminal would temporarily impact local air quality, and could result in exceedances of the NAAQS in the immediate vicinity of the LNG Terminal during these construction years. These exceedances would not be persistent at any one time during these years due to the dynamic and fluctuating nature of construction activities within a day, week, or month.

Based on our independent review of the analyses conducted and mitigation measures proposed, we conclude that construction of the Project would result in elevated emissions near construction areas and would impact local air quality. However, construction emissions would not have a long-term, permanent effect on air quality in the area. Operation of the Project would have minor impacts on local and regional air quality. Given the mitigation measures proposed by RG Developers, and air quality controls and monitoring requirements that would be included in the Title V/PSD permits for the facilities, the Project would not result in regionally significant impacts on air quality.

Noise

The most prevalent noise-generating equipment and activity during construction of the LNG Terminal is anticipated to be pile-driving, although internal combustion engines associated with general construction equipment and dredging would also produce noise that would be perceptible in the vicinity of the site. With the exception of dredging, construction at the LNG Terminal site would take place during daytime hours. RG LNG plans to use both impact-type and vibratory pile-drivers during construction of the LNG Terminal, and pile-driving would be conducted both on land and in water. Pile-driving could produce peak sound levels in the event that three pile-drivers operate simultaneously that result in an increase of greater than 10 decibels (dB) over ambient levels at the nearest noise sensitive area (NSA). As a result, we recommend that RG LNG monitor pile-driving, file weekly noise data, and implement mitigation measures in the event that measured noise impacts are greater than 10 dB over ambient levels at the NSAs. Estimated noise levels for site preparation and facility construction (including intermittent pile-driving during which all three pile-drivers do not operate simultaneously) are not estimated to result in significant impacts on NSAs in the LNG Terminal vicinity.

Installation of the pipeline facilities would include noise from internal combustion engines associated with typical pipeline and aboveground facility construction, as well as HDD activities. Construction noise would be temporary and would vary as construction progresses along the Pipeline System corridor. While most construction activity would occur during daytime hours, RB Pipeline indicated that some specialized construction activities could occur during nighttime hours (such as at HDDs, operation of pumps at dry-ditch waterbody crossings, hydrostatic testing, and tie-ins). If, during construction, RB Pipeline determines that nighttime construction is warranted, it would be required to submit a variance request for review and approval by the Director of OEP including certain details such as projected noise, dust, and light pollution impacts, and identify the measures that RB Pipeline would implement to mitigate these impacts.

RB Pipeline conducted an HDD acoustical impact assessment, which found that sound levels for 24-hour HDD operations would exceed FERC’s noise criterion of a day-night noise level of 55 dB on the A-weighted scale at NSAs near seven proposed HDDs. While RB Pipeline has identified potential mitigation measures to reduce sound levels during HDD construction, the site-specific measures that would be implemented at each location have not been identified. Therefore, we recommend that RB Pipeline prepare a noise mitigation plan for each NSA where HDD noise would exceed FERC’s noise criterion, and that these plans be implemented during construction.

Operation of the LNG Terminal, and compressor, meter, and booster stations would produce noise on a continual basis during the lifetime of the facilities. The results of the noise impact analysis indicate that the noise attributable to construction and operation of the LNG Terminal would be lower than the FERC noise criteria at the nearest NSAs, and the predicted increases in ambient noise would be below perceptible levels. The results of the noise impact analysis conducted for the compressor and booster stations indicates that operation of these facilities would not generate noise that exceeds FERC noise level requirements at the nearest NSAs. To ensure that NSAs are not significantly affected by noise during operations, we recommend that RG Developers conduct post-construction noise surveys after each noise-producing unit (e.g. each liquefaction train and compressor) is placed into service and once the entire LNG Terminal (including Compressor Station 3) is placed into service. In addition, no NSAs are within 1 mile of the stand-alone meter stations proposed for the Project; therefore, operation of these facilities is not expected to result in perceptible noise impacts at any NSAs.

While construction of the Rio Grande LNG Project would result in localized minor to moderate elevated noise levels near construction areas, impacts would be limited to the construction period for the Project. During operations, noise impacts would be minor at the aboveground facilities along the Pipeline System and at the NSAs in the vicinity of the LNG

Terminal. Based on the analyses conducted, mitigation measures proposed, and with our additional recommendations, we conclude that construction and operation of the Project would not result in significant noise impacts on residents and the surrounding communities.

Reliability and Safety

As part of the NEPA review and NGA determinations, Commission staff assessed the potential impact on the human environment in terms of safety and whether the proposed facilities would be in the public interest based on whether they would operate safely, reliably, and securely.

As a cooperating agency, the DOT assists FERC staff in evaluating whether RG LNG's proposed design would meet the DOT's 49 CFR Part 193 Subpart B siting requirements. The DOT reviewed the design spill information submitted by RG LNG and on November 29, 2016, and provided a letter to FERC staff stating that the DOT had no objection to RG LNG's design spill selection methodology to comply with the 19 CFR 193 siting requirements for the proposed LNG Terminal facilities. The DOT will provide a Letter of Determination on the Project's compliance with 49 CFR Part 193 Subpart B. This determination will be provided to the Commission as further consideration to the Commission on its decision to authorize or deny the Project.

If the Project is authorized and constructed, the facility would be subject to the DOT's inspection and enforcement program; final determination of whether a facility is in compliance with the requirements of 49 CFR 193 would be made by the DOT staff. Furthermore, DOT's 49 CFR 192 requirements would apply to the currently under construction Valley Crossing Pipeline that would be routed through the northern part of the proposed LNG terminal site. FERC staff, in consultation with DOT, has evaluated the potential risk and impact from an incident on the Valley Crossing Pipeline. Based on DOT Pipeline and Hazardous Materials Safety Administration incident data, the likelihood of a pipeline incident or failure would be low, and a worst-case pipeline rupture scenario would be even less likely.

As a cooperating agency, the Coast Guard also assisted the FERC staff by reviewing the proposed LNG Terminal and the associated LNG marine carrier traffic. The Coast Guard reviewed a Waterway Suitability Assessment submitted by RG LNG that focused on the navigation safety and maritime security aspects of LNG carrier transits along the affected waterway. On December 26, 2017, the Coast Guard issued a Letter of Recommendation to FERC staff indicating the BSC would be considered suitable for accommodating the type and frequency of LNG marine traffic associated with this Project, based on the Waterway Suitability Assessment and in accordance with the guidance in the Coast Guard's Navigation and Vessel Inspection Circular 01-11. If the Project is authorized and constructed, the LNG Terminal would be subject to the Coast Guard's inspection and enforcement program to ensure compliance with the requirements of 33 CFR 105 and 33 CFR 127.

As a cooperating agency, the FAA assisted FERC staff in evaluating impacts on and from the SpaceX rocket launch facility in Cameron County. Specific recommendations are included to address potential impacts from rocket launch failures on the Project. However, the extent of impacts on SpaceX operations, National Space Program, and to the federal government would not fully be known until SpaceX submits an application with the FAA requesting to launch, and whether the LNG Terminal is under construction or in operation at that time.

FERC staff conducted a preliminary engineering and technical review of the RG LNG design, including potential external impacts based on the site location. Based on this review, we recommend the Commission consider incorporating into the Order a number of proposed mitigation measures and continuous oversight prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout life of the LNG Terminal to enhance the reliability and safety of the terminal to mitigate the risk of impact on the public. With the incorporation of these mitigation measures and oversight, FERC staff found that RG LNG's Terminal design would include acceptable layers of protection or safeguards that would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public.

The Pipeline System 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 System 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 facilities would not have a significant impact on public safety.

Cumulative Impacts

Our analysis of cumulative impacts includes other projects in the vicinity of the proposed Rio Grande LNG Project that could affect the same resources in the same approximate timeframe. Other projects in the geographic scope with the greatest potential to contribute to cumulative impacts with the Rio Grande LNG Project are the proposed Annova and Texas LNG Terminals, both of which would be constructed along the BSC, along with each project's non-jurisdictional facilities. We conclude that the proposed Project's contribution to cumulative impacts is primarily associated with the LNG Terminal and not the pipeline facilities, and that the cumulative impact contribution of the LNG Terminal would not be significant for most resources. The greatest potential for cumulative impacts would be on soils, surface water quality, vegetation, wildlife, aquatic resources, threatened and endangered species, visual resources, land- and water-based transportation, air quality, and noise. Resources potentially subjected to moderate or significant cumulative impacts are discussed below.

Construction of the proposed Project, the Texas LNG Project, and the non-jurisdictional facilities for the two projects are anticipated to occur concurrently, on immediately adjacent lands which would result in soil disturbance in succession; as the Annova LNG Terminal would be on the south side of the BSC, it would not contribute to cumulative impacts on soils. Collectively the Rio Grande LNG and Texas LNG Projects would contribute to moderate, permanent impacts on soils due to prolonged and delayed revegetation, and the potential for increased runoff and erosion from unstable soils. Similarly, if dredging were to occur in the BSC for multiple projects at the same time, moderate, but temporary, cumulative impacts on water quality and aquatic resources may occur. In addition, it is expected that significant impacts from increased vessel traffic would occur along unarmored portions of the BSC from increased marine vessel traffic related to shoreline erosion and turbidity, which would be relatively persistent throughout the life of the proposed LNG projects in the Brownsville area.

The Rio Grande LNG Project and most of the other projects we identified (including, but not limited to, Texas LNG and Annova LNG) would be located partially or wholly within the same subwatershed, which is the geographic scope for vegetation, wildlife, aquatic species, and threatened and endangered species. Due to the relatively large proportion of the subwatershed that would be affected by the projects considered, as well as the low revegetation potential of the local soils, we have determined that the proposed LNG Terminal would contribute to moderate cumulative impacts on rare plant communities and vegetation. This impact on vegetation would also contribute to moderate impacts on wildlife species using the vegetation communities. Federally listed threatened and endangered species that may be subjected to moderate to significant cumulative impacts include sea turtles (moderate), from the combined construction impacts associated with dredging and in-water pile-driving; the Northern aplomado falcon (moderate), from loss of potential foraging habitat; the piping plover (moderate), from noise-related indirect impacts that are likely to adversely affect adjacent critical habitat; and the ocelot and jaguarundi (significant), from the loss and/or decrease in suitability of habitat and the potential increase in vehicular strikes during construction. All federally regulated projects, including all three of the proposed LNG projects along the BSC, are required to coordinate with the FWS to minimize impacts on federally listed species.

The potential for cumulative visual impacts would be greatest if, in addition to the proposed LNG Terminal, the Annova LNG and Texas LNG Projects are permitted and built concurrently. Motorists on SH-48 (and other local roadways) and visitors to local recreation areas would experience a permanent change in the existing viewshed during construction and operation of the projects. We conclude that cumulative impacts of the three LNG projects on visual resources would be potentially significant.

Construction of the proposed LNG Terminal and the Texas LNG Project would result in a substantial increase in daily vehicle trips on SH-48. Both RG LNG and Texas LNG have agreed to make improvements to SH-48 to ensure safe movement of traffic along the road especially during peak hour traffic flows and implement additional mitigation measures; however, moderate cumulative impacts on roadways would occur during overlapping construction.

During operations, LNG carriers calling on the Rio Grande LNG Terminal and other LNG facilities along the BSC may have moving security zones that could preclude other marine vessels from transiting the waterway for up to 39 hours per week. Mandates for prior notice of expected arrivals would minimize impacts on other vessels; however, we conclude that there would be a moderate cumulative impact on marine vessel traffic in the BSC from overlapping construction and operation.

With other projects in the geographic scope, construction of the Rio Grande LNG Project would contribute to localized moderate elevated emissions of criteria pollutants near construction areas during the period(s) when construction of these activities would overlap. Operational air emissions from the Rio Grande LNG Project would contribute to cumulative emissions with other projects in the geographic scope, and would be required to comply with applicable air quality regulations. Overall, impacts from the Rio Grande LNG Terminal along with the other LNG facilities would cause elevated levels of air contaminants in the area and a potential exceedance of the 1-hour nitrogen dioxide NAAQS in an uninhabited area between the proposed LNG project facilities. We are aware that each LNG Terminal could be constructed within the same time period, and the concurrent construction, commissioning, and operations emissions of the proposed Brownsville LNG terminals could contribute significantly to air quality impacts, potentially exceed the NAAQS in local areas, and result in cumulatively greater local air quality impacts. Along the Rio Bravo Pipeline, no compressor or booster stations would trigger PSD major source permitting requirements for any pollutants and would not cause or contribute to a NAAQS exceedance. Therefore, cumulative impacts on regional air quality as a result of the operation of the Rio Grande LNG Project and other facilities would be long-term during the operational life of the Project, but minor.

The Rio Grande LNG Project would emit GHGs, which have the potential to contribute to climate change. There is no standard methodology to determine how the Project's incremental contribution to GHGs would translate into physical effects on the global environment. However, the 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. 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.

For simultaneous construction activities at all of the three LNG projects proposed along the BSC, the predicted sound level increase over the existing ambient ranges from 2.2 to 9.8 decibels on the A-weighted scale (dBA) day-night sound level (L_{dn}) at certain NSAs (residences) in the general vicinity of the projects. These noise level increases result in levels slightly over 55 dBA L_{dn}, and range between less than noticeable increases in ambient noise to a doubling of noise at specific NSAs. For construction activities that are not simultaneous but incremental, the predicted sound level increase ranges from 1.0 to 8.6 dBA L_{dn} at the NSAs. These increases would be minor to moderate; however, all levels would be below 55 dBA L_{dn}. For the Palmito Ranch Battlefield National Historic Landmark (4.1 miles from the Rio Grande LNG Project), the predicted cumulative construction increase is 10.1 dBA L_{dn} over the existing ambient, which could result in periods of perceived doubling of noise. The predicted sound level impacts for simultaneous operation of all three LNG projects are much lower than construction impacts, with potential increases over the existing ambient sound level between 0.3 and 1.5 dBA L_{dn} at NSAs, resulting in a negligible to minor impact. Construction and operation of the pipeline facilities would not contribute to significant cumulative noise impacts on nearby NSAs.

In summary, the anticipated cumulative impacts associated with the construction and operation of the Project along with other projects in the geographic scope are primarily construction-related dredging and pile-driving impacts in the BSC on aquatic fish and sea turtle resources, construction vehicle traffic on SH-48, potential direct impacts on the federally listed ocelot and jaguarundi, and construction noise impacts on NSAs during concurrent construction. The primary operation-related cumulative impacts include marine vessel impacts on water quality and on existing marine vessel traffic in the BSC, as well as loss or degradation of vegetation (habitat for federally listed species). These cumulative impacts are predominantly based on concurrent construction and operation of the Rio Grande LNG, Texas LNG, and Annova LNG Projects.

ALTERNATIVES CONSIDERED

In accordance with NEPA and FERC policy, we evaluated the no-action alternative, system alternatives, and other siting and design alternatives that could achieve the Project objectives. The range of alternatives that could achieve the Project objectives included system alternatives for both the terminal and pipeline, alternative LNG Terminal sites, and alternative pipeline configurations. Alternatives were evaluated and compared to the Project to determine whether these alternatives were environmentally preferable to the proposed Project. While the no-action alternative would avoid the environmental impacts identified in this EIS, adoption of this alternative would preclude meeting the Project objectives. If the Project is not approved and built, the need could potentially be met by other LNG export projects developed elsewhere along the Texas Gulf Coast. Implementation of other LNG export projects likely would result in impacts similar to or greater than those of the proposed Project.

We evaluated six LNG Terminal system alternatives, including four existing LNG import terminals with planned, proposed, or authorized liquefaction projects; and two proposed stand-alone LNG export terminals. To meet all or part of RG LNG's contractual agreements, each of these projects would require substantial construction beyond what is currently planned and would not offer significant environmental advantages over the proposed LNG Terminal; therefore, they were eliminated from further consideration. We also evaluated alternative sites for the LNG Terminal within other Texas coast ports and other sites along the BSC. Each site was excluded from further consideration due to size constraints, lease restrictions, and/or presence of additional sensitive resources. We are also assessing alternatives to RG LNG's proposed temporary haul road through wetlands, which would extend about 1 mile between the LNG Terminal site and the Port Isabel dredge pile. As we do not find use of the proposed haul road to be justified if better options are available, we recommend that that RG LNG assess the feasibility of using barges or the existing roadway system to transport the fill material.

We reviewed three pipeline system alternatives; however, none of the alternatives had enough available capacity to transport the Project volumes. We also reviewed the construction of one larger diameter pipeline as opposed to the two mainline pipelines, as well as concurrent construction of both pipelines, but eliminated these alternatives from further review based on construction and safety considerations. Because none of the alternatives reduced impacts on the environment, we eliminated them from further consideration.

CONCLUSIONS

We determined that construction and operation of the Rio Grande LNG Project would result in adverse environmental impacts. We conclude that impacts on the environment from the proposed Project would be reduced to less than significant levels with the implementation of RG Developers' proposed impact avoidance, minimization, and mitigation measures and the additional measures recommended by FERC staff. However, the Rio Grande LNG Project, combined with the other projects in the geographic scope, including the Texas LNG and Annova LNG projects, would result in significant cumulative impacts from sediment/turbidity and shoreline erosion within the BSC during operations from vessel transits; on the federally listed ocelot and jaguarundi from habitat loss and the potential for increased vehicular strike during construction; and on visual resources from the presence of new facilities. We based our conclusions upon information provided by RG Developers 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 Native American tribes. The following factors were also considered in our conclusions:

- The LNG Facility site would be in an area currently zoned for commercial and industrial use, along an existing, man-made ship channel.

- The pipelines would be collocated with, or adjacent to, other disturbed right-of-way corridors for about 66.4 percent of the route.

- The pipelines would be installed by trenchless methods (HDD or bore) to avoid impacts on all major perennial streams (i.e., streams over 100 feet wide), as well as many smaller waterbodies, wetlands, and road crossings.

- RG Developers would follow the Project-specific Spill Prevention, Control, and Countermeasures Plans; Stormwater Pollution Prevention Plans; Unanticipated Contaminated Sediment and Soils Discovery Plan; Unanticipated Discovery Plan (for cultural resources); HDD Contingency Plan; Fugitive Dust Control Plans; Noxious and Invasive Weed Plan; and Migratory Bird Conservation Plan.

- The Coast Guard issued a Letter of Recommendation indicating the BSC would be considered suitable for the LNG marine traffic associated with the Project.

- The DOT has no objection to RG LNG's methodology to comply with the 49 CFR 193 siting requirements for the proposed LNG Terminal facilities.

- The LNG Terminal design would include acceptable layers of protection or safeguards that would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public.

- The pipelines and associated aboveground facilities would be constructed, operated, and maintained in compliance with DOT standards published in 49 CFR 192.

- RG Developers would implement their Project-specific *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan) and Procedures to minimize construction impacts on soils, wetlands, and waterbodies, which is based on FERC's Plan and Procedures, with acceptable deviations.

- All appropriate consultations with the FWS and NMFS regarding federally listed threatened and endangered species would be completed before construction is allowed to start in any given area.

- All appropriate National Historic Preservation Act consultations with the Texas SHPO and the Advisory Council on Historic Preservation would be completed before construction is allowed to start in any given area.

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

In addition, we developed recommendations that RG Developers should implement to further reduce the environmental impacts of the Project, including recommendations specific to engineering, vulnerability, and detailed design of the LNG Terminal, and ongoing recommendations relating to inspections, reporting, notification, and non-scheduled events that would apply throughout the life of the LNG Terminal facility. Some of our conclusions are based on implementation of these measures. We are seeking comment on these measures, presented in section 5.2 of the EIS, and are recommending that these mitigation measures be attached as conditions to any authorization issued by the Commission for the Project.

1.0 INTRODUCTION

On May 5, 2016, Rio Grande LNG, LLC (RG LNG) and Rio Bravo Pipeline Company, LLC (RB Pipeline), filed a joint application with the Federal Energy Regulatory Commission (Commission or FERC) for authorization pursuant to Sections 3(a) and 7(c) of the Natural Gas Act (NGA). In Docket No. CP16-454-000, RG LNG requests authorization under Section 3(a) of the NGA and Part 153 of the Commission's regulations to site, construct, and operate facilities necessary to liquefy and export natural gas at a proposed site (the Rio Grande LNG Terminal) along the Brownsville Ship Channel (BSC) in Cameron County, Texas. In Docket No. CP16-455-000, RB Pipeline requests a Certificate of Public Convenience and Necessity (Certificate) pursuant to Section 7(c) of the NGA and Part 157 of the NGA to site, construct, operate, and maintain a new pipeline system (the Rio Bravo Pipeline or Pipeline System) in Jim Wells, Kleberg, Kenedy, Willacy, and Cameron Counties, Texas. Collectively, RG LNG and RB Pipeline are called RG Developers; the Rio Grande LNG Terminal and the Rio Bravo Pipeline are collectively called the Rio Grande LNG Project (Project).

As part of the Commission's consideration of this application, we[1] prepared this draft environmental impact statement (EIS) to assess the potential environmental impacts resulting from construction and operation of the facilities proposed by RG Developers in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA).

The Rio Grande LNG Terminal would be located on about 750.4 acres of a 984.2-acre parcel of land along the northern shore of the BSC in Cameron County[2], approximately 9.8 miles east of Brownsville and about 2.2 miles west of Port Isabel. The Project, which is currently expected to begin operations in late 2021, would produce a nominal capacity of about 27 million tons per annum (MTPA) of liquefied natural gas (LNG) during its minimum 20-year life (which could be extended to a 50-year life).

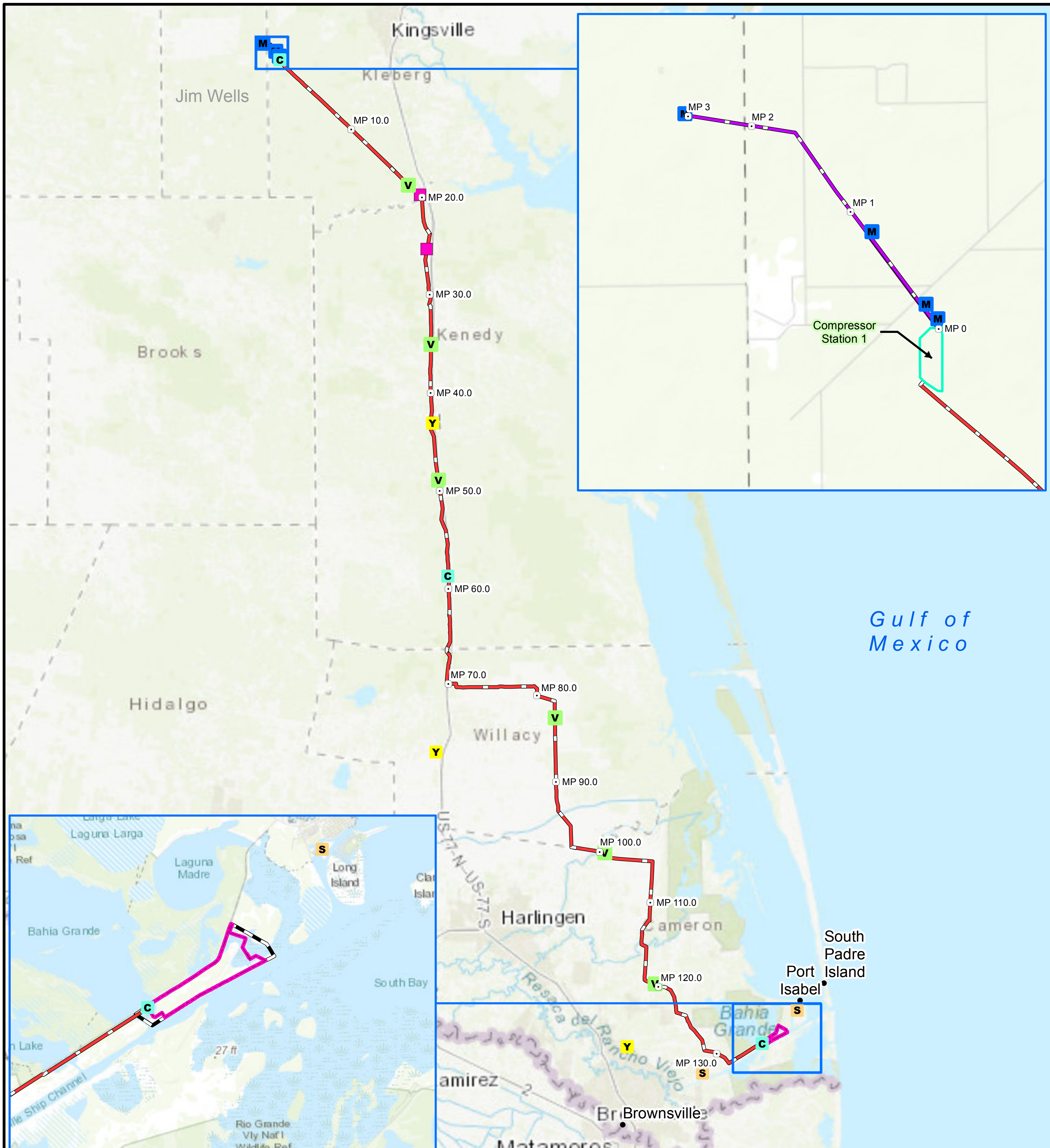
The LNG Terminal would receive natural gas via the proposed Rio Bravo Pipeline System, which would connect the LNG Terminal to the existing infrastructure near the Agua Dulce hub[3] in Nueces County. The Agua Dulce hub includes interconnects to natural gas pipelines including the Gulf Coast Mainline, Transcontinental Pipeline, and Kinder Morgan Tejas Pipeline near the origin of the Rio Bravo Pipeline System, allowing for multiple interconnects to the Rio Bravo Pipeline. Figure 1-1 depicts the general location of the Rio Grande LNG Project.

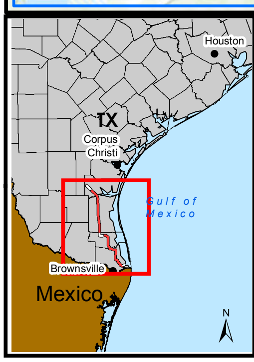
---

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

2 All Project locations referred to in this EIS (including towns, counties, and other municipalities) are within the state of Texas, unless specifically stated otherwise.

3 A natural gas hub is an interconnection of two or more pipelines that allows the transfer of gas.





Legend

⊙	Milepost	S	Storage Yard
M	Meter Station		Proposed Header System
V	Mainline Valve		Proposed Rio Bravo Pipeline
	Interconnect Booster and Meter Station		Proposed LNG Terminal Boundary
Y	Contractor Yard		LNG Terminal Site
C	Compressor Station		

0 10 20

Miles

N

Scale: 1:885,000

Basemap Source: Esri, DeLeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China, Esri Thailand, Tom Tom, 2013

Rio Grande LNG Project

Project Location Map

Figure 1-1

The natural gas would be liquefied at the Rio Grande LNG Terminal using six liquefaction trains, each of which would have a nominal capacity of 4.5 MTPA, and stored onsite in four, full-containment LNG storage tanks with a capacity of 180,000 cubic meters (m^3) each. The LNG would be loaded onto LNG vessels for export overseas and onto LNG trucks for road distribution to vehicle refueling stations in south Texas. During operations, RG Developers anticipate that an average of 312 LNG vessels would make port calls at the LNG Terminal each year. In addition, the Project would have the capacity to load 12 to 15 LNG trucks per day at each of the four loading bays. Detailed information regarding the facility components is provided in section 2.1.1.

The Pipeline System would include a 42-inch-diameter Header System, which would include dual pipelines for the first 0.8 mile of its route, and dual 42-inch-diameter mainline pipelines (individually identified as Pipeline 1 and Pipeline 2). The Header System would be about 2.4 miles of pipeline in Kleberg and Jim Wells Counties that would collect gas from six existing pipeline systems for transport into Pipelines 1 and 2. Pipelines 1 and 2 would be about 135.5 miles long, originate in Kleberg County, and transit through Kenedy, Willacy, and Cameron Counties before terminating at a compressor station within the boundaries of the LNG Terminal. Although the Pipeline System itself is not within the Agua Dulce hub, it has been sited to allow ease of connection to the existing Agua Dulce infrastructure. The Pipeline System, when complete, would provide the Rio Grande LNG Terminal with about 4.5 billion cubic feet per day (Bcf/d) of firm capacity. Although the Header System and Pipeline 1 are proposed to be constructed at the same time, Pipeline 2 would be constructed on a separate schedule (approximately 18 months after the completion of Pipeline 1) to accommodate the staged construction of the LNG Terminal; therefore, RB Pipeline estimates that Pipeline 1 would begin operation in late 2021, concurrent with the LNG Train 1 (see section 2.3).

RB Pipeline's proposed facilities are summarized below:

- 2.4 miles of 42-inch-diameter pipeline, including 0.8 mile of dual pipeline, to gather gas from existing systems in Kleberg and Jim Wells Counties (referred to as the Header System);
- 135.5 miles of 42-inch-diameter pipeline crossing Kleberg, Kenedy, Willacy, and Cameron Counties (Pipeline 1);
- 135.5 miles of 42-inch-diameter pipeline that would parallel Pipeline 1 with an offset of 25 feet (Pipeline 2);
- a new 180,000-horsepower (hp) compressor station in Kleberg County that would include two pig launchers (one for each pipeline) and a metering site (Compressor Station 1);
- a new 180,000-hp compressor station in Kleberg County that would include two pig launcher/receivers (Compressor Station 2);
- a new 180,000-hp compressor station within the boundaries of the LNG Terminal in Cameron County that would include a gas custody transfer meter and pig receivers (Compressor Station 3);

- two new 30,000-hp interconnect booster compressor stations (booster station) in Kenedy County, each of which would contain a metering site;
- four metering sites along the Header System;
- six mainline valve (MLV) sites (two MLVs per site);
- temporary and permanent access roads; and
- temporary contractor/pipe yards and offsite storage.

Under Section 3 of the NGA, FERC considers all factors bearing on the public interest as part of its decision to authorize natural gas facilities. 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 of the NGA, the Commission determines whether interstate natural gas transportation facilities are in the public convenience and necessity and, if so, grants a Certificate to construct and operate them. The Commission bases its decisions on technical competence, financing, rates, market demand, gas supply, environmental impact, long-term feasibility, and other issues concerning a proposed Project.

1.1 PURPOSE AND NEED

RG Developers' stated purpose of the Rio Grande LNG Project is to develop, own, operate, and maintain a natural gas pipeline system to access natural gas from the Agua Dulce Hub and an LNG export facility in south Texas to export 27 MTPA of natural gas that provides an additional source of firm, long-term, and competitively priced LNG to the global market. The Project purpose also includes providing LNG for truck transport and for fueling operations. Any exports would be consistent with authorizations from the U.S. Department of Energy (DOE). The DOE granted an authorization to RG LNG for export to countries having a free trade agreement (FTA) with the United States that includes national treatment for trade in natural gas (FTA nations) on August 17, 2016. An application for export to non-FTA nations is pending the DOE's review of RG Developers' application, which was filed on December 23, 2015.

RB Pipeline published a Notice of Open Season on May 24, 2016, and executed a Precedent Agreement on June 23, 2016, with RioGas Marketing, LLC. The Precedent Agreement included the total capacity of the Pipeline System (4.5 Bcf/d) for a period of 20 years. A third-party would own the natural gas entering the Pipeline System. A portion of that natural gas would be furnished to RB Pipeline for operation of the Pipeline System. Additional natural gas owned by the third party would be furnished to RG LNG for operation of the LNG Terminal and for liquefaction under tolling agreements. RG LNG would export the LNG on its own behalf, or as an agent for third parties, as authorized by the DOE.

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 in identifying significant environmental impacts; and
- identify and recommend specific mitigation measures to avoid or minimize environmental impacts.

This EIS focuses on the facilities that are under the FERC's jurisdiction (that is, the facilities proposed by RG Developers within the LNG Terminal and along the Pipeline System) and, to a lesser extent, the non-jurisdictional facilities that are integrally related to the development of the Project (i.e., potable water and sewage lines, electric transmission lines, and LNG trucking beyond the boundaries of the LNG Terminal site), which are discussed in section 1.4.1.

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 alternatives. The topics addressed in this EIS include alternatives; 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; and cumulative impacts. This EIS also presents our conclusions and recommended mitigation measures.

The Energy Policy Act of 2005 (EPAct 2005) provides that the FERC shall act as the lead agency for coordinating all applicable authorizations related to jurisdictional natural gas facilities and for purposes of complying with NEPA. The FERC, as the "lead federal agency," is responsible for preparation of this EIS. This effort was undertaken with the participation and assistance of the U.S. Army Corps of Engineers (COE), U.S. Coast Guard (Coast Guard), DOE, U.S. Department of Transportation's (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA), the DOT's Federal Aviation Administration (FAA), the U.S. Fish and Wildlife Service (FWS), the National Park Service (NPS), the U.S. Environmental Protection Agency (EPA), and the National Oceanic and Atmospheric Administration's (NOAA) – National Marine Fisheries Service (NMFS) as "cooperating agencies" under NEPA.

Cooperating agencies have jurisdiction by law or provide special expertise with respect to environmental impacts involved with a proposal. The roles of the FERC, DOE, COE, Coast Guard, DOT (PHMSA and FAA), FWS, NPS, EPA, and NMFS as cooperating agencies in the review and authorization process are described below. The EIS provides a basis for coordinated federal decision making in a single document, avoiding duplication among federal agencies in the NEPA environmental review process. In addition to the lead and cooperating agencies, other federal, state, and local agencies may use this EIS in approving or issuing permits for all or part of the Project. Federal, state, and local permits, approvals, and consultations for the Project are discussed in section 1.5.

1.2.1 Federal Energy Regulatory Commission

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

As the lead federal agency for the Project, the FERC is required to comply with Section 7 of the Endangered Species Act of 1973 (ESA), as amended; the Magnuson-Stevens Fishery Conservation and Management Act (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 EIS. The FERC will use this document to consider the environmental impacts that could result if it issues an authorization to RG LNG under Section 3(a) of the NGA and a Certificate to RB Pipeline under Section 7(c) of the NGA.

1.2.2 U.S. Army Corps of Engineers

The COE has jurisdictional authority pursuant to Section 404 of the Clean Water Act (CWA) (Title 33 of the United States Code, Section 1344 [33 United States Code (USC) 1344]), which governs the discharge of dredged or fill material into waters of the United States; Section 10 of the Rivers and Harbors Act (RHA) (33 USC 403), which regulates any work or structures that potentially affect the navigable capacity of a waterbody; and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 (33 USC 1413) which regulates transportation of dredged material offshore. Because the 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 EIS. The COE would adopt the EIS in compliance with 40 CFR 1506.3 if, after an independent review of the document, it concludes that the EIS satisfies the COE's comments and suggestions. The Project is within the Galveston District of the COE Southwestern Division.

The primary issuances to be decided by the COE include:

- Section 404 permits for impacts on waters of the United States associated with construction and operation of the Project;

- Section 10 permit for construction activities within navigable waters of the United States associated with the Project;

- Section 103 permit for transportation of dredged material offshore; and

- Section 14 permit for modification of COE civil works projects (e.g., federal canals or dredged material placement areas), if determined to applicable during ongoing reviews.

This EIS contains information needed by the COE to reach decisions on these issues. Through the coordination of this document, the 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, the COE must consider whether a proposed action 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. The COE would issue a Record of Decision to formally document its decision on the proposed action, including Section 404(b)(1) analysis and required environmental mitigation commitments.

1.2.3 U.S. Coast Guard

The Coast Guard is the federal agency responsible for assessing the suitability of the Project Waterway (defined as the waterways that begin at the outer boundary of the navigable waters of the United States) for LNG marine traffic. The Coast Guard exercises regulatory authority over LNG facilities that affect the safety and security of port areas and navigable waterways under Executive Order 10173; the Magnuson Act (50 USC 191); the Ports and Waterways Safety Act of 1972, as amended (33 USC 1221 et seq.); and the Maritime Transportation Security Act of 2002 (46 USC 701). The Coast Guard is responsible for matters related to navigation safety, vessel engineering and safety standards, and all matters pertaining to the safety of facilities or equipment located in or adjacent to navigable waters up to the last valve immediately before the receiving LNG tanks.

The Coast Guard also has authority for LNG facility security plan reviews, approval and compliance verifications 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 (to the territorial seas). As appropriate, the Coast Guard (acting under the authority in 33 USC 1221 et seq.) also would inform the FERC of design- and construction-related issues identified as part of safety and security assessments. If the Rio Grande LNG Project is approved, constructed, and operated, the Coast Guard would continue to exercise regulatory oversight of the safety and security of the LNG Terminal facilities, in compliance with 33 CFR 127.

As required by its regulations, the Coast Guard is responsible for issuing a Letter of Recommendation (LOR) as to the suitability of the waterway for LNG marine traffic following a Waterway Suitability Assessment (WSA). The process of preparing the LOR begins when an applicant submits a Letter of Intent (LOI) to the local Captain of the Port. In a letter dated March 18, 2015, RG LNG submitted its LOI and preliminary WSA to the Coast Guard as required by 33 CFR 127.007. The Coast Guard requested additional information, and a follow-on WSA was submitted on December 17, 2015. In a letter dated December 26, 2017, the Coast

Guard issued the LOR for the Project,[4] which stated that the BSC is considered suitable for LNG marine traffic in accordance with the guidance in Coast Guard Navigation and Vessel Inspection Circular (NVIC) 01-2011.

1.2.4 U.S. Department of Energy

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. On December 23, 2015, RG LNG filed an application with the DOE (Fossil Energy Docket No. FE-15-190-LNG) seeking authorization to export LNG to FTA nations that have or in the future develop the capacity to import LNG via ocean-going carrier.

The application also sought approval to export LNG to non-FTA nations. RG LNG subsequently filed an amendment to its application on June 7, 2016, requesting that the term of authorization be 30 years[5] for export to FTA nations and 20 years for non-FTA nations; the original application requested a 20-year term for export to both FTA and non-FTA nations. The application and amendment requested authorization to export the equivalent of 3.6 Bcf/d of domestically produced natural gas commencing the earlier of the date of first export or 7 years (non-FTA nations) or 10 years (FTA nations) from the date of issuance of the requested authorization.

Section 3(c) of the NGA, as amended by Section 201 of the Energy Policy Act of 1992 (Public Law 102-486), requires that applications to the DOE requesting authorization of the import and export of natural gas, including LNG from and to FTA nations be deemed consistent with the public interest and granted without modification or delay. On August 17, 2016, DOE granted RG LNG an authorization to export LNG to FTA nations[6] and is currently conducting its review of RG LNG's request to export LNG to non-FTA nations.

---

4 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 "Advanced Search" from the eLibrary menu and enter the accession number for the document of interest. The LOR for the project was filed with the FERC on January 18, 2018, and can be found on the FERC eLibrary website using Accession Number 20180118-3038.

5 The proposed life of the Rio Grande LNG Project is a minimum of 20 years, but up to 50 years (see section 1.0). RG LNG requested authorization from the DOE to export domestically produced natural gas for a period of 30 years (to FTA nations) or 20 years (to non-FTA nations). Therefore, if market conditions indicate that the export of natural gas from the LNG Terminal is warranted beyond the requested term, RG LNG would be required to seek additional authorization from the DOE.

6 DOE, RG LNG, DOE/FE Order No. 3869, FE Docket No. 15-190-LNG, Order Granting Long-Term, Multi-Contract Authorization to Export Liquefied Natural Gas by Vessel from the Proposed Rio Grande LNG Terminal to FTA Nations (August 17, 2016).

1.2.5 U.S. Department of Transportation

1.2.5.1 Pipeline and Hazardous Materials Safety Administration

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

The DOT's PHMSA has prescribed the minimum federal safety standards for LNG facilities in compliance with 49 USC 60101 et seq. These standards are codified in 49 CFR 193 and apply to the siting, design, construction, operation, maintenance, and security of LNG facilities. The National Fire Protection Association (NFPA) Standard 59A, (2001 edition) *Standard for the Production, Storage, and Handling of Liquefied Natural Gas,* is incorporated into these requirements by reference, with regulatory preemption in the event of conflict. In February 2004, the Coast Guard, the DOT, and the FERC entered into an Interagency Agreement to ensure greater coordination among these three agencies in addressing the full range of safety and security issues at LNG terminals, including terminal facilities and marine carrier operations, and maximizing the exchange of information related to the safety and security aspects of the LNG facilities and related marine operations. Under the Interagency Agreement, the FERC is the lead federal agency responsible for the preparation of the analysis required under NEPA for impacts associated with terminal construction and operation. The DOT and the Coast Guard participate as cooperating agencies but remain responsible for enforcing their respective regulations covering LNG facility siting, design, construction, and operation. In addition, the August 31, 2018 Memorandum of Understanding between the FERC and DOT provides guidance and policy on each agency's respective statutory responsibility to ensure that each agency works in a coordinated and comprehensive manner.[7]

As a cooperating agency, the DOT assists FERC staff in evaluating whether RG LNG's proposed design would meet the DOT's 49 CFR Part 193 Subpart B siting requirements. On November 29, 2016, the DOT provided a letter to FERC stating that it had no objection to RG LNG's design spill methodologies being used for the selection of single accidental leakage sources. Informal consultation between RG LNG and the DOT regarding additional LNG and pipeline safety and federal safety standards is currently ongoing.

1.2.5.2 Federal Aviation Administration

The DOT's FAA is the federal agency responsible for civil aerospace travel, including the regulation and development of civil aviation, air traffic control, and regulation of U.S. commercial space transportation. The FAA has agreed to become a cooperating agency for the Rio Grande LNG Project given its jurisdiction over the SpaceX project which, when complete, will launch commercial spacecraft from a location about 5 miles southeast of the proposed LNG Terminal site.

[7] This document can be viewed online at https://www.ferc.gov/legal/mou/2018/FERC-PHMSA-MOU.pdf.

1.2.6 U.S. Fish and Wildlife Service

The FWS is responsible for ensuring compliance with the ESA. Section 7 of the ESA, as amended, states that any project authorized, funded, or conducted by any federal agencies 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]). The FWS also reviews project plans and provides comments regarding protection of fish and wildlife resources under the provisions of the Fish and Wildlife Coordination Act (16 USC 661 et seq.). The FWS is also responsible for the implementation of the provisions of the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703) and the Bald and Golden Eagle Protection Act (BGEPA) (16 USC 688).

1.2.7 National Park Service

The NPS is a land managing agency within the U.S. Department of the Interior with jurisdiction over 80 million acres of federal land in the United States. It manages these lands to protect and preserve natural and cultural resources for the benefit of current and future generations. The NPS has agreed to become a cooperating agency for the Rio Grande LNG Project given its specific interest over three cultural heritage areas in the vicinity of the Project; specifically, the RB Pipeline would cross or occur in the vicinity of three nationally significant landmarks, including the King Ranch National Historic Landmark, the Palo Alto Battlefield National Historical Park/National Historic Landmark, and the Palmito Ranch Battlefield National Historic Landmark. The Palo Alto Battlefield National Historic Park/National Historic Landmark and Palmito Ranch Battlefield National Historic Landmark are also in the vicinity of the LNG Terminal site.

1.2.8 U.S. Environmental Protection Agency

The EPA is the federal agency responsible for protecting human health and safeguarding the natural environment. It sets and enforces national standards under a variety of environmental laws and regulations in consultation with state, tribal, and local governments. The EPA has delegated water quality certification (Section 401 of the CWA) to the jurisdiction of individual state agencies, but may assume this authority if the state program is not functioning adequately, or at the request of the state. The EPA also oversees the issuance of a National Pollutant Discharge Elimination System (NPDES) permits by the state agency for point-source discharge of used water into waterbodies (Section 402 of the CWA). The EPA shares responsibility for administering and enforcing Section 404 of the CWA with the COE, and has authority to veto COE permit decisions.

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

1.2.9 National Oceanic and Atmospheric Administration, National Marine Fisheries Service

NMFS, along with the FWS, has authority under the ESA to work with federal agencies and applicants to conserve ESA-listed species and their critical and other habitats. The FWS and NMFS will consult with lead federal agencies for actions that may affect ESA-listed species and/or critical habitats. NMFS also has the authority under the MSFCMA and the Marine Mammal Protection act (MMPA) to review a project's impacts to essential fish habitats and to protect marine mammals. The NMFS Office of Habitat Conservation has agreed to become a cooperating agency for the Rio Grande LNG Project given the presence of EFH in the Project vicinity.

1.3 PUBLIC REVIEW AND COMMENT

1.3.1 Pre-filing Process and Scoping

On March 20, 2015, RG Developers filed a request with the FERC to use our pre-filing review process. This request was approved on April 13, 2015, and pre-filing Docket No. PF15-20-000 was established in order to place information filed by RG Developers, documents issued by the FERC, as well as comments from the public, agencies, tribes, organizations, and other stakeholders into the public record. The pre-filing review process provides opportunities for interested stakeholders to become involved early in project planning, facilitates interagency cooperation, and assists in the identification and resolution of issues prior to a formal application being filed with the FERC.

RG Developers held open houses in Kingsville, Raymondville, and Brownsville on May 19, 20, and 21, 2015, respectively, to provide information to the public about the Rio Grande LNG Project. FERC staff participated in the meeting, describing the FERC process and providing those attending with information on how to file comments with the FERC.

On July 23, 2015, the FERC issued a *Notice of Intent to Prepare an Environmental Impact Statement for the Planned Rio Grande LNG Project and Rio Bravo Pipeline Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Meetings* (NOI). This notice was sent to about 720 interested parties including federal, state, and local officials; agency representatives; conservation organizations; Native American tribes; local libraries and newspapers; and property owners in the vicinity of proposed Project. Publication of the NOI established a 30-day public scoping period for the submission of comments, concerns, and issues related to the environmental aspects of the Project.

The FERC conducted three public scoping meetings for the proposed Project to provide an opportunity for the public to learn more about the Rio Grande LNG Project and to participate in our analysis by providing written or oral comments on environmental issues to be included in the EIS. Each scoping meeting had representatives from both the FERC staff and RG Developers, as well as informational materials on the Project and the FERC process. Two of the scoping meetings were held along the RB Pipeline route in Raymondville (August 10, 2015) and Kingsville (August 13, 2015). Five individuals elected to provide oral comments at the Raymondville scoping meeting; a transcript of these comments is part of the public record for the Rio Grande LNG Project and is available for viewing on the FERC internet website (http://www.ferc.gov). No oral comments were provided at the Kingsville scoping meeting.

A third scoping meeting was held in Port Isabel on August 11, 2015, near the site of the proposed Rio Grande LNG Terminal. As three LNG terminals have been proposed for our consideration along the BSC (the Rio Grande LNG Terminal, the Texas LNG Terminal [FERC Docket No. CP16-116-000], and the Annova LNG Terminal [FERC Docket No. CP16-480-000]), the Port Isabel scoping meeting included the applicants and informational materials for each of the three projects. The intent of the combined scoping meeting was to provide interested parties the opportunity to discuss, and provide comments for, all three projects in one venue. A total of 142 individuals elected to provide oral comments; the transcript of these comments is also available for viewing on the FERC internet website. All comments received at this scoping meeting were reviewed during preparation of this EIS, and incorporated as appropriate; however, each project is being individually assessed in a separate EIS.

On July 15, 2015, we met with representatives of the COE, NMFS, and the FWS, and on August 12, 2015, we met with representatives of the Coast Guard, FWS, NPS, and Texas Parks and Wildlife Department (TPWD) to discuss coordination of agency review, permit requirements, resource concerns, and each agency's interest in participating in our environmental review as a cooperating agency. Similar to the Port Isabel scoping meeting, these interagency meetings included discussions on each of the three planned or proposed LNG projects along the BSC. Additional calls, meetings, and site visits were also conducted prior to RG Developers filing their application, as well as bi-weekly calls between FERC, interested agencies, and representatives of RG Developers.

Issues identified after the initial open houses, and during and after public scoping meetings are summarized in table 1.3-1, along with the EIS section that address each topic. The most frequently received comments relate to socioeconomic impacts, air emissions, LNG safety and security, threatened and endangered species, and impacts on wetlands. Issues identified that are not considered environmental considerations or are outside the scope of the EIS process are summarized in table 1.3-2 and are not addressed further in this EIS.

1.4 NON-JURISDICTIONAL FACILITIES

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

Table 1.3-1 Key Environmental Concerns Identified During Scoping	
Issue/Specific Comment	**EIS Section Addressing Comment**
General	
Purpose of and need for proposed projects; natural gas markets; local and national benefits	1.1
Pre-filing process, landowner and public notifications and communications, public participation process, scoping meeting format	1.3
Impacts on the available power supply due to electricity use by the LNG Terminal	2.2.1
Future plans and abandonment	2.8
Alternatives	
No-action alternative	3.1
LNG Terminal site alternatives to more highly industrialized areas or avoid sensitive resources	3.3.1
Alternatives to LNG as a source of energy	3.1
Consideration of alternative pipeline routes to avoid sensitive resources	3.3.3
Surface and Groundwater Resources	
Impacts on sensitive surface water resources including the Laguna Madre and Bahia Grande	4.3.2.1, 4.3.2.2
Impacts on hydrology and water quality from dredging, construction of in-water facilities, and ship transits	4.3.2.2
Impacts on surface water quality from discharges and stormwater pollution	4.3.2.2
Impacts on groundwater quality	4.3.1.2
Surface and groundwater use and drinking water supply	4.3.1, 4.3.2
Impacts on aquatic environment from contaminated sediments or dredged material placement	4.3.1.2, 4.3.2.2
Waterbody crossings	4.3.2, appendix G
Wetlands	
Impacts on the Bahia Grande Restoration Project	4.3.2, 4.4.2
Impacts on wetlands	4.4.2
Restoration of wetlands and wetland mitigation	4.4.2.4
Vegetation	
Impacts on vegetation including thornscrub, native coastal prairie, and lomas	4.5.2, table 4.5-1
Wildlife and Aquatic Resources	
Impacts on migratory birds and nesting colonial waterbirds	4.6.1.3
Impacts on wildlife from habitat loss	4.6.1.2
Invasive species, including those that may be transported in ballast water	4.3.2.2, 4.6.2.2
Impacts of water discharges and ship traffic on aquatic species	4.6.2.2

Table 1.3-1 (continued) Key Environmental Concerns Identified During Scoping	
Issue/Specific Comment	**EIS Section Addressing Comment**
Impacts on submerged aquatic vegetation due to water quality impacts	4.6.2, 4.6.3
Impacts on aquatic habitats, including EFH	4.6.2.2, 4.6.3
Threatened, Endangered, and Special Status Species	
Impacts on threatened and endangered species and marine mammals	4.7
Impacts on the movement of the endangered ocelot	4.7.1
Agency coordination and requirements	4.7, 1.5
Land Use, Recreation, and Visual Resources	
Impacts on the Laguna Atascosa National Wildlife Refuge, the Bahia Grande Coastal Corridor Project, and existing land use policies	4.8.1.5, 4.8.3
Impacts on agricultural land	4.2.2, 4.5.2, 4.8.1
Light pollution	4.8.2
Impacts on outdoor recreation opportunities, fishing, and boating	4.8.1.5, 4.9.3
Impacts of storage tanks and LNG Terminal facilities on visual resources	4.8.2
Eminent domain	4.8.1.4
Socioeconomics	
Impact on minority and low-income populations	4.9.10
Impact on tourism and recreation-based commerce in the vicinity	4.9.3
Impact on commercial and recreational fisheries	4.9.3.2, 4.9.4.1
Housing impacts on communities in the vicinity	4.9.6
Employment opportunities for local contractors and laborers	4.9.1
Tax revenues	4.9.5
Assessment of and impacts on community resources including roads and public safety resources	4.9.7, 4.9.8
Cultural Resources	
Impacts on cultural resources including the King Ranch National Historic Landmark, Palmito Ranch Battlefield National Historic Landmark, and Palo Alto Battlefield National Historic Park/National Historic Landmark	4.10
Air Quality and Noise	
Consistency with the emissions limits and the National Ambient Air Quality Standards	4.11.1
Emissions from the LNG Terminal and dispersion of pollutants, including mitigation	4.11.1.3
Impact of emissions on human health	4.11.1.3
Greenhouse gases and climate change	4.11.1, 4.13.2
Noise impacts	4.11.2
Reliability and Safety	
Navigation safety	4.12.1

Table 1.3-1 (continued)
Key Environmental Concerns Identified During Scoping

Issue/Specific Comment	EIS Section Addressing Comment
Spills from hazardous materials maintained at the LNG Terminal	4.3, 4.6, 4.12.1
Emergency response plans, evacuations, and coordination with community public safety services	4.12.1
Impacts from operation in the vicinity of the SpaceX launch facility and Valley Crossing Pipeline	4.12.1
Terminal security, including the potential for the LNG Terminal to be a terrorist target	4.12.1
Catastrophic system failures, or damage to the LNG Terminal or pipeline facilities due to storm events, flooding, or corrosion	4.12.1, 4.12.2
Cumulative Impacts	
Analysis of cumulative impacts associated with multiple proposed LNG Terminals along the BSC	4.13.2
Cumulative impacts of the pipeline	4.13.2

Table 1.3-2
Issues Identified and Comments Received That Are Outside the Scope of the EIS

Issue / Specific Comment	Explanation
Environmental and economic consequences of any induced production, especially in shale gas plays, as a result of increased natural gas exports	Production and gathering activities, and the pipelines and facilities used for these activities, are not regulated by FERC, but are overseen by the affected region's state and local agencies with jurisdiction over the management and extraction of the shale gas resource. Determining the well and gathering line locations and their environmental impact is not feasible because the market and gas availability at any given time would determine the source of the natural gas. While past, present, and reasonably foreseeable future oil and gas infrastructure within the geographic scope of the cumulative impacts assessment are addressed in section 4.13, the specific locations for infrastructure associated with induced production are not reasonably foreseeable. Therefore, it is outside of the scope of this EIS.
Alternative uses of the Rio Grande LNG Terminal site, including use of the site as a national wildlife refuge	Alternative use of the LNG Terminal site, which is owned by the Port of Brownsville, is not under the jurisdiction of the Commission.
Effects of hydraulically fractured shale gas production	The development of natural gas in shale plays by hydraulic fracturing is not the subject of this EIS nor is the issue directly related to the proposed Project.
Effects of LNG combustion in end-use / importing markets	Review of the Project is limited to the economic and environmental impacts of the proposal before the Commission; therefore, the effects of LNG combustion in end-use/importing markets are outside of the scope of this EIS.
Consideration of other pending LNG export proposals before the DOE and FERC through the development of a programmatic EIS	The Commission does not intend to conduct a nation-wide analysis of proposed LNG export terminals. The DOE determines the public benefits of exporting LNG from terminals in the United States. The FERC's review and approval of individual projects under the NGA does not constitute a coordinated federal program.

The following non-jurisdictional actions were identified in association with the Project:

- LNG trucking activities that would take place after the LNG truck has departed from the LNG Terminal;
- construction of an electric transmission line and switchyard to extend power from American Electric Power's (AEP) existing system to the LNG Terminal;
- construction of a new 16-inch-diameter potable water pipeline to extend from the Brownsville Navigation District's (BND) existing system to the LNG Terminal;
- construction of a new 12-inch-diameter pumped-sewage pipeline to extend from the BND's existing system to the LNG Terminal;
- construction of standard utility connections at the compressor and booster stations; and
- modifications to Texas State Highway (SH)-48 near the LNG Terminal.

These facilities are described below and in our cumulative impacts analysis in section 4.13 of this EIS.

1.4.1 LNG and Natural Gas Liquids Condensate Trucking

The proposed truck loading facilities for LNG and natural gas liquids (NGL) condensate at the LNG Terminal are jurisdictional facilities; however, once a loaded truck leaves the LNG Terminal, it would no longer fall under the jurisdiction of the FERC. As a general rule, FERC jurisdiction over the interstate transportation of natural gas in either a gaseous or liquefied state is limited to transportation by pipeline (i.e., FERC jurisdiction does not extend to deliveries of natural gas, or its byproducts, by truck, train, or barge).[8] Further, jurisdiction over LNG import/export facilities and services under Section 3 of the NGA would not follow the LNG trucks after they exit the boundary of the LNG Terminal, as the LNG would at that point be moving in either interstate or intrastate commerce, rather than in foreign commerce. Because these activities are not under the Commission's jurisdiction, we cannot require RG LNG to implement measures to mitigate environmental impacts; therefore, the mitigation measures presented in this EIS relative to LNG trucking are only those proposed by RG LNG.

During operation of the Rio Grande LNG Project, a portion of the LNG produced at the LNG Terminal would be loaded onto third-party trucks for distribution to refueling stations in south Texas. While market demand would ultimately drive the amount of LNG loaded onto trucks, and no agreements have been executed for the transportation of LNG in trucks, RG LNG's trucking facilities are being designed to include 4 loading bays, each with the capacity to load 12 to 15 trucks per day. RG LNG's current projections indicate that full use of these

---

8 See Exemption of Certain Transport and/or Sales of Liquefied Natural Gas from the Requirements of Section 7(c) of the NGA, 49 FPC 1078, at 1079 (1973).

bays would result in the road distribution of 0.4 MTPA (less than 1.5 percent of the LNG Terminal's annual production). Similarly, RG LNG would install 2 condensate truck loading bays and anticipates that each bay would support up to 15 NGL condensate trucks (11,600 gallons each) per day.

Tanker trucks carrying LNG or condensate from the LNG Terminal would use the paved public road routes in the vicinity of the LNG Terminal, including SH-48, SH-550, and SH-802; Interstate Highways 69E, 2, 69C, 281, 77, 83, and 37; and Mexico 101. The DOT would require that tanker trucks comply with requirements for transporting hazardous materials.

1.4.2 Electric Transmission Line and Switchyard for the LNG Terminal

Operational power supply would be provided by an expansion of the local AEP power grid, which is being proposed to service the new Port of Brownsville developments. The new 138-kilovolt (kV) power line, which would be constructed and operated by AEP, would be approximately 8 miles in length and collocated with SH-48 for as much of the route as possible. Although the final routing of this power line has not been determined, the currently considered route crosses wetlands, waterbodies, and an FWS easement (wildlife crossing area). AEP would also construct, own, and operate two new switchyards, about 500-foot by 500-foot each, at either end of the new line to better provide reliability to the electric grid. The new switchyard within the LNG Terminal boundary would connect the LNG Terminal to the power lines via underground cables. RG LNG anticipates that permanent power would be available to the LNG Terminal beginning in 2019. Back-up power would be provided via six 2,275-megawatt diesel generators that would only be used during emergency scenarios where supplied power from the power grid is lost.

A new low voltage (12.5-kV) temporary power line, installed and operated by AEP, would be the main source of power during construction. The temporary power line would connect the Rio Grande LNG Terminal to an existing substation in Port Isabel (about 4 miles away), and would be located within the Texas Department of Transportation (TxDOT) right-of-way south of SH-48. The power line is anticipated to have 303 wooden poles, which would impact about 0.5 acre of land. RG LNG anticipates that the temporary power lines would be operational in Year 1 of construction; prior to that, portable diesel engine-driven generators would be used. The portable generators would also be used in conjunction with the temporary power lines in more remote locations of the LNG Terminal site.

1.4.3 Potable Water Supply Header

Permanent potable water required during operation of the LNG Terminal would be supplied by the BND via a 16-inch-diameter water supply header that will be constructed for incremental water supply for future Port of Brownsville users. The BND has plans to construct the water supply header in a proposed utility corridor adjacent to SH-48 so that existing and future customers could have access to freshwater from the municipal supplies in the Port of Brownsville. The LNG Terminal would tie directly into the BND's water supply header, and a system of piping within the LNG Terminal would deliver freshwater into the demineralized water system as well as to the various facilities requiring it for drinking water and to supply utility hoses and safety showers. RG LNG estimates that the LNG Terminal would require about 84.7 gallons per minute (gpm) (121,968 gallons per day) of freshwater, most of which would be used in the demineralized water system (72.5 gpm or 104,400 gallons per day). The BND and Brownsville Public Utilities Board have verified that the municipal system and proposed water supply header have sufficient capacity to service the Rio Grande LNG Terminal as well as the municipality's existing customers.

The BND anticipates that the water supply header would not be available for tie-in until construction has commenced mid-way through Year 1; prior to that, freshwater would be purchased from the BND, loaded onto RG LNG trucks at the bulk water loading area (see section 2.1.1.7), and delivered to the LNG Terminal.

1.4.4 Pumped Sewage Pipeline from the LNG Terminal

The BND proposes to construct a 12-inch-diameter pumped sewage collection header adjacent to its water supply header that, when complete, would transport sewage and wastewater generated by the terminal to an existing sewage treatment plant approximately 4.5 miles west of the LNG Terminal. Prior to construction of the pumped sewage collection header, RG LNG would pump sewage from its internal sewage system into trucks and have it delivered to the sewage treatment plant.

1.4.5 Utility Connections for the Pipeline Facilities

RB Pipeline has identified the need for standard utility connections at the compressor and booster stations, including electrical power, sewage lines, and freshwater supply lines. Although the routing of these utility lines is not currently known, RB Pipeline has begun coordinating with the local utilities to determine the placement, impacts, and permitting required for utility installation, and will provide additional information as it becomes available.

1.4.6 Modifications to State Highway 48

The TxDOT is currently planning to update portions of SH-48 along the Rio Grande LNG Terminal site to accommodate access. Modifications were identified during RG LNG's coordination with TxDOT and include the addition of land for acceleration, deceleration, and turning, as well as traffic lights. RG LNG anticipated that construction would begin in 2018 and the modifications were expected to be completed in 2019. While some modifications to SH-48 are documented by TxDOT as underway or beginning soon (texturizing the road shoulder), the additional land and installation of traffic lights that would support access to the Project site are not documented as ongoing (TxDOT 2018).

1.5 PERMITS, APPROVALS, AND REGULATORY REVIEWS

As the lead federal agency, the FERC is required to comply with Section 7 of the ESA, the MSFCMA, Section 106 of the NHPA, and Section 307 of the CZMA, EPAct 2005, and Sections 3 and 7 of the NGA. Each of these statutes has been taken into account in the preparation of this EIS (see table 1.5-1).

Table 1.5-1
Federal and State Agency Permits, Approvals, and Consultations Requirements for the Project

Agency	Permits, Approval, or Consultation	Status	
		Terminal	Pipeline
FEDERAL			
FERC	NGA - Section 3(a) - Authorization for construction and operation of liquefaction facility	Application filed on May 5, 2016.	Not applicable (NA)
	NGA - Section 7(c) – Certificate of Public Convenience and Necessity for construction and operation of the Pipeline System	NA	Application filed on May 5, 2016.
DOE	Authorization to export LNG by vessel to FTA and non-FTA nations	Application filed on December 23, 2015. FTA Authorization received on August 17, 2016. Non-FTA Authorization is pending.	NA
COE	Permit application pursuant to the CWA Section 404 / Rivers and Harbors Act - Section 10	Permit application and conceptual mitigation plan filed on July 27, 2016. Approved jurisdictional determination received March 6, 2018. Updated permit application filed on March 30, 2018. Under COE review.	Permit application for the Pipeline System CWA Section 10/404 filed on February 13, 2017. Updated permit application pending field surveys for re-routed areas of the pipeline alignment. Under COE review.
	Real Estate Permit application pursuant to the RHA - Section 14	Application filed on March 30, 2018.	Pending determination of need for easement crossings and review of pipeline alignment by the Real Estate Division of the COE.
Coast Guard	LOR as to the suitability of waterway for LNG marine transit	LOI submitted March 18, 2015. Follow-on WSA submitted on December 17, 2015. LOR issued December 26, 2017.	NA
DOT	49 CFR 192 Consultation (standards for natural gas pipelines) 49 CFR 193, Subpart B	Letter of Determination on Design Spill Methodology issued to FERC on November 29, 2016. Informal consultation is ongoing.	NA Informal consultation is ongoing.

Table 1.5-1 (continued)
Federal and State Agency Permits, Approvals, and Consultations Requirements for the Project

Agency	Permits, Approval, or Consultation	Status	
		Terminal	Pipeline
FEDERAL (continued)			
EPA	CWA Section 402 – NPDES - Hydrostatic Test Water Discharge Permit; Construction Waste Water Discharge Permit, and Operational Waste Water Discharge Permit	Permit application pending, anticipated submittal: one month after any FERC authorization.	Permit application pending, anticipated submittal: one month after any FERC Certificate.
FWS	ESA Section 7 Consultation Fish and Wildlife Coordination Act Consultation MBTA Consultation	Technical Assistance Request Submitted on March 27, 2015. Follow-up meetings on March 3 and December 2, 2016, and March 7, August 18, and November 7, 2017, for discussion of the Rio Grande LNG Project status, mitigation measures, and Section 7 consultation. Consultation is ongoing.	Technical Assistance Request Submitted on March 27, 2015. Follow-up meetings on March 3 and December 2, 2016, and March 7, August 18, and November 7, 2017, for discussion of the Rio Grande LNG Project status, mitigation measures, and Section 7 consultation. Consultation is ongoing.
International Boundaries and Water Commission	Consultation regarding the crossing of waterbodies regulated by the IBCW	NA	Consultation is pending.
NMFS	ESA Section 7 Consultation MMPA Section 101(a)(5) - Consultation, in conjunction with FWS, for potential impacts on federally protected marine mammals FWCA Consultation MSFCMA Consultation	Technical assistance request Submitted on March 27, 2015. Follow-up meetings in January, March, and July 2017, and February 2018. Consultation is ongoing.	Technical assistance request Submitted on March 27, 2015. Follow-up meetings in January, March, and July 2017, and February 2018. Consultation is ongoing.
NPS	Consultation on potential impacts on cultural resources and pursuant to Section 106 of the NHPA	Initial agency consultation meeting on February 5, 2016. Consultation is ongoing.	Initial agency consultation meeting on February 5, 2016. Consultation is ongoing.

Table 1.5-1 (continued)
Federal and State Agency Permits, Approvals, and Consultations Requirements for the Project

Agency	Permits, Approval, or Consultation	Status	
		Terminal	Pipeline
FEDERAL (continued)			
FAA	FAA Determination of Hazard or Determination of No Hazard pursuant to 14 CFR 77	Notice of Proposed Construction or Alteration (FAA Form 7460-1) is pending submittal. FAA determination provided for temporary construction cranes[a].	NA
STATE			
Texas Commission on Environmental Quality	CAA; New Source Review - Prevention of Significant Deterioration (PSD) permits, and Title V Operating Permit; Temporary Water Use Permit; Title 2, Texas Water Code - Section 11.138	PSD Permit (Construction) application filed on May 12, 2016; Revision 1 filed on November 30, 2016, Revision 2 filed on March 22, 2017; Final Air Quality Modeling Analysis Report filed January, 2018; consultation ongoing. Anticipated Temporary Water Use Permit Application submittal: 1st Quarter 2018.	Standard Permit and Permit by Rule application for Compressor Station 3 filed on May 12, 2016; approval received September 30, 2016. Standard Permit applications for Compressor Stations 1 and 2 filed March 24, 2017; approval is pending. Permit By Rule applications for Interconnect Booster Stations 1 and 2 filed March 24, 2017; approvals received June 9 and June 7, 2017, respectively. Title 2, Texas Water code - Section 11.138 -Temporary Water Use Permit - anticipated permit application submittal: one month after any FERC Certificate. Title 2, Texas Water code - Section 11.138 Temporary Water Use Permit - anticipated permit application submittal: one month after any FERC Certificate.
Texas Historical Commission – State Historic Preservation Office (SHPO)	Letter of approval on assessment and protection of historic properties pursuant to Section 106 of the NHPA; Title 9, Texas Natural Resources Code- Chapter 191 "Antiquities Code of Texas"	Phase I cultural survey report submitted on May 8, 2015; SHPO concurred with the findings on May 15, 2015. Phase I cultural survey for offsite facilities associated with the LNG Terminal submitted in October, 2016; SHPO concurred with the findings on December 1, 2016. Approval of the Project Unanticipated Discovery Plan received on November 10, 2016. Concurrence with the viewshed and noise assessments on potential impacts to the Palo Alto and Palmito Ranch Battlefields on March 19, 2018.	Approval of the Project Unanticipated Discovery Plan received on November 10, 2016. Phase I cultural survey report submitted on May 16, 2016, and revised in June 2016; SHPO concurred with the findings on September 6, 2016. Phase I cultural survey report addendum submitted in October 2016; SHPO concurred with the findings on November 30, 2016. Additional survey report(s) and consultation pending grant of landowner survey access.

Table 1.5-1 (continued)
Federal and State Agency Permits, Approvals, and Consultations Requirements for the Project

Agency	Permits, Approval, or Consultation	Status	
		Terminal	Pipeline
STATE (continued)			
TxDOT	Form 1058, Permit to Construct Access Driveway Facilities on Highway Right of Way pursuant to Texas Administrative Code, Part 1, Chapter 11, Subchapter C: Access Connections to State Highways Rule 11.56: delegation of Access Permit Authority to Municipalities of Eligible Counties	Anticipated permit application submittal: one month after any FERC Authorization.	Anticipated permit application submittal: one month after any FERC Certificate.
TPWD	Consultation pursuant to Title 5, TPWD Code- Chapters 67, 68, and 88 and Title 31, Texas Administrative Code - Section 65	Technical assistance request submitted on March 27, 2015. Follow-up meetings in December 2016 and March, May, and November 2017. Consultation is ongoing.	Technical assistance request submitted on March 27, 2015. Follow-up meetings in December 2016 and March and May 2017. Consultation is ongoing.
Railroad Commission of Texas	CZMA Section 407 - Coastal Use Permit Coastal Zone Management Consistency Determination.	Consistency Determination filed on July 27, 2016 as part of the COE Permit application and revised on March 6, 2017 and March 30, 2018; under review.	Consistency Determination filed on July 27, 2016, as part of the COE Permit application; revised on March 6, 2017; under review.
	CWA Section 401 - Water Quality Certification Title 16, Texas Administrative Code- Section 3.93.	Anticipated Water Quality Certification submitted on July 27, 2016 as part of the COE Permit Application; under review.	Submittal of Water Quality Certification is pending; anticipated one month after any FERC Certificate.
	Title 2, Texas Water Code - Section 26.131 - Hydrostatic Discharge Permit	Anticipated Hydrostatic Discharge Permit application submittal: one month after any FERC authorization.	Anticipated permit application submittal: one month after any FERC authorization.
	Title 2, Texas Water Code- Section 26.131(b) - Operations Discharge and Surface Water Management Permit	Anticipated Operations Discharge and Surface Water Management Permit application submittal: one month after any FERC authorization.	Anticipated permit application submittal: one month after any FERC authorization.
	Title 16, Texas Administrative Code - Section 8.115 - New Construction Commencement Report Permit	Anticipated permit application submittal: 1st Quarter 2019.	Anticipated permit application submittal: one month after any FERC authorization.

[a] As detailed in Section 4.12.1, an additional FAA determination may be required for LNG carriers.

Table 1.5-1, above, lists the major federal and state permits, approvals, and consultations identified for the construction and operation of the Project. Table 1.5-1 also identifies when RG Developers commenced or anticipate commencing formal permit and consultation procedures. The RG Developers are responsible for all permits and approvals required to implement the Rio Grande LNG Project, regardless of whether they appear in the table. FERC encourages cooperation between applicants and state and local authorities; however, state and local agencies, through the application of state and local laws, may not prohibit or unreasonably delay the construction or operation of facilities approved by FERC. Any state or local permits issued with respect to jurisdictional facilities must be consistent with the conditions of any authorization the Commission may issue.[9]

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)). To comply with Section 7, the FERC is required to determine whether any federally listed or proposed threatened or endangered species or their designated critical habitat occur in the vicinity of the proposed Project and conduct consultations with the FWS and/or NMFS, if necessary. If, upon review of existing data or data provided by RG Developers, the FERC determines that these species or habitats may be affected by the Project, the FERC is required to prepare a biological assessment (BA) to identify the nature and extent of adverse impact, and to recommend measures that would avoid the habitat and/or species, or would reduce potential impact to acceptable levels. Section 4.7 provides information on the status of this review.

The 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 Section 305(b)(2)). Although absolute criteria have not been established for conducting EFH consultations, NMFS recommends consolidating EFH consultations with interagency coordination procedures required by other statues, such as NEPA, the Fish and Wildlife Coordination Act (FWCA), or the ESA (50 CFR 600.920(e)), to reduce duplication and improve efficiency. As part of this consultation process, the FERC staff prepared an EFH Assessment. This assessment and the status of the EFH consultation are provided in section 4.6 of this EIS.

Section 106 of the NHPA requires that the FERC take into account the effects of its undertakings on properties listed, or eligible for listing, in the National Register of Historic Places (NRHP), including prehistoric or historic sites, districts, buildings, structures, objects, or properties of traditional religious or cultural importance, and to afford the Advisory Council on

---

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

Historic Preservation (ACHP) an opportunity to comment. The RG Developers, as non-federal parties, are assisting the FERC in meeting its obligations under Section 106 by preparing the necessary information, analyses, and recommendations under the ACHP's regulations in 36 CFR 800, including Section 800.10 (Special requirements for protecting National Historic Landmarks). The status of cultural resources surveys and Section 106 consultation is provided in section 4.10.

EPAct 2005 and Section 3 of the NGA require us to consult with the U.S. Department of Defense to determine if there would be any impacts associated with the Rio Grande LNG Project on military training or activities on any military installations. We issued a letter to the U.S. Department of Defense on February 12, 2016; on June 4, 2018, a response was received indicating that the Project would have minimal impact on military training and operations in the area.

Besides the FERC, other federal agencies have responsibilities for issuing permits or approvals to comply with various federal laws and regulations. The Coast Guard exercises regulatory authority over the suitability of the Project Waterway for LNG marine traffic. As required by its regulations, the Coast Guard is responsible for issuing an LOR as to the suitability of the waterway for LNG marine traffic. The Coast Guard issued its LOR on December 26, 2017. Impacts on vessel traffic are summarized in section 4.9.8.2 of this EIS.

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 dredging and/or filling waters of the United States. Before an individual Section 404 permit can be issued, the CWA requires completion of a Section 404(b)(1) guideline analysis. The RG Developers submitted the Section 401/404 application to the COE for the LNG Terminal on July 27, 2016 and for the Pipeline System on February 14, 2017; revised permits are anticipated to be submitted in early 2018 to account for Project changes. The FERC, in the NEPA review represented by this EIS, has analyzed all technical issues required for the Section 404(b)(1) guideline analyses, including analysis of natural resources and cultural resources that would be affected by the Project, as well as analyses of alternatives. The results of our analysis of alternatives are provided in section 3.0 of this EIS; a summary of impacts on surface waters and wetlands are provided in sections 4.3.2.2 and 4.4.2, respectively, of this EIS.

In addition to CWA responsibilities, the COE has jurisdiction over Sections 10 and 14 of the RHA. Section 10 requires authorization for excavation, fill, or modification within or beneath navigable waterways. The RG Developers' Section 10 applications for the LNG Terminal and Pipeline System were filed concurrently with their Section 401/404 applications. Impacts on Section 10 waterbodies are summarized in section 4.3.2.2 of this EIS. The need for authorization under Section 14, which authorizes the review of requests that could modify COE civil works projects will be determined upon further review by the COE.

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. For oil and gas projects, the Texas CZMA is administered by the Railroad Commission of Texas (RRC) through the Texas Coastal Management Program (CZMP). Activities or development affecting land within Texas' coastal zone are evaluated by the RRC for compliance with the CZMA through a process called "federal consistency." The LNG Terminal and the majority of pipeline facilities from MP 69.8 to the LNG Terminal would be located within the designated coastal zone. The RG Developers have requested a CZMA determination for the Project as part of the COE Section 10/404 permitting process, and submitted a revised application for determination of consistency with the Texas CZMP to the COE and RRC on March 6, 2017; provision of a subsequent revision occurred in early 2018 and is under review. Therefore, we have recommended in section 4.8.3 that RG Developers file the final determination from the RRC with the FERC prior to construction.

The CAA was enacted by the U.S. Congress to protect the health and welfare of the public from the adverse effects of air pollution. The CAA is the basic federal statute governing air pollution. Federal and state air quality regulations established as a result of the CAA include, but are not limited to, Title V operating permit requirements and PSD Review. The EPA is the federal agency responsible for regulating stationary sources of air pollutant emissions; however, the federal permitting process has been delegated to the Texas Commission on Environmental Quality (TCEQ) in Texas. The RG Developers submitted their PSD permit application along with an Air Dispersion Modeling Protocol and Results for the LNG Terminal and Compressor Station 3 to the TCEQ on May 12, 2016; revised applications were submitted on November 30, 2016, and March 21, 2017. The RG Developers plan to submit the Title V permit application for the LNG Terminal and Compressor Station 3 prior to beginning construction. Compressor Stations 1 and 2 and the booster stations would all require minor source permits, which RB Pipeline submitted to the TCEQ on March 24, 2017, and Title V operating permits which would be submitted prior to commencing operations. Air quality impacts that could occur as a result of construction and operation of the Project are evaluated in section 4.11.1.3 of this EIS.

The proposed Project must comply with Sections 401, 402, and 404 of the CWA. Water quality certification (Section 401) has been delegated to the state agencies, with review by the EPA. Water used for hydrostatic testing that is point-source discharged into waterbodies would require a NPDES permit (Section 402), which would be issued by the TCEQ. Potential impacts on water quality as a result of construction and operation of the Project are discussed in section 4.3.2.2 of this EIS.

2.0 PROPOSED ACTION

2.1 PROPOSED FACILITIES

The Rio Grande LNG Project consists of an LNG Terminal and pipeline facilities located in south Texas. A description of these facilities is provided below:

- LNG Terminal: Construction and operation of various LNG, LNG distribution, and appurtenant facilities within the boundaries of the site leased by RG LNG along the BSC in Cameron County. Components of the Rio Grande LNG Terminal (LNG Terminal) would include:
    - RG LNG's facilities to treat and liquefy natural gas, store LNG, and load LNG onto LNG carriers and trucks for export and domestic distribution, respectively:
        - liquefaction trains;
        - storage tanks;
        - docking facilities and turning basin;
        - truck loading and unloading facilities;
        - administration buildings and parking;
        - operation and safety requirements (security fencing, fire suppression, storm water management structures, spill containment structures); and
        - ground flares.
    - utilities (water, sewage, electricity, plant air, nitrogen); and
    - RB Pipeline's Compressor Station 3 (RB Pipeline's Gas Gate Station), a metering site, and the interconnection to the RB Pipeline System.
- Pipeline Facilities: Construction of new pipeline facilities to transport natural gas from sources of existing supply to the LNG Terminal. Components of RB Pipeline's facilities include:
    - the Pipeline System, including:
        - 2.4 miles of 42-inch-diameter pipeline, including 0.8 mile of dual pipeline, to gather gas from existing systems in Kleberg and Jim Wells Counties (referred to as the Header System); and
        - 135.5 miles of parallel 42-inch-diameter pipelines originating in Kleberg County and terminating at the Rio Grande LNG Terminal in Cameron County (referred to as Pipelines 1 and 2).

- the aboveground pipeline facilities, including:
  - four stand-alone metering sites along the Header System;
  - two new compressor stations in Kleberg County (Compressor Station 1, which includes a metering site) and Kenedy County (Compressor Station 2);
  - two new interconnect booster compressor stations in Kenedy County, each with a metering site; and
  - appurtenant facilities along the Pipeline System.

Figure 1-1 in section 1.0 provides the general location of the Rio Grande LNG Project.

2.1.1 LNG Terminal

The LNG Terminal would be located on 750.4 acres of a 984.2-acre parcel of land along the northern shore of the BSC in Cameron County, approximately 9.8 miles east of Brownsville and about 2.2 miles southwest of Port Isabel (see figure 2.1.1-1). RG LNG would lease the site from the BND for a term of up to 50 years.

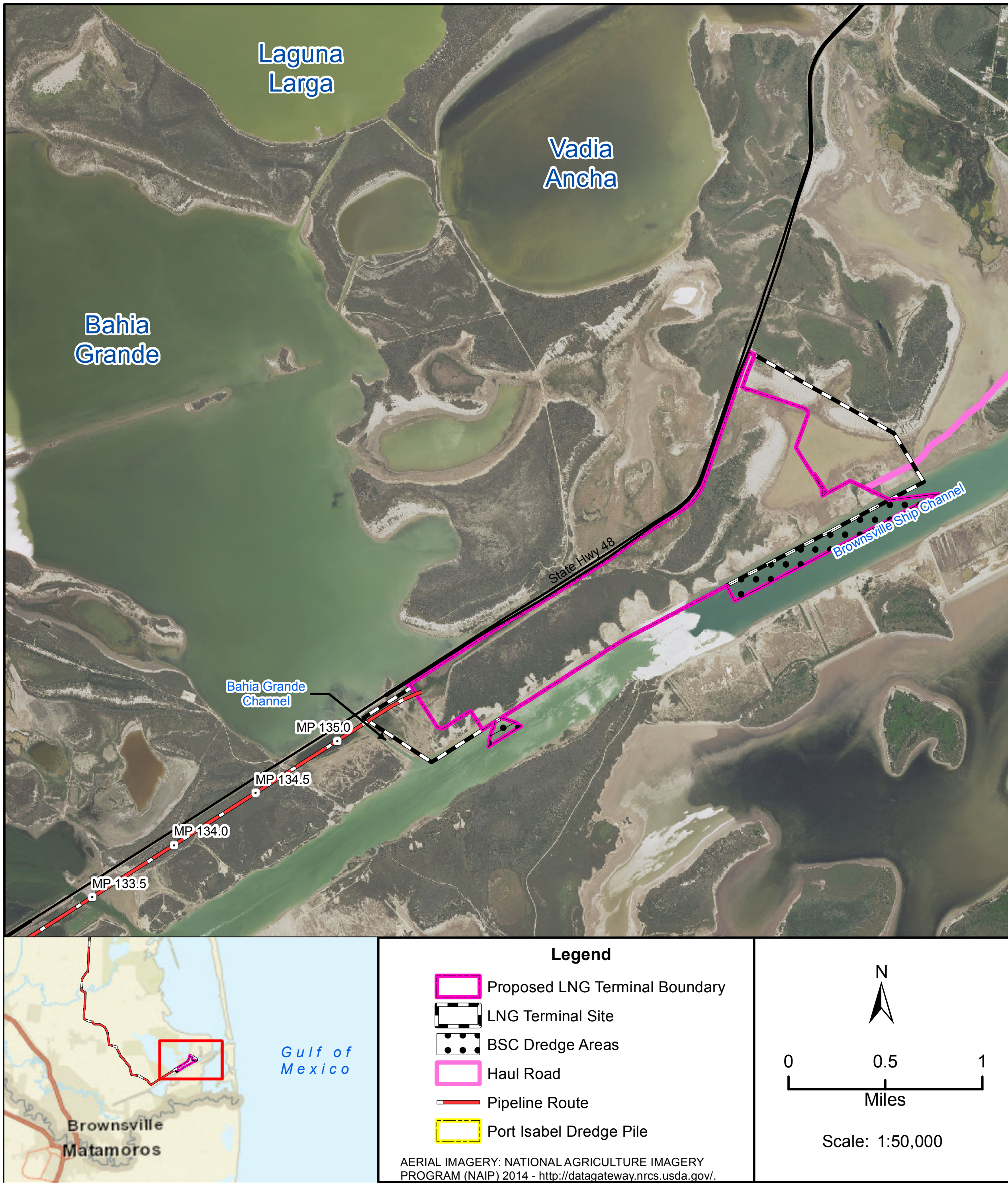
The LNG Terminal would receive natural gas via RB Pipeline's proposed Pipeline System, which would connect the LNG Terminal to the existing infrastructure near the Agua Dulce hub in Nueces County. The Pipeline System would terminate at RB Pipeline's Compressor Station 3, which would be within the boundaries of the LNG Terminal. Upon custody transfer of the natural gas to RG LNG, it would be treated, liquefied, and stored onsite in four, full-containment LNG storage tanks.

The LNG would be loaded onto either LNG carriers for export overseas, or onto LNG trucks for distribution to vehicle refueling stations in south Texas. Additional information regarding the LNG Terminal components is provided below; major components of the LNG Terminal are depicted in figure 2.1.1-2.

2.1.1.1 RB Pipeline Gas Gate Station

RB Pipeline would construct and operate the Gas Gate Station within the boundary of the LNG Terminal. The Gas Gate Station would include Compressor Station 3, which would facilitate the transportation of up to 4.5 Bcf/d of natural gas (feed gas) from RB Pipeline's proposed Pipeline System to the LNG Terminal. Compressor Station 3 would raise the operating pressure of the Pipeline System to about 1,200 pounds per square inch (psi), at which point the natural gas would pass into RG LNG's control through a custody transfer meter (Metering Site 4).

As described above, although the Gas Gate Station would be within the LNG Terminal, it would be owned and operated by RB Pipeline. As such, the Gas Gate Station would be surrounded by a security perimeter fence with gated access to segregate it from the rest of the LNG Terminal facilities.

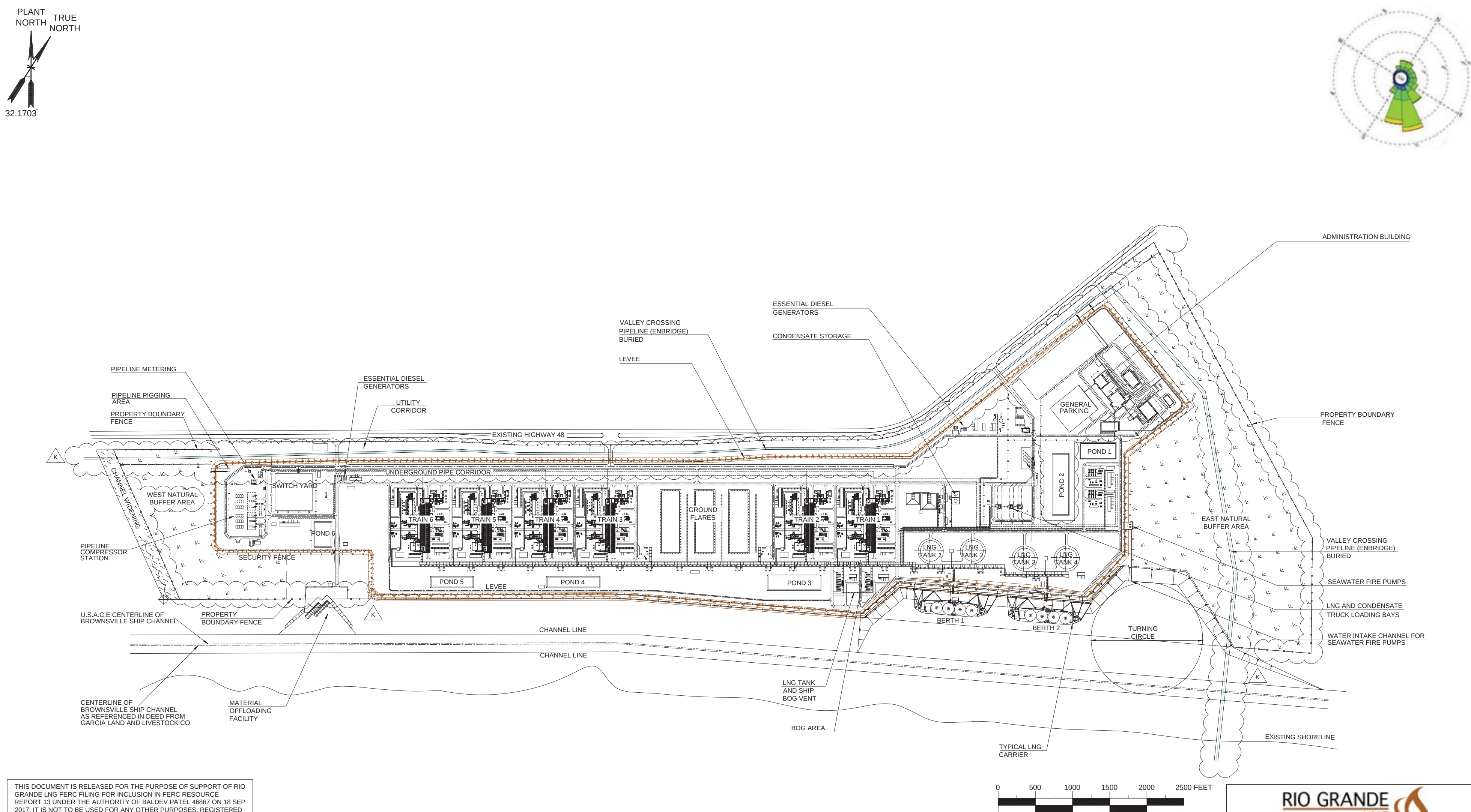


AERIAL IMAGERY: NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP) 2014 - http://datagateway.nrcs.usda.gov/.

Rio Grande LNG Project

Rio Grande LNG Terminal Site

Figure 2.1.1-1



THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF SUPPORT OF RIO GRANDE LNG FERC FILING FOR INCLUSION IN FERC RESOURCE REPORT 13 UNDER THE AUTHORITY OF BALDEV PATEL 46867 ON 18 SEP 2017. IT IS NOT TO BE USED FOR ANY OTHER PURPOSES. REGISTERED BRANCH OFFICE: CB&I UK LIMITED REGISTRATION NUMBER: F-10296

RIO GRANDE LNG

PROJECT NO: 195910

Rio Grande LNG Project

LNG Terminal Plot Plan

Figure 2.1.1-2

2.1.1.2 LNG Trains

Six LNG trains would be constructed and operated at the Rio Grande LNG Terminal, each of which would have a nominal capacity of 4.5 MTPA, resulting in the LNG Terminal's nominal capacity of 27.0 MTPA. Feed gas would be piped from the Gas Gate Station to the LNG trains where it would be pre-treated and cooled into a liquid. Each liquefaction train would include a dedicated pre-treatment unit.

Gas Pre-treatment

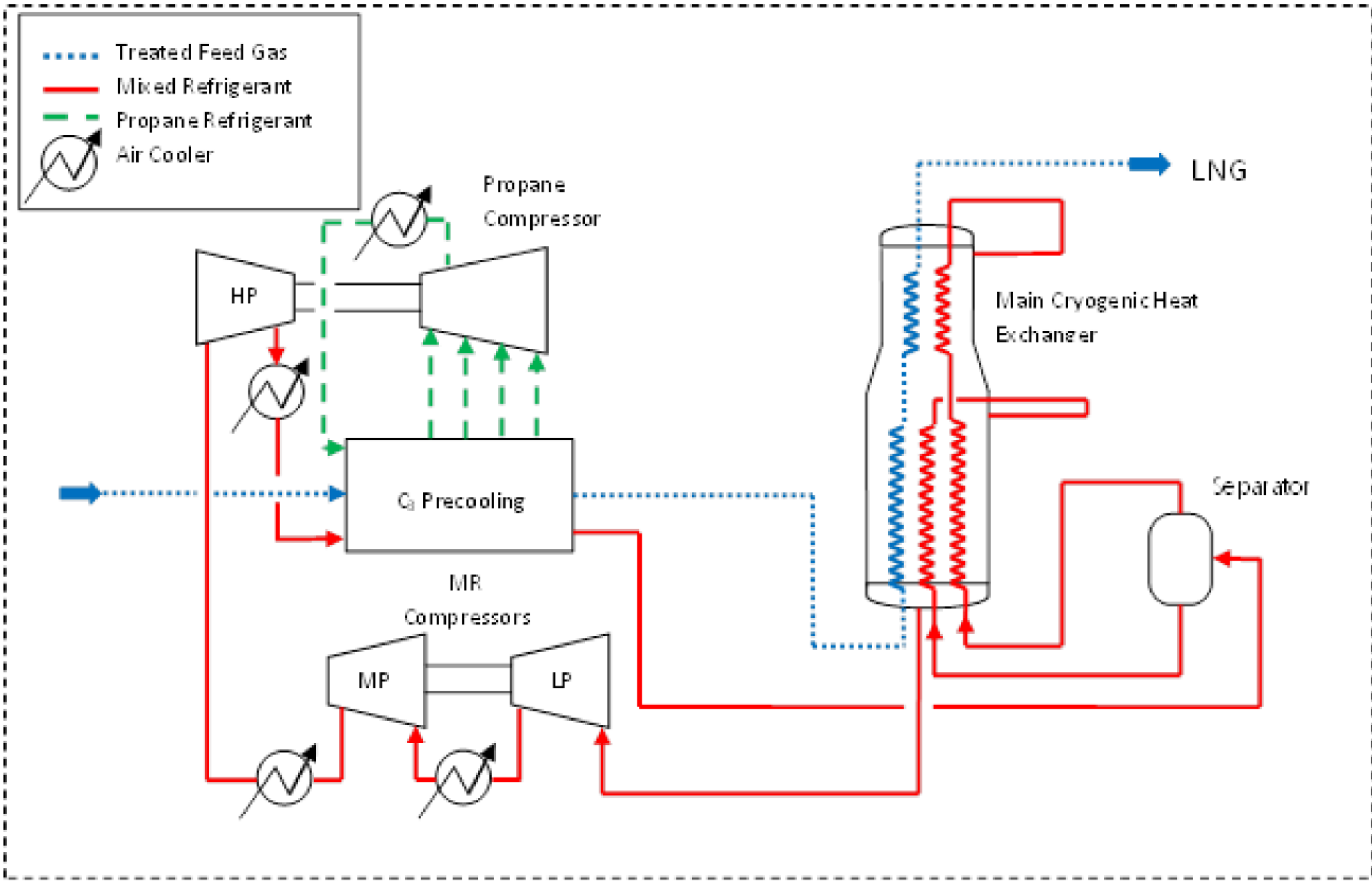
Prior to liquefaction, feed gas entering the LNG Terminal would be pre-treated to remove components that could freeze out and clog the liquefaction equipment or would otherwise be incompatible with the liquefaction process or equipment. Pre-treatment is a four-step process that includes acid gas removal, water removal (dehydration), mercury removal, and NGL removal.

The inlet feed gas would be routed to the acid gas removal unit where a hydrogen sulfide (H_2S) scavenger vessel absorbs most of the H_2S in the feed gas stream. The H_2S scavenger vessel would reduce the H_2S concentration to less than 0.4 parts per million (ppm) by volume. This is required to reduce sulfur dioxide (SO_2) emissions. The feed gas is then filtered to remove residual dust coming from the H_2S scavenger units and flows to the amine-based acid gas removal unit to lower carbon dioxide (CO_2) and trace amounts of H_2S to accepted industry standards (less than 50 ppm of CO_2 and less than 0.4 ppm of H_2S). The separated CO_2 and H_2S (acid gas) as well as trace amounts of hydrocarbons would be routed to the thermal oxidizer before venting to the atmosphere (air emissions associated with operation of the LNG Terminal are discussed in section 4.11.1). The water-saturated gas exiting the acid gas removal unit would be cooled to condense a portion of the water before routing the partially dried natural gas through molecular sieve bed dryers to remove the remaining water; the condensed water would be recycled to the acid gas removal unit.

Once dehydrated, the natural gas would pass through a mercury removal unit, which uses a sulfur impregnated activated carbon absorbent to remove trace mercury that could corrode any aluminum components in the liquefaction process. In the last step of pre-treatment, heavy hydrocarbons that would freeze during the liquefaction process are condensed out of the natural gas by the NGL extraction unit. This condensate would be transferred to the onsite truck-loading facility for transport to local markets in Texas and surrounding states.

Liquefaction and Boil-off Gas

Following pre-treatment, the natural gas would be condensed into a liquid by cooling it to –260 degrees Fahrenheit (°F) via the Air Products and Chemicals, Inc. liquefaction process (C3MR™). A schematic of the liquefaction process is shown in figure 2.1.1-3. The liquefaction process would use two refrigerant cycles. In the first cycle, a closed-loop propane refrigerant system would pre-cool treated feed gas and mixed refrigerant. The pre-cooled feed gas would enter the main cryogenic heat exchanger where it would be condensed and sub-cooled. Low temperature refrigeration would be provided by the second cycle, a closed-loop mixed refrigerant system, composed of nitrogen, methane, ethylene or ethane, and propane.



Rio Grande LNG Project

Schematic of C3MR™ Process

Figure 2.1.1-3

LNG exiting the main cryogenic heat exchanger would then be let down in pressure using valves, and would be routed and flashed into the LNG storage tanks. The flash gas produced in the LNG storage tanks would be routed to the boil-off gas (BOG) compressor system, where it would be compressed and be sent to the fuel gas system. The refrigerant compressors in each liquefaction train would be driven by two natural gas-fired turbines. During start-up, fuel gas would be provided by feed gas to each train. During liquefaction operation, fuel gas for the gas turbines would be provided by flash gas and BOG produced within the LNG storage tanks. Eight BOG compressors would be needed to serve all six liquefaction trains and to control boil off generated during LNG carrier loading operations.

2.1.1.3 LNG Storage Tanks

Four LNG storage tanks, each with a net capacity of 180,000 m^3, would store the LNG produced by the six LNG trains. The full-containment LNG storage tanks must be designed to meet the requirements of 49 CFR 193 and NFPA 59A. Additionally, the storage tanks would be constructed to the regulations of American Petroleum Institute (API) Code 625, and other applicable standards.

Each LNG storage tank would have the following features:

- an inner wall (primary containment) composed of low-temperature 9-percent nickel steel;
- an outer wall (secondary containment) composed of reinforced post-tensioned concrete with a steel liner as a vapor barrier;
- a reinforced concrete domed roof, supporting an insulated deck, LNG and vapor pipework, and pipe columns and nozzles;
- thermal insulation systems:
  - foam-glass layers under the inner tank with bottom/corner protection,
  - resilient blanket with perlite fill of the annular space between inner and outer tank walls, and
  - thermal insulation (blankets) on the suspended deck;
- submerged motor in-tank pumps and supported by a structure attached to the roof and walls;
- a foundation heating system;
- pressure, level, and temperature instrumentation, including monitoring of tank cool-down;
- pressure and vacuum relief systems;

- nozzles and internal pipework, including cool-down spray;
- roof platforms and walkways; and
- external stairways, ladders, and pipe supports.

The LNG storage tanks would be designed and constructed so that the self-supporting 9-percent nickel steel primary containment and the concrete secondary containment would be capable of independently containing the LNG. The 9-percent nickel steel primary containment would contain the LNG under normal operating conditions. The concrete secondary containment would be capable of containing 110 percent of the capacity of the inner tank. All piping and equipment connections would be through each LNG storage tank roof to minimize the potential for leaks during an unanticipated auxiliary failure. A site plot plan showing the location of the proposed LNG storage tanks in relation to other Project facilities is shown on figure 2.1.1-2; a diagram of the LNG storage tanks is depicted on figure 2.1.1-4.

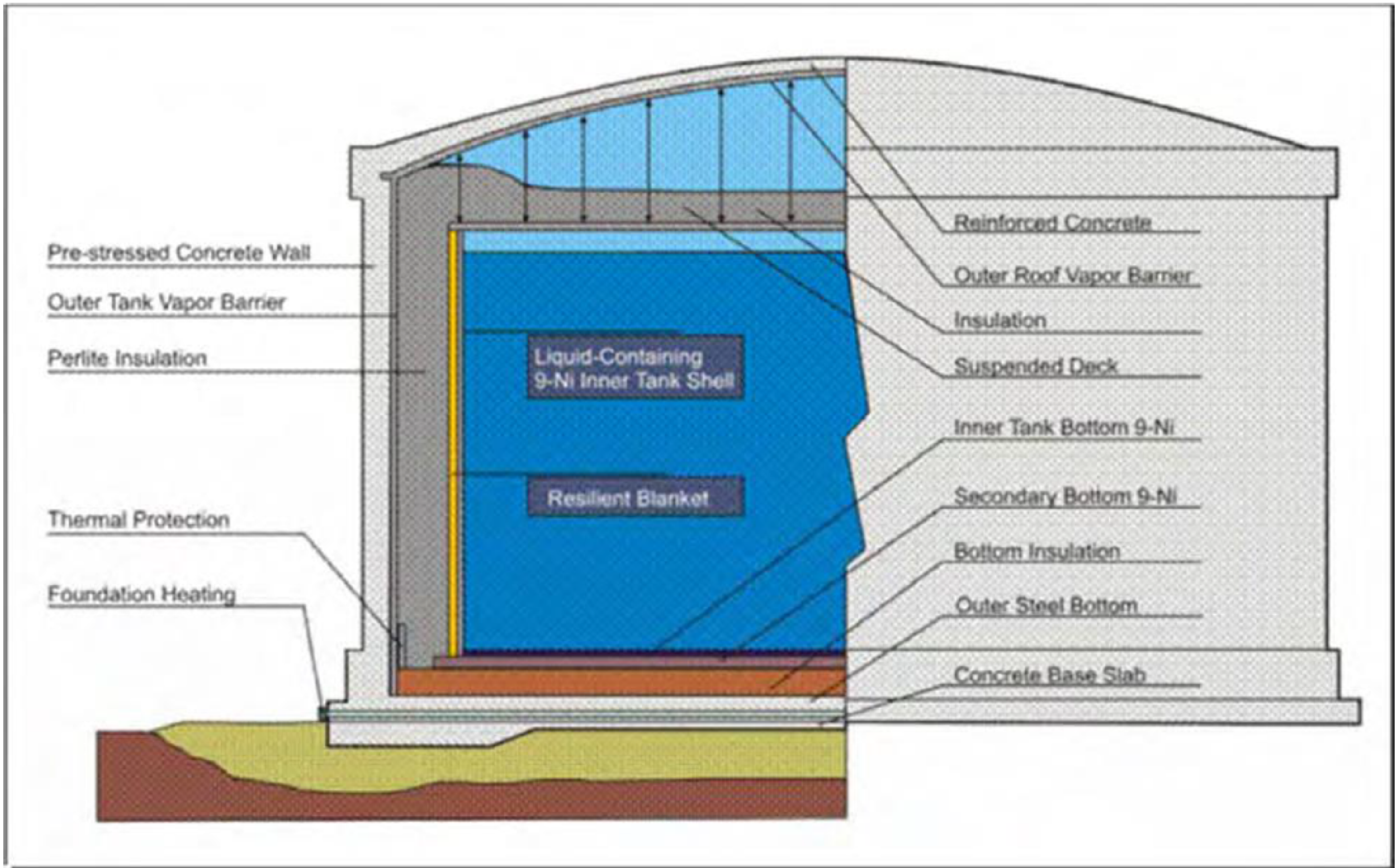
2.1.1.4 Marine Facilities

LNG Loading and Ship Berthing Area

Two LNG carrier loading berths would be constructed along the south-central boundary of the LNG Terminal that would accommodate simultaneous loading of two LNG carriers (see figure 2.1.1-5). The berths would be recessed into the LNG Terminal property so that loading LNG carriers, separated by 250 feet, would not encroach on the navigable channel boundaries of the BSC. Construction of the loading berths would require dredging to a depth of up to -45 feet mean lower low water (MLLW) (-43 feet plus -2 feet of overdepth).

Each berth would consist of a reinforced concrete loading platform with an LNG spill containment system, LNG piping, and safety and electrical systems, which would be connected to the shore via a trestle wide enough to support a personnel walkway, a 15-foot-wide roadway, and space for auxiliary systems and LNG piping. The loading platform would be designed such that equipment is at least one foot above the predicted 500-year storm surge (see section 4.12.1) LNG carriers would dock at the loading platform using three bow and three stern mooring dolphins, which would be connected to the loading platform via personnel catwalks. Each berth would also have four breasting dolphins, offset from the loading platform, designed to withstand impacts from wind, currents, and carrier berthing impacts. The loading platform, trestle, and mooring and breasting dolphins would be supported by steel or concrete piles.

RG LNG anticipates that the LNG Terminal would receive one LNG carrier per LNG train, per week, with capacities between 125,000 and 185,000 m^3. At full build-out, this would equate to six LNG carriers calling at the LNG Terminal per week (about 312 carriers per year, or as allowed by the Coast Guard). During loading operations, LNG would be transferred from the storage tanks to the loading platforms using a 36-inch-diameter loading header line and 24-inch-diameter loading lines.



Rio Grande LNG Project

Typical LNG Tank Components

Figure 2.1.1-4

Rio Grande LNG Project

Rio Grande LNG Terminal Rendering

Figure 2.1.1-5

Four marine loading arms, each 20 inches in diameter, would transfer product to and from the LNG carriers, including two dedicated LNG loading arms, one vapor return arm, and one hybrid arm that could be used for LNG loading or vapor return, as needed. Each loading arm would be equipped with emergency release couplers and triple swivel joints. The maximum loading rate for one LNG carrier would be 12,000 cubic meters per hour (m^3/hr); during simultaneous loading of two LNG carriers, the aggregate loading rate would be 18,000 m^3/hr.

Turning Basin

A 1,500-foot-diameter turning basin would be constructed to the east of the LNG carrier loading berths to accommodate turning maneuvers of the LNG carriers calling on the LNG Terminal. LNG carriers would be escorted into the BSC and turning basin via tug boats, rotated in the turning basin, and then placed adjacent to a loading berth with the bow facing eastward. The turning basin would be partially recessed into the LNG Terminal site, but the area of the turning basin would encroach on the navigable channel of the BSC such that channel transit would be temporarily precluded until the LNG carriers were moored at the berth (see figure 2.1.1-2). As with the loading berths, the turning basin would be dredged to a depth of up to -45 feet; however, as the navigable channel is maintained at a depth of -45 feet, the portion of the turning basin overlapping the navigable channel would not require additional dredging.

Material Offloading Facility

RG LNG would construct a material offloading facility (MOF) along the western extent of the LNG Terminal site, adjacent to the BSC. The MOF would primarily be used during construction for marine delivery of bulk materials and larger or prefabricated equipment as an alternative to road transportation; however, it would be maintained for the life of the Project for periodic delivery of bulk materials. The MOF, which would require a dredged depth of up to -12 feet MLLW (-10 feet plus -2 feet of overdepth), would be constructed of a steel sheet pile bulkhead with a pile-supported relieving platform and would support both lift-on/lift-off and roll-on/roll-off transport. Fencing would be placed around the MOF to control access and to separate it from the adjacent wetlands on the west side of the LNG Terminal site; access would be through the western LNG Terminal entrance. The MOF would be capable of berthing two barges simultaneously. RG LNG anticipates that 880 barges would deliver materials to the MOF during the first 5 years of construction, although deliveries would continue as needed for the remainder of construction and into operations. Bulk materials delivered to the MOF would include the crushed sand or stone necessary for concrete fabrication. Equipment requiring transport via deeper-draft vessels would be delivered to the Port of Brownsville for road transport to the LNG Terminal site.

2.1.1.5 Truck Loading Area

The Rio Grande LNG Terminal would include truck-loading facilities that allow LNG and condensate products to be loaded and distributed to local markets, as well as truck-unloading facilities to receive the refrigerants used for liquefaction operations. Dedicated spill impoundment basins would be provided for all truck loading/offloading areas. The truck loading/unloading areas are depicted in figure 2.1.1-2 above. Information on the transit routes of these trucks is provided in section 1.4.1.

LNG Truck Loading

The LNG truck-loading area, which is depicted on figure 2.1.1-2 above, would include four loading bays, each with the capacity to load 12 to 15 trucks per day. The capacity of the LNG trucks would be about 13,000 gallons (49 m^3) with a loading rate of about 300 gpm (68 m^3/hr). As a result, LNG loading would take about 45 minutes, with an additional 15 minutes likely required for initializing and completing LNG transfer. Although the actual distribution of trucks would depend on market demand, RG LNG's current projections indicate that full use of these bays would result in the road distribution of 0.4 MTPA (less than 1.5 percent of the LNG Terminal's annual production).

Natural Gas Liquids Condensate Truck Loading

In addition to LNG, the NGL condensates recovered during the LNG liquefaction process would be loaded onto trucks for local distribution. Two loading bays would be constructed, each of which could load up to 15 trucks per day, sized at 11,600 gallons (44 m^3). The actual use of condensate trucks would depend on the amount of heavy hydrocarbons removed from the feed gas prior to liquefaction.

Refrigerant Truck Unloading

Two unloading bays, one for propane and one for liquid ethylene (or ethane), would be constructed near the respective refrigerant storage tanks. During normal operations, RG LNG anticipates six shipments of refrigerant every two months; propane would be delivered either by International Organization for Standardization (ISO) container or tanker truck while ethylene (or ethane) would be delivered by ISO container.

2.1.1.6 Pressure Relief and Flare System

The Rio Grande LNG Terminal would have both an elevated (100-foot) vent stack and three ground flare units to safely and reliably protect plant systems from overpressure during start-up, shutdown, plant upsets, and emergency conditions. Upset events that require flaring or depressurizing are not planned, and control systems are designed to prevent such events. Planned flaring is usually associated with system cool down and planned maintenance shutdown scenarios.

The vent stack would dispose of vapors from the LNG tanks and BOG system when necessary; BOG from the vessel would be transferred to shore and treated in the BOG handling system to avoid air emissions. The vent stack would have a pilot burner and an ignition system that could be used to burn off natural gas in upset or emergency conditions; however, the pilot light would not be lit under normal operations. Three ground flare units would be installed to safely depressurize the LNG trains during an emergency scenario. Two ground flare units would be required to depressurize the six LNG trains (three trains each); a third would be installed to maintain sufficient flare capacity and as a redundancy in case a ground flare unit needs to be shut down for maintenance or inspection. The ground flares would be up to 8 feet high and surrounding by a 67-foot-high wall for heat protection and to avoid visibility from outside the boundaries of the LNG Terminal.

2.1.1.7 Utilities and Support Facilities

Water Supply and Sewage Handling

Freshwater Supply

Potable water required during construction and operation of the LNG Terminal would be supplied by the BND via a 16-inch-diameter water pipeline that is planned for construction. The BND would construct this water supply header in a proposed utility corridor adjacent to SH-48 so that existing and future customers could have access to freshwater from the municipal supplies in the Port of Brownsville. The LNG Terminal would tie directly into the BND's water supply header, and a system of piping within the LNG Terminal would deliver freshwater into the demineralized water system, as well as to the various facilities requiring it for drinking water and to supply utility hoses and safety showers. Freshwater would also be used for the freshwater firewater tank, as discussed below. RG LNG estimates that the LNG Terminal would require about 84.7 gpm (121,968 gallons per day) of freshwater, most of which would be used in the demineralized water system (72.5 gpm or 104,400 gallons per day). Peak usage would be about 317.7 gpm (457,488 gallons per day).

The BND and the Brownsville Public Utilities Board have verified that the municipal system and proposed water supply header have sufficient capacity to service the Rio Grande LNG Terminal as well as the municipality's existing customers. The water supply header would likely not be available for tie-in until after construction of the LNG Terminal begins. Prior to its availability, potable water would be obtained from a BND fire hydrant at the temporary bulk water loading station, located about 4.5 miles west of the LNG Terminal site along SH-48. RG LNG would load tanker trucks at the metered hydrant and deliver the water to the LNG Terminal site.

Demineralized Water System

Makeup water required for acid gas removal within each LNG train would be supplied by the demineralized water system. In addition, demineralized water would be used for periodic water washing of gas turbine drives and as makeup to equipment in the water cooling systems. Water for the demineralized water system would be supplied by the BND freshwater supply header, and would be treated onsite.

Firewater Supply

The firewater system would be used in the event of a fire emergency to control and/or extinguish a fire at the site. Water for the firewater system would generally be supplied by a freshwater storage tank with a capacity of 519,098 gallons. The maximum firewater pump capacity, which would be 4,315 gpm would be sufficient to support 2 hours of maximum firewater demand. If the freshwater storage tank were depleted or unavailable, firewater would be obtained from the BSC via a short water intake channel that would be screened to protect aquatic resources.

Sewage Handling

The BND proposes to construct a 12-inch-diameter pumped sewage collection header adjacent to its water supply header that, when complete, would transport sewage and wastewater generated by the Rio Grande LNG Terminal to an existing sewage treatment plant approximately 5 miles west of the LNG Terminal. The final design of the BND's sewage collection header is under development. Prior to completion of the pumped sewage collection header, RG LNG would pump sewage from its internal sewage system into trucks and have it delivered to the sewage treatment plant.

Power Supply

Operational power supply would be provided by an expansion of the local AEP power grid, which is being proposed to service the new Port of Brownsville developments. The new power lines, which would be constructed and operated by AEP, would be located between the LNG Terminal and SH-48. AEP would also construct and operate a switchyard within the Rio Grande LNG Terminal boundaries that would connect the LNG Terminal to the power lines via underground cables. Back-up power would be provided via six 2,275-megawatt diesel generators, which would only be used during emergency scenarios where supplied power from the power grid is lost.

As the permanent power lines would likely not be available for tie-in until after construction has begun on the LNG Terminal, RG LNG would initially obtain power through a temporary power line and/or portable generators. The planned temporary power line, which would be installed and operated by AEP, would be the main source of power during construction, once available. The temporary power line would run about 4 miles from an existing substation in Port Isabel to the Rio Grande LNG Terminal. The power line would be located within the TxDOT right-of-way south of SH-48. RG LNG anticipates that the temporary power line would be completed shortly after construction of the LNG Terminal begins; prior to that, portable diesel engine-driven generators would be used. The portable generators would also be used in conjunction with the temporary power line in more remote locations of the LNG Terminal sites.

Communication

The Rio Grande LNG Terminal would have internal and external communications systems. The internal telecommunication system for the LNG Terminal would include:

- telephone exchange;
- radio system with two 66-foot-tall communication towers;
- computer network;
- plant telecommunications network;
- a telemetry system for data transfer to/from the Pipeline System;

- electronic mail system for communication; and
- a closed-circuit television system.

Communications with external entities, such as the local emergency services, would be via the phone switched telephone network. Marine band very-high-frequency radios would be provided for communication with the LNG vessels. Access to the LNG Terminal's control system would be provided to allow remote monitoring of LNG Terminal operation by approved applicable parties (e.g., LNG Terminal management, RG LNG head office, LNG customers, and RB Pipeline operators). The telecommunication systems would comply with applicable governmental rules and regulations.

Buildings and Access Roads

The LNG Terminal would include administration and central control buildings; a canteen, medical, and visitor building; a warehouse, workshop, and chemical shelter; garages; electrical equipment enclosures; and electrical substations. Temporary buildings would also be used during construction, but would be moved periodically to maintain a safe distance from operational LNG facilities as construction continues. Existing local roadways would be used to access the LNG Terminal during construction and operation, with direct access provided by SH-48. Because there are no existing roads within the LNG Terminal site, internal roads would be constructed within the site boundary.

In addition, RG LNG has proposed a new 1.8-mile-long temporary haul road to transport fill material from the nearby Port Isabel dredge pile; however, we have reviewed the justification for the temporary haul road's placement in wetlands and do not find construction of the temporary haul road as proposed to be an acceptable deviation from our 2013 *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) (see section 4.4.2.3). No new roads would be constructed for permanent access to the LNG Terminal or its temporary offsite facilities; however, modifications may be necessary along SH-48 to accommodate additional construction traffic and the three proposed entrances to the LNG Terminal site. Proposed road modifications are discussed further in section 4.9.

Facility Drainage and Containment

Drainage, containment, and treatment systems would be provided to ensure the proper disposal of effluents from process, service, and surface water streams, as well as domestic effluent from the LNG Terminal, in accordance with State requirements. No operational process waters would be discharged directly to surface waterbodies.

RG LNG would construct spill containment systems around the truck loading/unloading areas, chemical storage areas, LNG storage and loading areas, and LNG train area. These systems would utilize curbed areas, troughs, open drains, and impoundment basins to hold LNG, or other chemicals, as described in section 1.4.6.

RG LNG would implement its Stormwater Pollution Prevention Plan (SWPPP) during construction in accordance with the NPDES and applicable state discharge permits. During operation of the LNG Terminal, stormwater would be directed into six ponds for dilution and temperature adjustment to ambient before being discharged into the BSC. Where stormwater could be contaminated by spills or leaks of hazardous materials, such as near the LNG trains and truck loading areas, it would be directed through an oil water separator prior to discharging to the BSC. RG LNG will develop and provide an operational SWPPP for review and approval by the Director of the Office of Energy Projects (OEP); we have recommended that this plan, as well as a final SWPPP for construction activities at the LNG Terminal, be provided for review prior to construction (see section 4.2.2.1).

2.1.2 LNG Transport Vessels

2.1.2.1 LNG Carriers

RG LNG has submitted an application to the DOE seeking authorization to export to FTA and non-FTA nations (see discussion in section 1.2.4). Although LNG carriers and their operation are directly related to the use of the proposed LNG Terminal, they are not subject to the authorization under Section 3(a) of the NGA sought by RG LNG's application with the Commission. As previously discussed, the Coast Guard is the federal agency responsible for determining the suitability of the waterway for LNG marine traffic associated with Rio Grande LNG Project. As required by its regulations, the Coast Guard has completed its review of the WSA and issued a LOR on December 26, 2017, which indicated that the BSC is suitable for marine traffic related to the Project.

The ships that transport LNG are specially designed and constructed to carry LNG for long distances. LNG carrier construction is highly regulated and consists of a combination of conventional ship design and equipment, with specialized materials and systems designed to safely contain liquids stored at a temperature of –260 °F. Additional information on LNG carrier regulations and safety measures is presented in section 4.12.1.

2.1.2.2 LNG Trucks

As stated in section 1.4.1, LNG trucking activities that take place outside the boundaries of the LNG Terminal do not fall under the jurisdiction of FERC. The DOT and the TxDOT have jurisdiction over vehicle operation within the United States and the State of Texas, respectively. The trailers that transport LNG are specially designed and constructed to transport LNG for long distances in accordance with applicable DOT regulations (49 CFR 178.338). Truck operations at the facility must comply with the transfer procedures requirements of 49 CFR 193. Truck operators must be trained to meet hazardous material and motor carrier safety requirements of the DOT and TxDOT. Typical LNG trucks loading at the LNG Terminal would have a capacity of approximately 13,000 gallons (49 m^3).

2.1.3 Pipeline Facilities

In order to accommodate RG LNG's request for natural gas service at the Rio Grande LNG Terminal, RB Pipeline would construct its Pipeline System in Jim Wells, Kleberg, Kenedy, Willacy, and Cameron Counties. In addition to the facilities within the LNG Terminal that would be constructed, owned, and operated by RB Pipeline (i.e., the Gas Gate Station with Compressor Station 3 and Metering Site 4), the Rio Bravo Pipeline Project includes the following components: two new compressor stations; two interconnect booster stations; a Header System to collect natural gas; dual, 42-inch-diameter mainline pipelines (Pipelines 1 and 2), 8 metering sites, and appurtenant facilities. These facilities, which are shown in figure 1-1 in section 1.0, figure 2.1.3-1, and appendix B, are described in additional detail below.

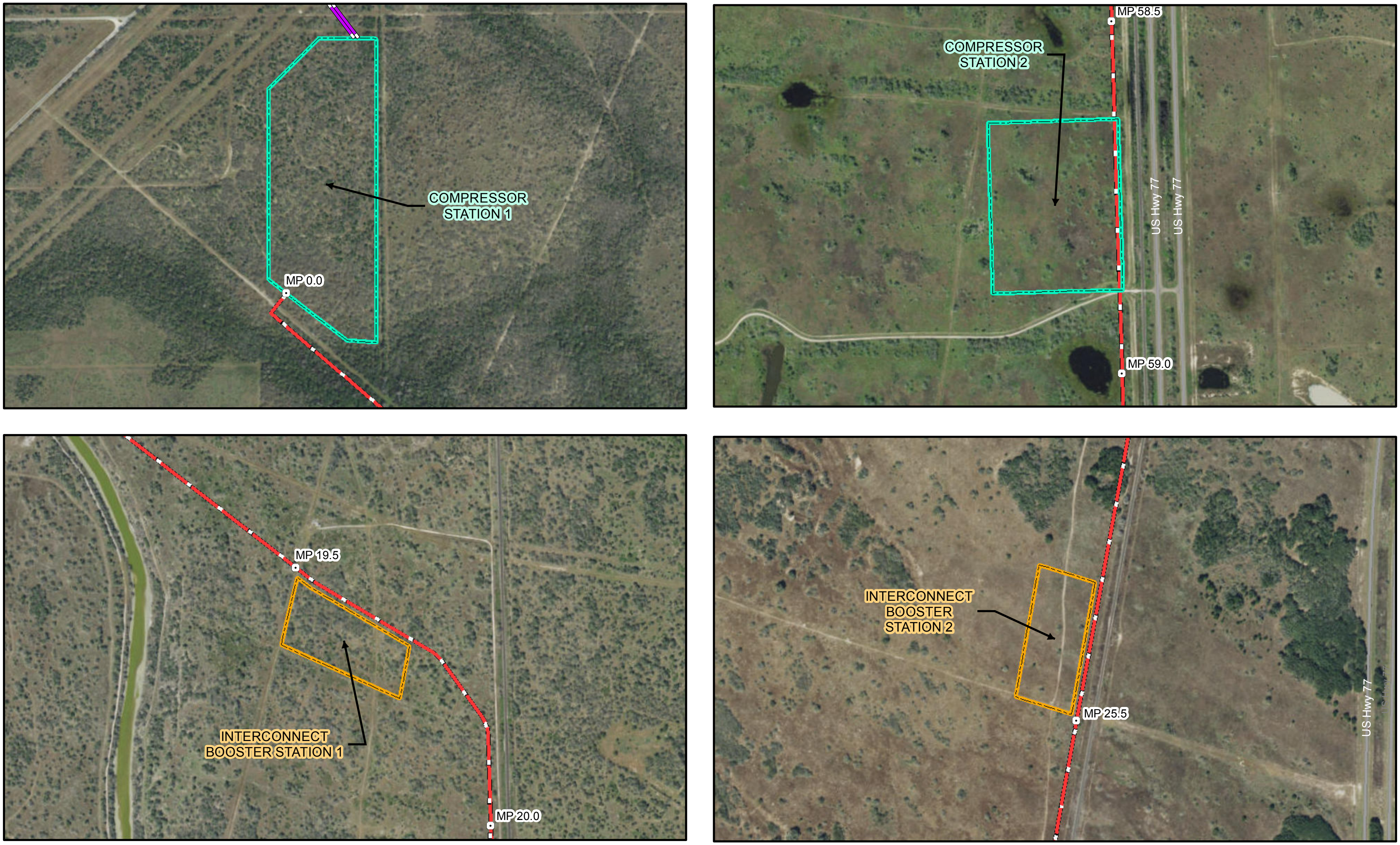
2.1.3.1 Pipeline System

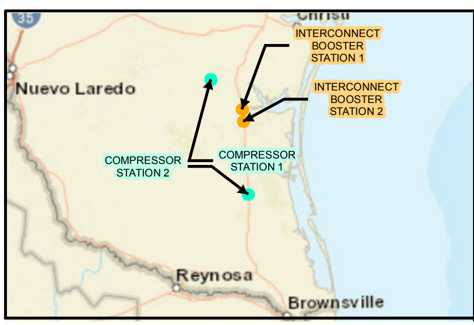
As a result of its constructability analysis or through landowner consultations, RB Pipeline identified four route variations during the pre-filing process and following RG Developers' application filing. Because RB Pipeline formally incorporated these realignments into its project design, they are now a part of the proposed Project. Thus, the data and analyses presented in this draft EIS also reflect the inclusion of these four realignments:

- RB Pipeline realigned its pipeline between MP 0.6 and MP 1.2 based on constructability and minimizing construction workspace. The variation resulted in a reduction of overall pipeline length of about 0.2 mile and subsequently about 3 acres less ground disturbance.
- RB Pipeline adjusted its workspaces and route in an effort to abut to the newly constructed Valley Crossing Pipeline (VCP) right-of-way. It was not possible to abut VCP in all locations, and based on this, one realignment from approximate MP 60.2 to MP 68.5 was about 1.9 miles offset to the east of the former alignment. The realignment would primarily traverse scrub-shrub and pasture; however, the variation would be about 1.2 miles shorter than the previously designed route and affect less acreage during construction and operation.
- RB Pipeline reviewed and incorporated an approximate 8-mile-long route variation beginning at MP 68.5. The variation was adopted in response to landowner requests; however, it also would provide engineering efficiencies, reduced wetland impacts, and avoid wildlife denning areas.
- RB Pipeline realigned its pipeline between MP 119.0 and MP 119.5 to avoid a newly constructed residence. The realignment moved ATWS from being adjacent to the residence to over 55 feet from the residence, and sited the pipelines about 150 feet from the residence.

Header System

A new 2.4-mile-long Header System would be constructed at the upstream end of the Pipeline System, allowing it to interconnect to a system of existing infrastructure transporting natural gas from multiple shale plays around the country through displacement; however, due to the proximity of the Project to the Agua Dulce Market Area, RG Developers anticipate physical delivery from Texas production areas. The Header System, located in Jim Wells and Kleberg Counties, would consist of dual, 42-inch-diameter pipelines from milepost (MP) HS-0.0 to HS-0.8, and a single, 42-inch-diameter pipeline from MP HS-0.8 to HS-2.4. Natural gas would flow from the Header System to Compressor Station 1, and into Pipelines 1 and 2.





Legend

- Proposed Compressor Station
- Proposed Interconnect Booster Station
- Proposed Rio Bravo Pipeline
- Proposed Header System

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap

N

0 500 1,000
Feet

Scale: 1:12,500

Rio Grande LNG Project

Compressor Stations and Interconnect Booster Station Locations

Figure 2.1.3-1

The counties crossed by the Pipeline System are listed, by milepost, in table 2.1.3-1.

Table 2.1.3-1
Counties Crossed by the Rio Bravo Pipeline System

Facility/County	MP Range	Length (miles)
Header System		
Jim Wells	HS-2.0 to HS-2.4	0.4
Kleberg	HS-0.0 to HS-2.0	2.0
Subtotal	--	***2.4***
Pipelines 1 and 2		
Kleberg	0.0 to 19.1	19.1
Kenedy	19.1 to 66.2	47.1
Willacy	66.2 to 100.1	33.9
Cameron	100.1 to 135.5	35.4
Subtotal	--	***135.5***
Total	--	**137.9**

The Header System would operate at a pressure of about 750 psi, dependent on the final number of interconnects. Temporary pig launchers and receivers would be installed to conduct required pipeline integrity surveys. RB Pipeline would interconnect with eight pipeline systems, with an aggregate capacity of about 6.7 Bcf/d; four of these interconnects would be along the Header System (see table 2.1.3-2 below).

Table 2.1.3-2
Proposed Pipeline Interconnects for the Rio Bravo Pipeline Project

Metering Site No.	System Name	System Owner	MP	System capacity (Bcf/d)	System Status[a]
Header System					
HS-1	Gulf Coast Mainline	Natural Gas Pipeline of America	HS 0.1	0.5	FERC-jurisdictional
HS-1	Transco	Transcontinental Pipeline	HS 0.1	0.5	FERC-jurisdictional
HS-2	TGP	Tennessee Gas Pipeline	HS 0.2	1.0	FERC-jurisdictional
HS-3	HGPC System	Energy Transfer Partners	HS 0.8	0.75	Intrastate
HS-3	TGPL Mustang	Kinder Morgan Tejas	HS 0.8	1.0	Intrastate
HS-4	--	NET Mexico Pipeline Partners	HS 2.4	2.0	Intrastate
Pipeline System					
2	TETCO STFE PETR	Texas Eastern Transmission Co.	19.6	0.6	FERC-jurisdictional
3	North Padre Island	Transcontinental Pipeline	25.4	0.4	FERC-jurisdictional

HS = Header System
[a] All systems proposed for interconnections are currently operational systems.

Pipeline 1

Pipeline 1 would be 135.5 miles of 42-inch-diameter pipeline beginning at Compressor Station 1 in Kleberg County and ending at Compressor Station 3, within the boundaries of the Rio Grande LNG Terminal, in Cameron County (see table 2.1.3-1 above). Pipeline 1 would have a maximum allowable operating pressure (MAOP) of 1,480 psi and a maximum operating pressure of 1,350 psi. Permanent pig launchers and/or receivers would be installed at each of the three compressor stations to monitor the integrity of the pipeline during the life of the Project.

Pipeline 1 would be constructed concurrent with the Header System, such that both pipelines would be operational and transporting natural gas to the Rio Grande LNG Terminal by the time LNG Train 1 became operational. Upon completion of these facilities, the Header System and Pipeline 1 would be capable of transporting 2.25 Bcf/d to the Rio Grande LNG Terminal to supply natural gas for liquefaction and for operations of the LNG Terminal facilities.

Pipeline 2

Pipeline 2 would be identical to Pipeline 1 in size and operating pressure, but would be offset from Pipeline 1 by 25 feet. During construction, additional pig launcher/receiver facilities, MLVs, and interconnections would be installed to accommodate the second pipeline. Upon completion of Pipeline 2, the full Pipeline System would be capable of transporting 4.5 Bcf/d to the LNG Terminal to supply natural gas for LNG and for operations of the Terminal facilities, which exceeds the average of 3.6 Bcf/d proposed for export.

2.1.3.2 Aboveground Facilities

The Project would include the construction of new aboveground facilities, including three compressor stations, two booster compressor stations, eight metering sites, and six MLVs.

Compressor Stations

RB Pipeline would construct three compressor stations (see table 2.2-1 below), each of which would include two compressor buildings, an office building, a Supervisory Control and Data Acquisition System (SCADA), parking areas, and various utility buildings, tanks, valves, and piping. Each compressor station would also be surrounded by a perimeter security fence with gate access control and video surveillance of the site and its perimeter. Outdoor lighting would be limited to that required for security during nighttime operation and would have downward or directional placement to minimize potential effects on local residences and migratory birds. The SCADA system at each compressor station would provide for remote communications and operation from the Rio Grande LNG Terminal control building; however, in the event of an abnormal compressor station shutdown, onsite personnel would be required for start-up.

Table 2.2-1 Land Requirements for the Rio Grande LNG Terminal Project			
Facility	**Pipeline MP**	**Land Requirements for Construction (acres)**	**Land Required for Operation (acres)**
LNG TERMINAL			
LNG Terminal facilities[a], *including* --LNG facilities --Support systems --LNG vessel berths --Turning basin --MOF Compressor Station 3, *including* Metering Site 4 pig receiver	135.3	819.1	819.1
Temporary offsite storage / parking	N/A	24.8	0.0
Temporary bulk water loading area	N/A	0.1	0.0
Temporary haul road[b]	N/A	11.0	0.0
Port Isabel dredge pile[c]	N/A	293.4	0.0
West natural buffer area (65 acres)[d]	N/A	0.0	0.0
East natural buffer area (158 acres)[d]	N/A	0.0	0.0
LNG Terminal Total	**--**	***1,148.4***	***819.1***
PIPELINE SYSTEM			
Header System	HS-0.0 to HS-2.4	32.9	17.0
Pipeline 1	0.0 to 135.5	1,974.6	1,206.2
Pipeline 2[e]	0.0 to 135.5	1,974.6	1,206.2
Pipeline System Subtotal[e]	**--**	***2,007.5***	***1,223.1***
Aboveground Facilities			
Metering Site HS-1	HS-0.1	2.1	2.1
Metering Site HS-2	HS-0.2	1.4	1.4
Metering Site HS-3	HS-0.8	2.0	2.0
Metering Site HS-4	HS-2.4	1.4	1.4
Compressor Station 1, *including* Metering Site 1 pig launcher	0.0	37.2	37.2
MLV 1	18.0	0.1	0.1
Booster Station 1, *including* Metering Site 2	19.6	9.7	9.7
Booster Station 2, *including* Metering Site 3	25.4	9.9	9.9
MLV 2	35.1	0.1	0.1
MLV 3	48.9	0.1	0.1
Compressor Station 2, *including* pig launcher / receiver	58.7	28.6	28.6
MLV 4	83.6	0.1	0.1
MLV 5	100.5	0.1	0.1
MLV 6	119.5	0.1	0.1
Aboveground facilities subtotal	**--**	***93.1***	***93.1***

Table 2.2-1 (continued) Land Requirements for the Rio Grande LNG Terminal Project			
Facility	**Pipeline MP**	**Land Requirements for Construction (acres)**	**Land Required for Operation (acres)**
Access roads	N/A	***109.5***	***12.6***
Contractor / pipe yards	--	***297.2***	***0.0***
Pipeline System Total	--	***2,507.2***	***1,328.7***
Grand Total	--	***3,655.6***	***2,147.8***

[a] Including the 27-acre parcel containing RB Pipeline's Gas Gate Station with Compressor Station 3, which falls within the boundaries of the LNG Terminal.

[b] About 2.3 acres of the proposed temporary haul road disturbance would be located within the east natural buffer area; however, we do not consider the road, as proposed, to be acceptable due to impacts on wetlands (see sections 3.3.2 and 4.4.2.1).

[c] The Port Isabel dredge pile is an active dredged spoil disposal site; RG LNG's use of this site would be consistent with its current use.

[d] The leased property for the LNG Terminal includes 984.2 acres, including about 233.8 acres of land that would not be affected by construction and operation of the LNG Terminal. Therefore, this land is excluded from the total impact.

[e] Construction impacts for Pipeline 2 would occur within the same construction footprint used for Pipeline 1; the Pipeline System subtotal represents the footprint of the Pipeline System and ATWS and is not the sum total of each pipeline's impacts.

Compressor Station 1 would be constructed at MP 0.0 of Pipelines 1 and 2 in Kleberg County and would receive feed gas from the Header System. Compressor Station 2 would be constructed at MP 58.7 in Kenedy County. These stations would raise the pressure of the pipelines to about 1,350 psi and, at full build-out, would have six, 30,000-hp natural gas turbines for a total capacity of 180,000 hp.

Compressor Station 3 would be located at MP 135.5 of the Pipeline System. Although it would also have a perimeter fence and be owned at operated by RB Pipeline, it would be within the boundaries of the Rio Grande LNG Terminal. At full build-out, Compressor Station 3 would have six, 30,000-hp electric-driven solar compressors, for a total capacity of 180,000 hp, and would increase the pressure of the pipelines to about 1,200 psi.

Each compressor station would have a pig launcher and/or receiver, based on its location along the pipeline. Compressor Station 1 would have dual pig launchers to accommodate both Pipeline 1 and Pipeline 2. Compressor Station 2 would have dual pig launcher/receivers, and Compressor Station 3 would have dual pig receivers. Each compressor station would also have a permanent access road for use during construction and operation.

Booster Stations

RB Pipeline would construct two interconnect booster stations (see table 2.2-1), each of which would include one compressor building, an office building, a SCADA system, parking areas, and various utility buildings, tanks, valves, and piping. Each booster station would have one natural gas-fired turbine.

Metering Sites

RB Pipeline would construct eight metering sites. Four of the metering sites would be collocated with other aboveground facilities, including a check meter at Compressor Station 1, a custody transfer meter at Compressor Station 3, and a metering site at each of the booster stations. Pending agreements with interconnect system owners, RB Pipeline would construct and operate the remaining metering sites, which would be stand-alone facilities along the Header System (see table 2.2-1). Two of the stand-alone metering sites would contain two meter stations each.

2.2 LAND REQUIREMENTS

Construction of the Rio Grande LNG Project would require a total of 3,655.6 acres of land, including 1,148.4 acres associated with construction of the LNG Terminal and 2,507.2 acres for the Pipeline System. Following construction, 2,147.8 acres of land would be permanently maintained for operation and maintenance of the facilities, including 819.1 acres for the LNG Terminal and marine facilities (67.8 acres of which would be dredging within the BSC), and 1,328.7 acres for the pipeline and related facilities. Table 2.2-1 summarizes the land requirements for the Rio Grande LNG Project. Section 4.8 provides a more detailed description and breakdown of land requirements and use.

2.2.1 LNG Terminal

Construction of the LNG Terminal, which includes RB Pipeline's Gas Gate Station, would require 750.4 acres of the 984.2-acre site leased from the BND, all of which would be permanently maintained within the operational footprint of the LNG Terminal. Construction of the marine loading berths, turning basin, and MOF would require excavation and dredging of 68.7 acres adjacent to the navigable channel of the BSC.

In addition to the facilities proposed for the LNG Terminal site, RG LNG has also proposed to construct a temporary haul road to the Port Isabel dredge pile to obtain fill materials, and would use a temporary bulk water loading area and two offsite storage/parking areas to support construction activities. Collectively these offsite facilities would temporarily impact 329.3 acres. About 0.6 mile of the temporary haul road would be constructed on land leased by a third party (Texas LNG, LLC), and coordination between the two parties would need to occur prior to its construction; however, we have determined that construction of the temporary haul road is not an acceptable deviation from our Procedures (see section 4.4.2.3). Following construction, these areas would be restored to pre-construction conditions, unless requested otherwise by the landowner and in accordance with applicable state and federal permits.

2.2.2 Pipeline Facilities

2.2.2.1 Pipeline System and Additional Temporary Workspace

Construction of the Pipeline System and additional temporary workspace (ATWS) would require a total of 2,007.5 acres of land. Of this, 1,223.1 acres would be retained for operation and maintenance of the pipeline facilities. Approximately 66.4 percent of the Pipeline System would be collocated with, or adjacent or parallel to, existing pipeline, roadway, railway, and/or utility rights-of-way (see table 2.2.2-1). In these cases, the pipeline would not be installed within an existing right-of-way, but may utilize the existing utility right-of-way for temporary construction workspaces. Figures 2.2.2-1 and 2.2.2-2 depict the typical right-of-way cross-sections in uplands and wetlands, respectively. The Header System construction right-of-way would be identical to that depicted in figure 2.2.2-1 for the extent of the dual pipelines, but would have a smaller construction and operational right-of-way for the single-pipeline portion of the route, as described below.

Table 2.2.2-1
Collocation of the Pipeline System and Existing ROWs and Man-made Linear Features[a]

Start MP	End MP	Parallel Length (miles)	Adjacent Infrastructure Type	Existing Infrastructure Owner	Offset from the Construction ROW (feet)[a]	Cumulative Construction ROW Overlap (acres)[b]
HEADER SYSTEM						
Kleberg County						
HS-1.7	HS-2.1	0.4	Gas pipeline	Unknown	0-100	1.0
Jim Wells County						
HS-2.1	HS-2.4	0.3	Gas pipeline	Unknown	0-100	1.2
PIPELINES 1 AND 2						
Kleberg County						
0.0	3.2	3.2	Gas pipeline	Sarita Gas – ExxonMobil Corp.	10 – 26[c]	0.0
3.2	3.5	0.3	Gas pipeline	Sarita Gas – ExxonMobil Corp.	98 – 124[c]	0.0
3.5	18.5	15.0	Gas pipeline	Sarita Gas – ExxonMobil Corp.	5 – 34[c]	0.0
18.6	19.0	0.4	Gas pipeline	Sarita Gas – ExxonMobil Corp.	14 – 33[c]	0.0
Kenedy County						
19.0	19.1	0.1	Gas pipeline	Sarita Gas – ExxonMobil Corp.	33 – 50[c]	0.0
19.9	20.5	0.6	Railroad	Union Pacific	88 – 91[c]	0.0

Table 2.2.2-1 (continued) Collocation of the Pipeline System and Existing ROWs and Man-made Linear Features[a]						
Start MP	**End MP**	**Parallel Length (miles)**	**Adjacent Infrastructure Type**	**Existing Infrastructure Owner**	**Offset from the Construction ROW (feet)[a]**	**Cumulative Construction ROW Overlap (acres)[b]**
Kenedy County (continued)						
23.8	29.1	5.3	Railroad	Union Pacific	65 – 105[c]	0.0
30.1	30.3	0.2	Railroad	Union Pacific	100[c]	0.0
30.6	66.2	35.6	Gas pipeline	VCP	4	0.0
Willacy County						
66.2	69.8	3.6	Gas pipeline	VCP	4	0.0
71.1	74.4	3.3	Electrical	Unknown	91 – 141[c]	0.0
76.5	78.8	2.3	Canal	Unknown	92 – 97[c]	0.0
81.9	90.9	9.0	Electrical	Unknown	46 – 129[c]	0.0
94.9	97.0	2.1	Public road	Farm-to-Market 1420	85 – 125[c]	0.0
97.1	100.0	2.9	Public road	County Line Road	65 – 86[c]	0.0
Cameron County						
100.0	100.5	0.5	Public road	County Line Road	65 – 86[c]	0.0
100.5	101.0	0.5	Public road	Farm-to-Market 2925 / E Brown Tract Road	77 – 82[c]	0.0
115.1	117.1	2.0	Electrical	Unknown	24 – 52[c]	0.0
132.3	135.4	3.1	Gas pipeline	VCP	-25	8.6

ROW = right-of-way; VCP = Valley Crossing Pipeline.

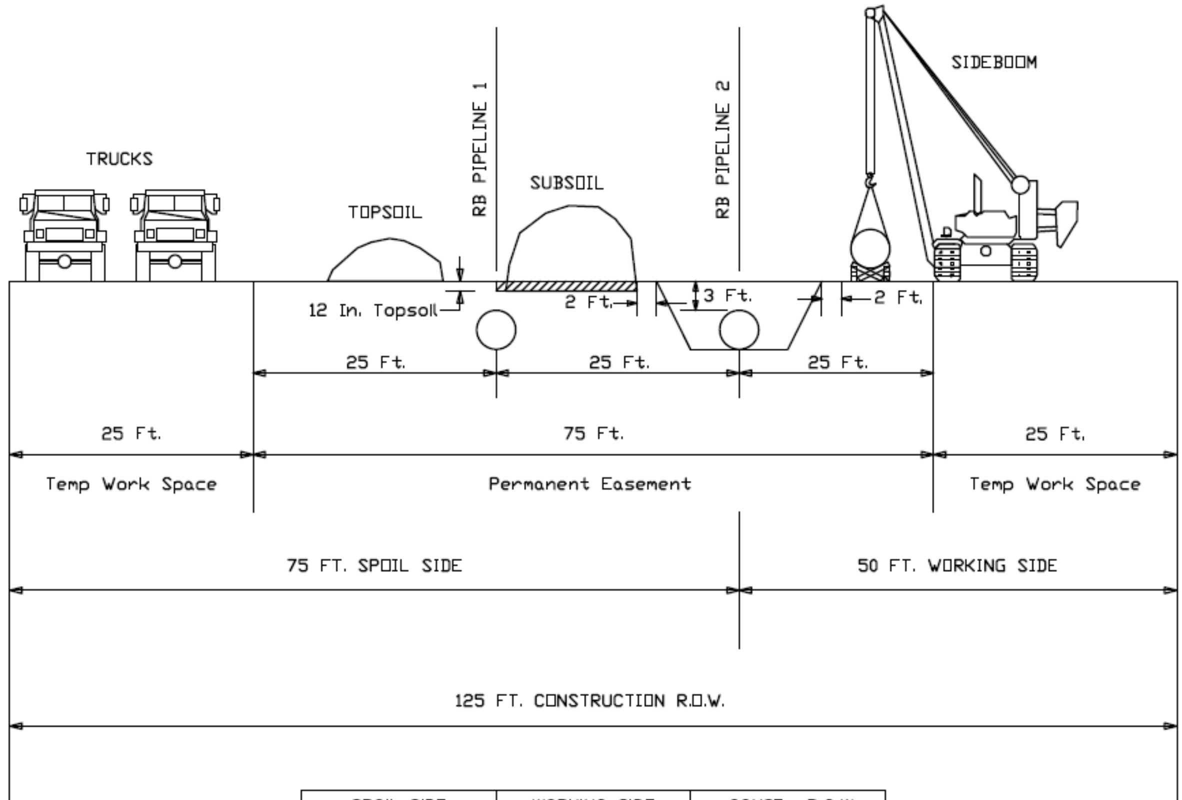
[a] The offset distance is the estimated distance between the edge of the construction ROW and the foreign feature. A negative number denotes overlap.

[b] The cumulative construction ROW includes the construction footprint of Pipeline 1 and Pipeline 2. Acreages are based on an assumed/estimated amount of overlap of 10 feet allowed by the utility.

[c] The offset distance is calculated from the edge of the construction ROW to the actual foreign feature as depicted on the revised November 2017 alignment sheets. The dimension of the permanent easement of these features was unknown.

Header System

Construction of the 2.4-mile-long Header System, including ATWS, would affect 32.9 acres of land. For the portion of the Header System that contains dual, 42-inch-diameter pipelines (MP HS-0.0 to HS-0.8), the construction right-of-way would be 125 feet wide. The remaining 1.6 miles from MP HS-0.8 to HS-2.4 would require a 100-foot-wide construction right-of-way. After construction, 17.0 acres of land would be maintained in an herbaceous state within operational right-of-way, which would be 75 feet wide for the dual pipeline and 50 feet wide for the single pipeline.



SPOIL SIDE (FT.)	WORKING SIDE (FT.)	CONST. R.O.W. (FT.)
75'	50'	125'

NOTES:

1. ALTHOUGH THE DIMENSIONS SHOWN IN THE ABOVE SKETCH AND TABLE ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS THAT MAY INCLUDE ATWS WHICH ARE SHOWN ON THE ALIGNMENT SHEETS AND NOTED IN THE ATWS TABLES.

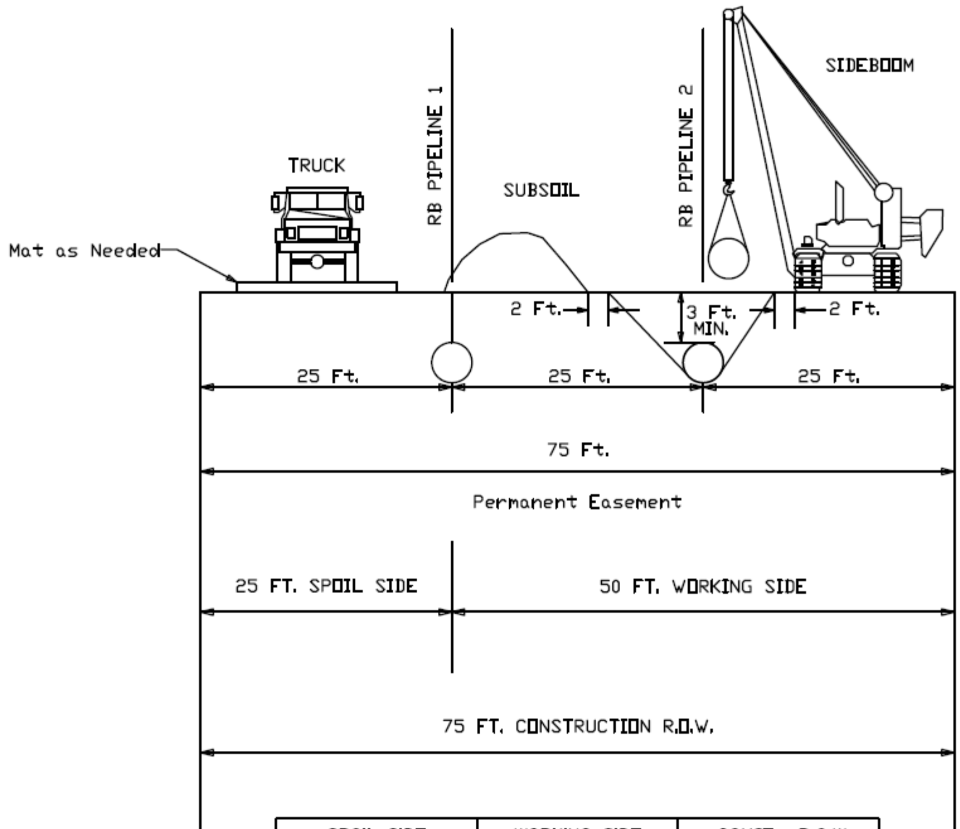
2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED WITHIN ALL CULTIVATED OR ROTATED CROPLANDS AND MANAGE PASTURES AND OTHER AREAS AT LANDOWNER'S OR LAND MANAGING AGENCY'S REQUEST.

3. NO EQUIPMENT DIRECTLY ABOVE EXISTING PIPELINE WITH OUT PADDING/MATTING AND APPROVAL OF OWNER AUTHORITY.

Rio Grande LNG Project

Typical Right-of-way Cross-section for Uplands

Figure 2.2.2-1



SPOIL SIDE (FT.)	WORKING SIDE (FT.)	CONST. R.O.W. (FT.)
50'	25'	75'

NOTES:

1. ALTHOUGH THE DIMENSIONS SHOWN IN THE ABOVE SKETCH AND TABLE ARE TYPICAL, SOME VARIATIONS MAY EXIST DUE TO SITE SPECIFIC CONDITIONS THAT MAY INCLUDE ATWS WHICH ARE SHOWN ON THE ALIGNMENT SHEETS AND NOTED IN THE ATWS TABLES.

2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED FOR THE WIDTH OF THE DITCH LINE ONLY. DOES NOT APPLY TO SATURATED SOILS AND/OR AREAS OF FREESTANDING WATER.

3. EQUIPMENT TO WORK ON MATS OR ACCEPTED SUBSTRATE AS REQUIRED.

Rio Grande LNG Project

Typical Right-of-way Cross-section for Wetlands

Figure 2.2.2-2

Pipeline 1

Pipeline 1 would be a 135.5-mile-long, 42-inch-diameter pipeline, installed within a 125-foot-wide construction right-of-way. Construction of Pipeline 1, including ATWS, would affect 1,974.6 acres of land. Following construction, Pipeline 1 would be offset within a 75-foot-wide permanent right-of-way so that Pipeline 2, when constructed, would occupy the same permanent right-of-way with a 25-foot offset from Pipeline 1. Once Pipeline 2 was installed, the 75-foot-wide permanent right-of-way would affect 1,206.2 acres of land that would be permanently maintained in an herbaceous state.

Pipeline 2

Pipeline 2 would also be a 135.5-mile-long, 42-inch-diameter pipeline, installed within the same 125-foot-wide construction right-of-way affected by Pipeline 1. As such, all land disturbed by the construction of Pipeline 2 would have been previously disturbed during the construction of Pipeline 1. Similarly, land associated with ATWS, access roads, contractor/pipe yards, and aboveground facilities would have been previously disturbed.

2.2.2.2 Aboveground Facilities

Compressor Stations

Construction of Compressor Stations 1 and 2 would affect 65.8 acres. Compressor Station 3 is discussed above, as it would be within the boundaries of the LNG Terminal site. All 65.8 acres of land associated with Compressor Stations 1 and 2 would be retained by RB Pipeline via lease option; however, only the facilities themselves would be fenced off (for security) and converted to developed land. The fenced area would total about 41.0 acres; the remaining 24.8 acres outside of the fencelines would be stabilized and revegetated.

Booster Stations

Similar to the compressor stations, Booster Stations 1 and 2 would affect a total of 19.6 acres of land during construction. Although the entire parcel impacted during construction would be retained by RB Pipeline, only those areas fenced off for security would be converted to developed land (about 12.0 acres). Remaining land on the leased parcels would be stabilized and revegetated.

Metering Sites

The Project would include eight metering sites, four of which would be collocated within the boundaries of a compressor station or booster station. The remaining four metering sites would affect a total of 6.9 acres of land, which would be disturbed during construction and maintained during operations.

2.2.2.3 Contractor/Pipe Yards

RB Pipeline would use three contractor/pipe yards during construction. Contractor/Pipe Yard 1 would be about 6.7 miles south of MP 69.8, in a 135.6-acre agricultural area.

Contractor/Pipe Yards 2 and 3 would both be in open land; Yard 2 would be about 25.5 acres adjacent to the pipelines at MP 43.1; and Contractor/Pipe Yard 3 would be about 136.1 acres and located 5.8 miles southwest of the pipelines at MP 123.7. Each yard would be returned to approximately pre-construction conditions after construction and would not be used during operation. No wetlands or waters of the United States are present within the proposed contractor/pipe yard sites.

2.2.2.4 Access Roads

To the extent feasible, RB Pipeline would use existing public road crossings as the primary means of accessing the pipeline facilities during construction. RB Pipeline has proposed the use of 64 roads (including 52 temporary and 12 permanent access roads); 5 of these would be newly constructed, while 2 are existing roads that would be expanded, graded, and graveled. All improvements, less a portion of the expansion of AR-014 (about 300 feet in length) and newly constructed HS-004, would take place on land within the proposed permanent right-of-way. A list of access roads proposed for use, including their locations, current conditions, and proposed modifications (if any) is provided in appendix C.

After construction is complete, the temporary access roads would be returned to pre-construction or better (improved) condition. Operations would be supported by the use of 13 roads, including those providing access to Compressor Stations 1 and 2, Booster Stations 1 and 2, and the stand-alone metering sites along the Pipeline System. Access roads through waterbodies and wetlands are discussed in sections 4.3 and 4.4, respectively.

2.3 CONSTRUCTION SCHEDULE AND WORKFORCE

RG Developers initially anticipated starting construction of the Project in 2018; however, the start of construction would be based on receipt of all certifications, authorizations, and necessary permits. The Project has been proposed in six staged construction phases where the LNG Terminal site would be developed over the course of about 7 years, with the first LNG train becoming operational in Year 4 of construction and the final LNG train becoming operational by Year 7. Each stage of construction would be associated with one of the six LNG trains; Stage 1 would include site preparation and security fencing of the entire work area, construction of LNG Train 1, and construction of all infrastructure required for the operation of LNG Train 1. Each subsequent stage of construction would begin about 6 to 9 months after construction of the previous train, and would include all additional infrastructure required for that train. The major components of each stage of construction are listed in table 2.3-1.

Construction activities would occur predominantly during the day, between 7:00 a.m. and 7:00 p.m., Monday through Friday, and site preparation and construction activities (including pile-driving) would be limited to daytime hours. However, dredging may occur up to 24 hours per day, 7 days per week.

<table>
<tr><th colspan="3">Table 2.3-1
Major Components of the Proposed Construction Stages</th></tr>
<tr><th>Construction Stage
(planned timeframe)</th><th>LNG Terminal Construction</th><th>Pipeline System Construction</th></tr>
<tr><td>Stage 1
(Q2 Year 1 to Q3 Year 4)</td><td>Full site preparation and fill
Grading for Stage 1 facilities and laydown
Erect temporary buildings and utilities
Full site security fencing and levee construction
All Project dredging
LNG Berth 1 and turning basin
Utility switchyard and custody transfer meter substation
LNG Train 1
LNG Tanks 1 and 2
LNG Truck Loading Bays 1 and 2
Material offloading facilities
Ground flares, unit 1
Condensate storage tanks (2)
Refrigerant truck loading bays (2)
Condensate truck loading bays (2)
Firewater supply system
BOG compressors 1 and 2
Permanent plant buildings
Power Generation 1
Ponds 1, 2, 3 and 6, drainage system and effluent treatment plants
Communications systems and towers
Permanent parking</td><td rowspan="2">Pipeline 1 installed (beginning in Year 3)
Header System installed
Compressor Station 1 – full buildout at partial capacity
Compressor Station 2 – full buildout at partial capacity
Compressor Station 3 – full buildout at partial capacity
Booster Station 1 – full buildout at full capacity
Booster Station 2 – full buildout at full capacity</td></tr>
<tr><td>Stage 2
(Q2 Year 2 to Q1 Year 5)</td><td>Grading for Stage 2 facilities and laydown
LNG Train 2
Utilities and electrical substations for LNG Train 2
Firewater distribution to Stage 2 areas
Drainage system expansion into Stage 2 areas
BOG compressor 3
Ground flares, unit 2</td></tr>
<tr><td>Stage 3
(Q1 Year 3 to Q4 Year 5)</td><td>Grading for Stage 3 facilities and laydown
LNG Train 3
Utilities and electrical substations for LNG Train 3
Firewater distribution to Stage 3 areas
Drainage system expansion into Stage 3 areas
BOG compressor 4</td><td>Add 30,000 hp capacity to Compressor Station 1
Add 30,000 hp capacity to Compressor Station 2
Add 30,000 hp capacity to Compressor Station 3</td></tr>
</table>

Table 2.3-1 (continued)
Major Components of the Proposed Construction Stages

Construction Stage (planned timeframe)	LNG Terminal Construction	Pipeline System Construction
Stage 4 (Q3 Year 3 to Q2 Year 6)	Grading for Stage 4 facilities and laydown LNG Train 4 Utilities and electrical substations for LNG Train 4 Essential power generation unit (West) Firewater distribution to Stage 4 areas Drainage system expansion into Stage 4 areas BOG compressors 5 and 6 Ground flares, unit 3 LNG Tank 3 LNG Berth 2 LNG Truck Loading Bays 3 and 4	Pipeline 2 installed (beginning in Year 5) Add 30,000 hp capacity to Compressor Station 1 Add 30,000 hp capacity to Compressor Station 2 Add 30,000 hp capacity to Compressor Station 3
Stage 5 (Q2 Year 4 to Q1 Year 7)	Grading for Stage 5 facilities and laydown LNG Train 5 Utilities and electrical substations for LNG Train 5 Firewater distribution to Stage 5 areas Pond 5 and drainage system expansion into Stage 5 areas BOG compressor 7 LNG Tank 4	Add 30,000 hp capacity to Compressor Station 1 Add 30,000 hp capacity to Compressor Station 2 Add 30,000 hp capacity to Compressor Station 3
Stage 6 (Q3 Year 4 to Q3 Year 7)	Grading for Stage 6 facilities and laydown LNG Train 6 Utilities and electrical substations for LNG Train 6 Firewater distribution to Stage 6 areas Drainage system expansion into Stage 6 areas BOG compressor 8 Remove temporary facilities	Add 30,000 hp capacity to Compressor Station 1 Add 30,000 hp capacity to Compressor Station 2 Add 30,000 hp capacity to Compressor Station 3

Q = quarter

As previously noted, similar to the LNG Terminal, the Pipeline System would be constructed in stages that correspond to the LNG Terminal stages. Pipeline 1, the Header System, the compressor stations, and aboveground facilities would be constructed during Stages 1 and 2 so that Pipeline 1 would be operational upon startup of LNG Train 1 operations. Construction of Pipeline 2 would commence about 18 months after Pipeline 1 became operational. Although compression would be added to each compressor station during subsequent stages, there would be no increase in the footprint of the facilities.

In total, a maximum of 6,725 workers would be employed during construction of the Rio Grande LNG Project. The majority of workers would be associated with the LNG Terminal, where an average of 2,950 workers (peak of 5,225) would be employed. RG LNG estimates that about 30 percent of the workers would be hired locally (see section 4.9.1.1).

RB Pipeline is proposing a multi-stage construction period for the Pipeline System. Pipeline 1, the Header System, and the aboveground facilities would be constructed during Stages 1 and 2, during which the average monthly workforce would be 1,240 workers (peak of 1,500). About 8 months after the completion of Stage 2, construction would resume to begin Stages 3 through 6. Stages 3 through 6 would involve installation of additional compression at each of the compressor stations, which would require an average monthly workforce of 240 workers (peak of 300). Construction of Pipeline 2, which would occur as part of Stage 4, would occur over a 12-month period and require an average workforce of 760 staff. RB Pipeline anticipates that the majority of construction workers for the pipeline facilities (90 percent) would be hired from outside the Project area (see section 4.9.1.2).

2.4 ENVIRONMENTAL COMPLIANCE

The FERC may impose conditions on any Certificate or authorization it grants for the Rio Grande LNG Project. These conditions include additional requirements and mitigation measures, such as those recommended in this EIS, to minimize the environmental impact that would result from construction and operation of the proposed Project (see sections 4 and 5). We will recommend that these additional requirements and mitigation measures (bold type in the text of the EIS) be included as specific conditions to any approving Certificate or authorization issued for the Rio Grande LNG Project. We will also recommend to the Commission that RG Developers be required to implement the mitigation measures proposed as part of the Project unless specifically modified by other Certificate or authorization conditions. RG Developers 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.

RG LNG would employ at least one environmental inspector (EI) per construction stage to monitor construction activities at the Rio Grande LNG Terminal. RB Pipeline would employ at least two EIs per construction "spread" (standard, sequential assembly line installation as described in section 2.3.2), to monitor construction activities at the pipeline facilities during all phases of construction, including cleanup and restoration; one EI would inspect the pipeline and one EI would inspect the associated aboveground facilities. The Pipeline System would be constructed with a total of four spreads: two spreads for the Header System and Pipeline 1, and two spreads for the later construction of Pipeline 2.

The responsibilities of the EIs employed by RG Developers are described in the Project-specific *Upland Erosion Control, Revegetation, and Maintenance Plan* (Plan; see appendix D) and *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures; see appendix E). RG Developers' Project-specific Plan and Procedures are based on the 2013 FERC Plan and Procedures[10], which are a set of construction and mitigation measures developed to minimize the potential environmental impacts of the construction of pipeline projects in general. The EIs employed by RG Developers would monitor activities as described in the Project-specific Plan and Procedures.

The EIs' responsibilities would include verifying that environmental obligations, conditions, and other requirements of permits and authorizations are met. RG Developers have requested deviations from the Procedures, as described in detail in section 4.4.2.3 and appendix F. Although justification has been provided for these alternative measures, RG Developers would be required to otherwise comply with the requirements of the Procedures; where justification was not deemed sufficient for a requested alternative measure, we have concluded that the request was not acceptable. The EIs would inspect construction and mitigation activities to verify environmental compliance.

RG Developers would conduct environmental training for each of their EIs to familiarize them with Project-specific issues and requirements. RG Developers would also incorporate environmental requirements and specifications in contractor bid documents; provide the contractors with copies of environmental permits, certificates, and clearances; and conduct environmental training for contractor personnel prior to and during construction, as needed, to make them aware of the environmental requirements at each facility.

In addition to RG Developers' environmental compliance activities, FERC staff would conduct field inspections during construction. Other federal and state agencies may also conduct oversight or inspections to the extent determined necessary by the individual agency. After construction is completed, FERC staff would continue to monitor affected areas during operation to verify successful restoration. Additionally, FERC staff would conduct annual engineering safety inspections of the Rio Grande LNG Terminal throughout the life of the facility.

2.5 CONSTRUCTION PROCEDURES

This section describes the general procedures proposed by RG Developers for construction activities at the Rio Grande LNG Terminal and pipeline facilities. Refer to section 4.0 for more detailed discussions of proposed construction and restoration procedures as well as additional measures that we are recommending to avoid or reduce environmental impacts.

Under the provisions of the Natural Gas Pipeline Safety Act of 1968, as amended, the proposed LNG Terminal must be designed, constructed, operated, and maintained in accordance with the DOT's *Liquefied Natural Gas Facilities: Federal Safety Standards* (49 CFR 193) and incorporated 2001 and 2006 edition requirements, as applicable in the NFPA 59A *Standards for*

---

10 The FERC Plan and Procedures can be viewed on the FERC website at http://www.ferc.gov/industries/gas/enviro/plan.pdf and http://www.ferc.gov/industries/gas/enviro/procedures.pdf, respectively.

the Production, Storage, and Handling of LNG. These standards specify siting, design, construction, equipment, and fire protection requirements for new LNG facilities. The LNG ship loading facilities and any appurtenances located between the LNG ships and the last manifold (or in the absence of a manifold, the last valve) immediately before the LNG storage tanks must comply with applicable sections of the Coast Guard regulations in *Waterfront Facilities Handling Liquefied Natural Gas* (33 CFR 127) and Executive Order 10173.

On November 29, 2016, the DOT provided a Letter of Determination (LOD) to FERC staff stating that it had no objection to RG LNG's methodology to comply with the Part 193 siting requirements for the proposed LNG liquefaction facilities. If the Project is authorized and constructed, the facility would be subject to the DOT's inspection and enforcement program, and final determination of whether a facility is in compliance with the requirements of 49 CFR 193 would be made by the DOT staff. Informal consultation between Rio Grande LNG and PHMSA regarding additional LNG and pipeline federal safety standards, including compliance with Part 193, Subpart B, is currently ongoing.

The pipeline facilities must be designed, constructed, operated, and maintained in accordance with DOT regulations in *Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards* (49 CFR 192). Among other design standards, these regulations specify pipeline material selection; minimum design requirements; protection from internal, external, and atmospheric corrosion; and qualification procedures for welders and operations personnel. On November 29, 2016, PHMSA approved RG LNG's methodologies for single-accidental leakage sources for the design of the facility. Informal consultation between Rio Grande LNG and PHMSA regarding additional LNG and pipeline safety and federal safety standards is currently ongoing.

RG Developers would be required to implement all conditions in the authorization or Certificate issued by the Commission for the Rio Grande LNG Terminal and the Rio Bravo Pipeline Project, respectively. As previously noted, RG Developers would implement their Project-specific Plan and Procedures, which are based on the FERC's 2013 Plan and Procedures. We have reviewed the Project-specific Plan and Procedures and found them to be acceptable, with the exception of certain alternative measures requested by RG Developers. Detailed information regarding requested alternative measures to FERC's 2013 Plan and Procedures is provided in section 4.4.2.3 and appendix F.

To prevent contamination of soils within nearby wetlands, waterbodies, and other sensitive resources during construction, RG Developers would develop and implement Project-specific spill prevention and response procedures in accordance with the requirements of 40 CFR 112. RG Developers would implement their Spill Prevention, Control, and Countermeasures Plans[11] (SPCC Plan) during construction of the LNG Terminal and pipeline facilities. These plans outline potential sources of releases at the sites, measures to prevent a release to the

---

[11] The SPCC Plan for LNG Terminal construction was filed with the FERC on September 1, 2016 (see accession number 20160901-5281 from FERC's eLibrary website). The SPCC Plan for pipeline construction was filed with the FERC on December 29, 2016 (see accession number 20161229-5149).

environment, and initial responses in the event of a spill. We have reviewed RG Developers' draft SPCC Plans for construction and found them to be acceptable.

In addition, RG LNG would develop an operational SPCC Plan that would be implemented during operation of the LNG Terminal; we have recommended in section 4.2 that RG Developers provide the operational plans, and final versions of the draft plans, for our review and approval prior to construction. RG Developers would also implement conditions resulting from other permit requirements and their respective Project-specific plans and measures developed to avoid or minimize environmental impacts during construction, which are discussed throughout this EIS.

2.5.1 LNG Terminal

2.5.1.1 Site Preparation

The existing grade at the site generally varies between 0.2 and 18.5 feet above North American Vertical Datum of 1988 (NAVD 88). During site preparation, the site would be cut and filled, leveled, and graded to achieve an elevation of 10 feet NAVD 88 throughout the majority of the site (including the LNG trains and ground flares) and 9 feet NAVD 88 for the stormwater holding ponds and LNG storage tanks. RG LNG would also construct a storm surge protection levee surrounding the LNG Terminal site with elevations ranging from 17 to 19 feet NAVD 88.

Prior to the start of construction, RG LNG would install temporary erosion controls along the boundaries of the construction areas, in accordance with its Plan and Procedures. Preliminary site-clearing, grading, and compaction would begin on the southwestern portion of the property, including the areas for the first LNG trains and the LNG storage tanks. RG LNG would not strip topsoil from the property and would improve the soil currently present, as required for placement of the foundations and structures. Debris and grubbed material that is not reused on site would be collected and disposed of at an approved offsite disposal facility in compliance with local requirements.

After priority areas are accessible, RG LNG has proposed to import an estimated 3.5 million cubic yards (mcy) from the nearby Port Isabel dredge pile, via a temporary haul road (which we are not recommending as proposed, see section 3.4). In addition, RG LNG could bring supplementary structural fill material to support foundations, roads, and pavement from other clean offsite sources. Although initial site preparation and fill would be conducted for the full facility footprint during Stage 1, additional grading activities would take place at each subsequent construction stage as necessary.

2.5.1.2 Materials and Equipment Delivery and Offsite Concrete Batch Plant

RG LNG proposes to use two offsite contractor/pipe yards during construction of the LNG Terminal, including one in Port Isabel (about 2.3 miles east of the LNG Terminal site boundary) and one in the Port of Brownsville (about 2.4 miles west of MP 133.5 of the Rio Bravo Pipeline). Because much of the staging activities would take place on the LNG Terminal site itself during early construction, the offsite yards would be used more extensively for equipment and materials storage as available space becomes constrained during later construction. Equipment and materials required for the construction of the LNG Terminal would be delivered by truck or barge. Materials delivered via barge may either be delivered directly to the LNG Terminal site, via the MOF, or delivered to the Port of Brownsville, where they would be loaded onto a truck or trucks and transported via SH-48. The method of delivery would depend on the size and weight of the equipment. Overground and marine transportation are discussed in detail in section 4.9.8.

Concrete required for construction of the LNG Terminal would be provided by an onsite batch plant that would be located outside of the site levee, but adjacent to the location of the future MOF. The batch plant would produce concrete for the first 4 years of construction, using cement, sand, and stone delivered from offsite sources by truck or barge. Concrete production would also require about 27 million gallons of water over the 4-year period. Water usage during construction of the proposed Project is discussed in section 4.3.2.2.

2.5.1.3 Facility Foundations

RG LNG would support the land-based structures (liquefaction trains and related facilities) at the LNG Terminal site using deep foundations of 24-inch-diameter cast-in-place auger piles. The LNG loading platforms, breasting dolphins, and mooring dolphins would be supported by steel pipe or concrete piles with 36-, 48-, 96-, and 108-inch diameters, depending on the specific component being constructed.

In addition to pipe piles, the MOF would also require about 745 feet of sheet piling (see table 2.5.1-1). About 9,200 pilings would be installed over the course of construction, most of which would be associated with the liquefaction trains and related facilities. Pile-driving activities would occur up to 10 hours per day, 5 days per week (see table 2.5.1-1). The majority of pile-driving would be conducted on land; however, the sheet piling at the MOF and a total of four piles would be driven in-water (two at the MOF and two for the fixed aid to navigation at the Berth 1 jetty). Acoustic impacts from pile-driving activities are discussed in detail in section 4.11.2.

2.5.1.4 LNG Loading and Ship Berthing Facilities

Construction of the LNG loading and ship berthing facilities includes the following primary tasks, which are described in the following sections:

- dredging of the ship berthing area, turning basin, and MOF;
- placement of sheet pile bulkhead and rock armoring;
- construction of the jetty platform and the breasting and mooring structures; and
- construction of the fixed aid to navigation structure.

Table 2.5.1-1
Pile-driving Activities Associated with Construction of the Rio Grande LNG Terminal

Project Component	Pile Type	Pile Size	Number of Piles	Driving Location	Installation Method	Estimated Duration[a,b]
MOF	Steel sheet pile	AZ12-700 (each pair being approximately 55-inches long x 12-inches deep)	745 linear feet of bulkhead (about 162 pairs)	In water	Vibratory hammer (impact hammer only used if early refusal is reached)	25 days
	Steel pipe piles (or concrete piles)	36-inch-diameter	240	On land	Impact hammer	55 days
	Steel pipe piles (or concrete piles)	48-inch-diameter	2	In water	Impact hammer	2 days
LNG Berth 1 Jetty	Steel pipe piles (or concrete piles)	36-inch diameter	55	On land	Impact hammer	15 days
	Steel pipe piles	108-inch-diameter	4	On land	Impact hammer	8 days
	Steel pipe piles	96-inch-diameter	6	On land	Impact hammer	12 days
Fixed aid to navigation at the Berth 1 Jetty	Steel pipe piles (or concrete piles)	48-inch diameter	2	In water	Impact hammer	2 days
LNG Berth 2 Jetty	Steel pipe piles (or concrete piles)	36-inch-diameter	55	On land	Impact hammer	15 days
	Steel pipe piles	108-inch diameter	4	On land	Impact hammer	8 days
	Steel pipe piles	96-inch-diameter	6	On land	Impact hammer	12 days
Stage 1: LNG Train 1 and related offsite utilities	CIP auger piles	24-inch-diameter x 70 foot	1,416	On land	Auger piling rig	114 / 165 days
	CIP auger piles	24-inch-diameter x 70 foot	928	On land	Auger piling rig	
Stage 2: LNG Train 2	CIP auger piles	24-inch-diameter x 70 foot	1,165	On land	Auger piling rig	68 / 98 days
Stage 3: LNG Train 3	CIP auger piles	24-inch-diameter x 70 foot	1,165	On land	Auger piling rig	68 / 98 days
Stage 4: LNG Train 4 and related offsite utilities	CIP auger piles	24-inch-diameter x 70 foot	1,365	On land	Auger piling rig	96 / 138 days
	CIP auger piles	24-inch-diameter x 70 foot	464	On land	Auger piling rig	
Stage 5: LNG Train 5	CIP auger piles	24-inch-diameter x 70 foot	1,165	On land	Auger piling rig	68 / 98 days
Stage 6: LNG Train 6	CIP auger piles	24-inch-diameter x 70 foot	1,165	On land	Auger piling rig	68 / 98 days

CIP = cast-in-place.

[a] The number and type of piles required for the facility foundation will be confirmed during detailed engineering and design.

[b] Pile-driving operations would take place 8 to 10 hours per day, Monday through Friday. Days for auger piling show estimated working/calendar days based on operation of two rigs.

Dredging of the Ship Berthing Areas, Turning Basin, and MOF

RG LNG would dredge the berthing areas and turning basin to a depth of -45 feet MLLW, which includes -2 feet of overdredge allowance. The sides of the berthing areas and turning basin would be contoured at a 1:3 slope. The MOF would be dredged to a depth of -12 feet MLLW, which includes -2 feet of overdredge allowance, to allow barges and shallow draft vessels to directly offload bulk materials at the LNG Terminal site. RG LNG would install rock armoring to provide scour protection from propeller wash on the slope parallel to the shoreline.

About 623,000 cubic yards (yd^3) of material would be excavated along the shoreline and within the BSC by land-based equipment for the construction of the berthing areas, turning basin, and MOF. This material would be directly placed at the LNG Terminal site for fill. An additional 39,000 yd^3 of material would be dredged from the MOF using a hydraulic dredge before construction of the LNG Terminal and either used for additional fill at the LNG Terminal site or pumped via temporary pipeline to the Port of Brownsville Placement Area (PA) 4B, which is located directly across the BSC from the LNG Terminal site.

About 6.5 mcy of material would be dredged from the berths and turning basin using water-based equipment. Material would either be dredged using a mechanical dredge and placed at the New Work Ocean Dredged Material Disposal Site (ODMDS), or using a hydraulic dredge and temporary pipeline and placed at Port of Brownsville PAs 5A, 5B, or a combination of 5A and 5B. The New Work ODMDS is about 4.4 miles from shore and would require approval by the EPA and the COE prior to use. Because PAs 5A and 5B are located along the BSC across from the LNG Terminal site, a temporary pipeline used to transport dredged material would be placed on the channel bed and allowed to settle by its own weight, so as not to impede vessel traffic.

RG LNG's Dredged Material Management Plan is being developed, and the final determination of dredging methods and dredged material placement locations would be finalized in consultation with the BND and federal and state agencies. RG LNG is also considering potential beneficial uses of dredged material. Dredged material placement areas under consideration are discussed in section 4.2.3.

Placement of Sheet Piling and Rock Armoring

To minimize shoreline erosion, the LNG Terminal waterfront along the BSC would be stabilized from the MOF to the berths and turning basin. The MOF would be constructed using a steel sheet pile bulkhead. East of the MOF, channel embankments and the top slope of the shoreline (to a depth of -2 feet MLLW) would be graded to a 1:3 slope, stabilized with bedding stone overlain by geotextile fabric, and then covered with rip-rap. In the marine berths and turning basin, where vessel activity could erode the underwater channel slopes, the shoreline would be dredged to a 1:3 slope and stabilized with rip-rap to a depth of -43 feet MLLW. The rock armoring would extend to the top of the slope at elevation +6 feet NAVD 88 and would tie-in to the MOF bulkhead. RG LNG would maintain the integrity of the shoreline protection throughout the operational life of the LNG Terminal.

Construction of the Jetty Platforms and the Breasting and Mooring Structures

As discussed in section 2.1.1.4, the LNG Terminal would include two marine berths for LNG carrier loading. The berth jetties would be constructed from concrete slabs and beams. The Berth 1 jetty would be constructed prior to dredging so that all pile-driving could take place over land. During dredging, RG LNG would leave a small land mass in place so that the Berth 2 jetty could be constructed using land-based equipment during Stages 4 through 6; this land mass would be excavated after construction of the Berth 2 jetty. Each berth would have four breasting dolphins, as well as three bow and three stern mooring dolphins, which would be connected to the loading platform via personnel catwalks.

Fixed Aid to Navigation Structure

RG LNG proposes to install one fixed aid to navigation in the marine berth/turning basin area, which would include in-water piles, and above-water framing and lighting. Installation would include in-water pile-driving of two 48-inch steel pipe or precast concrete piles. Construction of the facility would require 8- to 10-hour days for 2 days (see table 2.5.1-1). Acoustic impacts from pile-driving activities are discussed in detail in section 4.11.2.

2.5.1.5 LNG Trains

The DOT establishes and has the authority to enforce the federal safety standards for the siting, construction, operation, and maintenance of onshore LNG facilities, including the LNG trains. The DOT's LNG safety regulations are codified in 49 CFR 193. Concrete batching plants would be constructed on the LNG Terminal site; 1.2 million tons of cement, sand, and aggregate would be used to construct the six trains. Construction of the trains would be started sequentially with a 6- to 8-month delay between the start of construction for each subsequent train.

2.5.1.6 LNG Storage and Processing Facilities

One of the more labor-intensive and time-consuming activities associated with construction of the LNG Terminal would be the construction of the two LNG storage tanks. After site preparation, the LNG storage tanks would be erected on site using conventional construction techniques (see section 2.1.1.2). Figure 2.1.1-4 depicts the design of a typical LNG storage tank. Following the installation of the concrete slab foundation, construction of the tank base and post-tensioning of the outer concrete container wall would follow. In parallel to construction of the outer concrete container wall, the steel dome roof and suspended deck would be constructed on temporary supports inside the outer container of each storage tank, to be later air-raised into position. The bottom carbon steel vapor liner would then be installed. On top of the outer concrete container wall, the steel dome roof compression ring would be cast into the concrete and then the steel dome roof would be air-raised into position and secured to the compression ring.

Roof nozzles, penetrations, and studs would be installed, as would steel reinforcement and concrete covering of the steel dome roof. Concurrent with the installation of roof nozzles and penetrations, work would begin on the inner 9-percent nickel steel container, including the secondary bottom, bottom corner protection, and inner container annular and bottom plates. The inner 9-percent nickel steel container would be erected. Internal accessories such as pump columns, bottom and top fill, instrument wells, and purge and cool-down piping would be installed, followed by installation of roof platforms, walkways, pipework, and pipe supports.

To ensure that the tanks are capable of operating at the design pressure, testing of the outer and inner tanks must be completed in accordance with the requirements in 49 CFR 193.2303, via incorporation by reference of NFPA 59A (2001 Edition), Section 4.5 Testing of LNG Containers. The inner 9-percent nickel steel container of the LNG storage tanks would be hydrostatically tested using water from the BSC. Once the construction opening in the outer concrete wall is closed, the integrity of the outer tank would be pneumatically tested. Each LNG storage tank would require about 30 million gallons of test water. Hydrostatic testing of the LNG storage tanks is currently anticipated to be conducted one at a time. Water is not proposed for reuse, resulting in a total of 120 million gallons of water being withdrawn from the BSC for hydrostatic testing of the inner tanks. After testing is complete, the test water would be released into the onsite retention ponds, tested, and treated as applicable, before being released back into the BSC in accordance with applicable permits and RG LNG's Hydrostatic Test Plan for the LNG tanks.

2.5.1.7 LNG Truck Loading Facilities

After site preparation, RG LNG would install piling and foundations for the pipe rack, truck loading shelter, loading area, weigh scale, and associated equipment. The LNG spill containment system and truck loading pipe racks and shelter would then be installed. Once these components are set in place and secured on the foundations, piping from the LNG storage tank area to the LNG truck loading area; metering equipment; loading arms; and electrical, instrument, and gas detection systems would be installed. Concurrently, fire protection, including a firewater deluge system, would be installed in the LNG truck loading area, and a foam system would be installed for the LNG truck area spill containment basin. LNG truck loading systems and controls would be verified and tested for proper functioning before being placed into service, in accordance with ASME standards. All valves would be aligned in accordance with the facility commissioning procedures, including installation of car seals (valve locks) where necessary. LNG piping systems would be purged with nitrogen and dried out in accordance with the facility dry-out procedures, followed by the facility cool-down phase.

2.5.1.8 Compressor Station 3

As described in section 2.0, RB Pipeline would construct and operate its Gas Gate Station within the boundaries of the LNG Terminal site. Construction methods related to RB Pipeline's aboveground facilities is discussed in section 2.5.2.2.

2.5.1.9 Site Restoration

Following construction, the entire 750.4 acres of land used during construction would be retained for operations. RG LNG plans to vegetate the northern levee and certain open areas within the fenceline using native species to the extent practicable, and as determined in coordination with the FWS, EPA, and the Natural Resources Conservation Service (NRCS). RG

LNG is also proposing to maintain the east and west edges of the property, which would not be disturbed during construction, as natural buffer areas.

2.5.2 Pipeline Facilities

2.5.2.1 Pipeline System

RB Pipeline would construct the Pipeline System in accordance with its Plan and Procedures, and in compliance with the requirements of 49 CFR 192 (Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards). Key aspects of construction are described below, and figure 2.5.2-1 depicts the typical pipeline construction sequence.

Survey and Staking

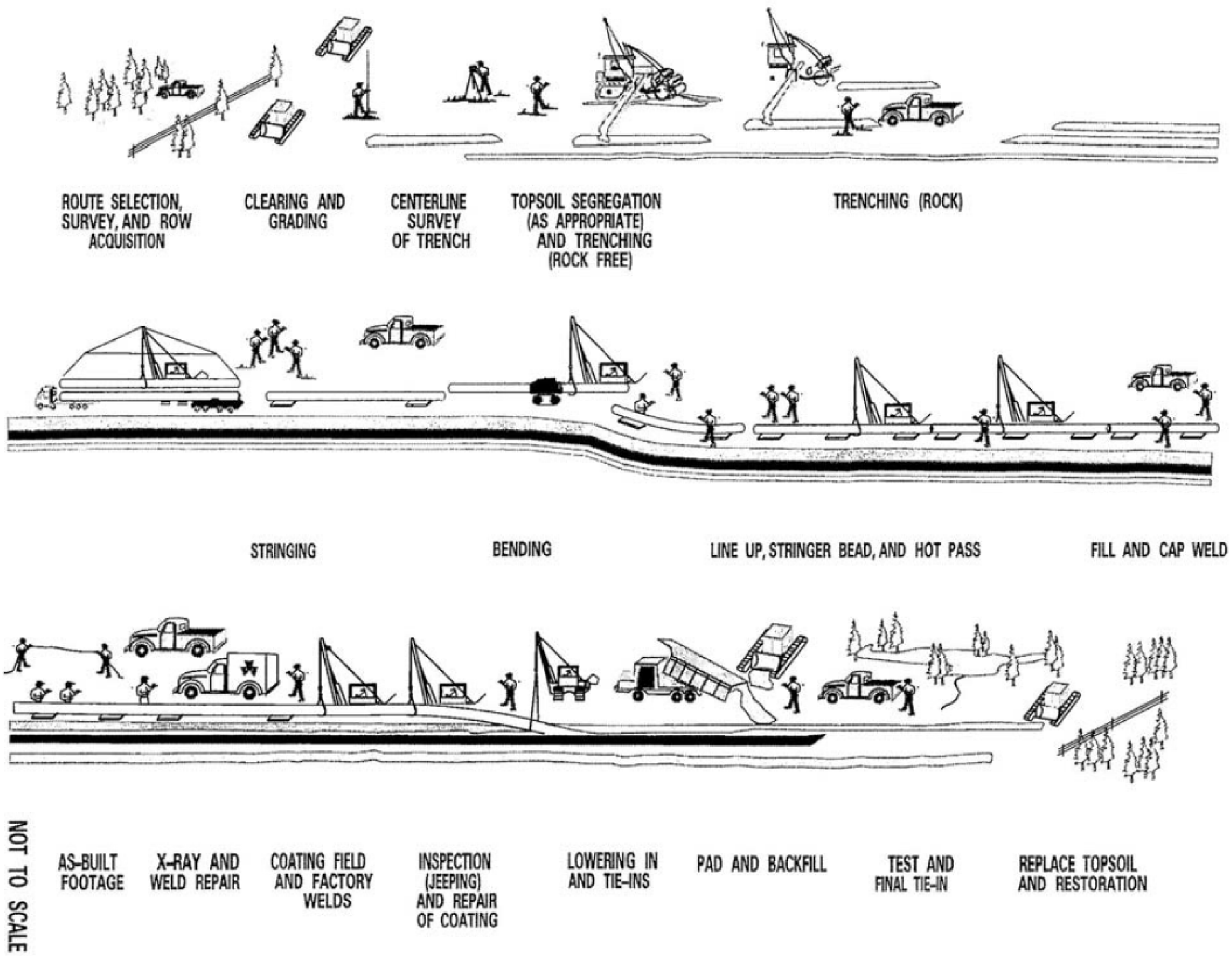
After RB Pipeline completes land or easement acquisition and before the start of construction, crews would mark the outside limits of the approved work areas (i.e., the construction right-of-way boundaries and ATWS), as well as the pipeline centerline, approved access roads, and features to be crossed. Property owners would be notified prior to surveying and staking activities. Wetland boundaries, cultural resources, and other environmentally sensitive areas within the right-of-way would be clearly marked with visible signage and fenced with erosion control devices for protection. As required by its Plan and Procedures, RB Pipeline would install temporary erosion controls after initial soil disturbance, where necessary, to minimize erosion and would be maintained throughout construction as needed.

Clearing and Grading

The construction workspace would be cleared and graded to remove brush, trees, roots, and other obstructions, such as large rocks and stumps. Vegetation removal would generally be conducted using mechanical means; however, hand-cutting with chain saws may be used in specific areas as needed for safety or environmental resource protection. To minimize soil erosion, removal of vegetation would be limited in certain locations, such as stream banks and slopes, as practicable. Where necessary, the construction workspace would be graded to create a safe work area, accommodate pipe-bending equipment, and provide sufficient space to accommodate working and passage of heavy construction equipment.

RB Pipeline would limit grading in wetlands to the extent practicable, and restoration would be completed per the terms of a Project-specific wetland plan that RG LNG would develop in consultation with the COE. In addition, RB Pipeline would install temporary fences and gates where needed, including where requested by landowners to prevent off-road vehicle access.

In uplands, tree stumps and rootstock would be removed from construction workspaces, as necessary. In wetlands, the pulling of stumps would be limited to the trenchline and other areas where it is deemed necessary for safety reasons. Elsewhere in wetlands, stumps and rootstock would be left intact to promote revegetation following construction.



Rio Grande LNG Project

Typical Pipeline Construction Sequence

Figure 2.5.2-1

Trees and other woody vegetation debris (including excavated stumps) would be chipped, burned, or disposed of offsite according to applicable regulations and local ordinances. Cleared trees may also be removed from the right-of-way by the clearing contractor and used for timber. Chipped material may be spread across upland portions of the right-of-way, outside of agricultural land, in a manner that does not prohibit revegetation.

Immediately following clearing, and before beginning grading activities, crews would install erosion control devices at the locations outlined in RG Developers' Plan and Procedures. This would include the installation and maintenance of temporary erosion controls such as silt fence, straw bales, temporary slope breakers (interceptor dikes); as well as permanent erosion controls such as permanent trench plugs and slope breakers. The EI would be responsible for ensuring that the erosion controls are installed correctly, inspected, and maintained in accordance with the Plan and Procedures.

Grading would take place after the construction workspace has been cleared and any stumps have been removed. In cultivated or rotated cropland and managed pastures, RB Pipeline would strip and segregate up to 12 inches of topsoil over the trenchline and spoil storage side of the right-of-way; if the topsoil is less than 12 inches in depth, the actual depth of the topsoil would be removed and segregated. RB Pipeline may also strip and segregate up to 12 inches of topsoil in non-agricultural areas, if requested by a land management agency or landowner. Excavated materials would typically be stored on the non-working side of the construction workspace; however, site-specific conditions may require that the topsoil be stored or placed on the working side adjacent to the trench or at the edge of the construction workspace.

Trenching

Track-mounted excavators and/or wheel ditching machines would be used to excavate the pipeline trenches to a depth sufficient to allow approximately 3 feet of coverage of the pipelines, which, once constructed must comply with the DOT standards at 49 CFR 192. The width of the trenches would be about 10 to 14 inches wider than the pipeline, dependent on the substrate crossed. In areas with consolidated rock, if encountered during construction, the minimum amount of cover would be 2 feet. A deeper burial depth may be required in certain areas such as at crossings of foreign pipelines, foreign utilities, waterbody crossings, and where requested by the landowner, if applicable. Additional depth of cover generally requires a wider construction right-of-way to store the additional spoil. Any areas used for the disposal of excess construction materials would be in compliance with RG Developers' Plan, and applicable regulations and permits.

Spoil material excavated from the trench would be temporarily piled to one side of the right-of- way, adjacent to the trench. Subsoil would not be allowed to mix with the previously stockpiled topsoil. Where trench dewatering is needed, water would be discharged off the right-of-way into a well-vegetated upland area and/or into an approved filter.

Pipe Stringing, Bending, Welding, and Lowering-in

Prior to pipeline construction, the pipe would be moved into the contractor/pipe yards by rail or truck, then trucked to the required locations along the right-of-way. The pipe segments (also called "joints") would be positioned along the construction right-of-way parallel to the centerline of the trench so they are easily accessible to construction personnel. The joints are typically strung on the working side of the trench for bending, welding, coating, and lowering-in operations and the associated inspection activities.

Track-mounted hydraulic pipe-bending machines would be used to bend the pipe in the field to the required alignment and to match the existing natural ground contours, although pre-fabricated induction bends may be used for larger bends. Following bending, the ends of the pipe sections would be aligned and welded together, typically with the use of external line-up clamps or internal traveling line-up clamps. As each weld is completed, the pipe would be placed on supports adjacent to the trench. Each weld would be inspected visually, radiographically, or by some other nondestructive testing method. Bending, welding, and coating activities would comply with the DOT's minimum safety requirements at 49 CFR 192 and the requirements of the API Standard.

Prior to shipment to the site, an external protective coating is typically applied to pipe to prevent corrosion, except for a small area at the end of the pipe joint. After welding, the pipe joints would be coated with similar or compatible materials. The entire pipe coating would be inspected for defects, and any damage would be repaired prior to lowering the pipe into the trench.

Before the pipeline is lowered in, the trench would be inspected to ensure that it is free of rocks and other debris that could damage the pipe or protective coating. RB Pipeline may elect to use a padding machine, where applicable, to ensure that rocks mixed with subsoil do not damage the pipe. The padding would consist of subsoil free from rocks and would surround the pipe along the bottom, both sides, and at the top. No topsoil would be used as padding material. Where there is not sufficient padding material on site or when the native material that was excavated from the trench is not suitable backfill material (e.g., too rocky), RB Pipeline would acquire additional material from existing borrow pits.

Typically, any water that is present in the trench would be removed and pumped to a vegetated upland through an approved filter. In some locations, such as within saturated wetlands, it may be necessary to provide negative buoyancy to the pipe, which RB Pipeline could accomplish by installing counter buoyancy weights.

Backfilling

After the pipeline is lowered into the trench and adequately protected, the trench would be backfilled using a bulldozer, backhoe, auger-type backfilling machine, or other suitable equipment. Backfill typically consists of the material originally excavated from the trench. In areas where topsoil has been segregated, the subsoil would be placed in the trench first and then the topsoil would be placed over the subsoil. Backfilling would be to grade or higher, with use of excess material to accommodate any future soil settlement. Any material unsuitable for backfill would be disposed of in accordance with applicable regulations. If additional backfill were required, material would be obtained from established borrow pits.

During backfilling, RB Pipeline would minimize erosion potential by restoring the natural contour of the ground and surface drainage patterns as close to pre-construction conditions as practicable. In order to minimize the possibility of subsurface water flow into the trench due to local topography, sandbags or foam-type trench breakers would be installed where necessary. Where the Pipeline System crosses streams, wetlands, or groundwater, permanent trench plugs may be installed as appropriate to minimize the flow of water from the intersected body to and from the trench.

Permanent slope breakers would be installed along the right-of-way, where necessary, to reduce runoff velocity and prevent sediment deposition into sensitive resources. Due to the relatively flat nature of the local terrain, RB Pipeline anticipates that trench and/or slope breakers would be needed in only limited areas.

Testing

Once pipeline installation and backfilling are completed, the pipelines would be cleaned using a cleaning pig and hydrostatically tested, and once constructed, must comply with the DOT safety standards at 49 CFR 192 and applicable permit conditions to verify its integrity and ensure its ability to withstand the MAOP. Hydrostatic testing would be conducted in segments, and consists of capping the ends of a pipe section using foam-filling pigs, filling the pipeline with water, pressurizing the pipeline to 125 percent of its MAOP, and maintaining that test pressure for a minimum of 8 hours. After testing is completed, the line would be depressurized and the water discharged by means of foam-drying pigs. Where appropriate, test water would be reused in subsequent sections of pipe to minimize water usage.

RB Pipeline proposes to use approximately 21.0 million gallons of water to hydrostatically test each pipeline (Pipelines 1 and 2). The water would be obtained from one of three waterbodies, including Los Olmos Creek (MP 19.2), Arroyo Colorado (MP 99.8), and Resaca De Los Cuates (MP 118.7). About 1.2 million gallons would be used to hydrostatically test the Header System; this water would be trucked in, or piped in from another test section. Water pumps would be placed in or near the source waterbody and covered with a 4-millimeter mesh screen to prevent entrainment or impingement of aquatic organisms. The rate of withdrawal would be dictated by the flow rate at the source waterbody so that adequate flow rates within the waterbody would be maintained for the protection of aquatic life.

Pumps would be located on mobile equipment and water would be withdrawn in accordance with applicable waterbody withdrawal permits. Pumps would be placed outside of wetlands and riparian areas to the extent practicable, and would be placed in secondary containment if within 100 feet of a wetland or waterbody. Hydrostatic test water discharges would be performed in accordance with all applicable state water regulations and federal and state discharge requirements. The water would be discharged into a well-vegetated upland area using energy dissipation devices as needed to minimize erosion and sedimentation. No chemicals are proposed to be added to the pipeline test water. If brackish water sources are proposed for use at a later date, RB Pipeline would develop a specific hydrostatic test plan to address the use, treatment, and disposal of the brackish test water, in compliance with applicable regulations. Section 4.3.2.2 provides additional information on hydrostatic testing and test water discharge.

Cleanup and Restoration

After the trench is backfilled, RB Pipeline would remove all remaining debris, surplus materials, and temporary structures and dispose of them in accordance with applicable federal, state, and local regulations. In accordance with the Project-specific Plan, RB Pipeline would finish grade and restore all disturbed areas as closely as practicable to pre-construction contours. Site contouring would be accomplished using acceptable excess soil from construction. Restoration and revegetation would be conducted in accordance with the Project-specific Plan, Procedures, NRCS and county conservation district reseeding recommendations, and landowner requirements.

Cathodic Protection and Alternating Current Mitigation

RB Pipeline would install cathodic protection equipment along the pipeline to prevent the corrosion of metal surfaces over time. Cathodic protection groundbeds would be sited within the permanent right-of-way near county roadways with available electrical power connections, or within the footprint of the aboveground facilities. These systems could consist of underground negative connection cables, linear anode cable systems, aboveground junction boxes, and/or rectifiers. Prior to construction of the proposed Project, RB Pipeline would also develop an Alternating Current Mitigation Plan to ensure safety and prevent corrosion for areas where the pipeline parallels high voltage power lines.

Special Construction Procedures

Construction involving wetlands, waterbodies, or construction across or within roads, highways, railroads, and streets, would require construction techniques that differ from the standard measures implemented in general areas. RB Pipeline's special construction techniques are summarized below.

Agricultural Areas

RB Pipeline would construct through agricultural areas in accordance with its Plan to minimize impacts on current agricultural uses. Although no drain tiles or irrigation systems have been identified to date, RB Pipeline is continuing to consult with landowners to determine the presence of these systems, or any that would be installed within 3 years of construction, and would repair or replace any such system impacted by construction.

In agricultural land that is annually cultivated, has rotated crops, or is composed of managed pastures, RB Pipeline would remove the actual depth of topsoil over the trench and spoil side of the construction right-of-way, up to a maximum of 12 inches, and stockpile it separately from the subsoil excavated from the pipeline trench. Following installation of the Pipeline System, agricultural areas would be restored in accordance with the Project-specific Plan.

Wetland Crossings

The Pipeline System would cross forested, scrub-shrub, and emergent wetlands, as further discussed in section 4.4. Construction and restoration activities within wetlands would be performed in accordance with the wetland construction and mitigation measures contained in RG Developers' Procedures. RB Pipeline has proposed a 75-foot-wide construction right-of-way through most wetlands; a 100-foot-wide right-of-way is proposed for wetland crossings that are 1,000 feet or longer to allow for spoil storage (see appendix F).

During clearing, vegetation in wetlands would be cut flush with the surface of the ground and removed from the wetland for disposal. Stump removal, grading, topsoil segregation, and excavation would be limited to the area immediately over the trenchline to avoid excessive disruption of wetland soils and the native seed and rootstock within the wetland. A limited amount of stump removal and grading may also be conducted in other areas if dictated by safety-related concerns. Immediately after initial ground disturbance, erosion control devices such as silt fence and staked straw bales would be installed and maintained adjacent to wetlands and within temporary extra workspaces as necessary to minimize the potential for sediment runoff. Sediment barriers would be installed across the full width of the construction right-of-way at the base of slopes adjacent to wetland boundaries. If trench dewatering is necessary in wetlands, the trench water would be discharged into stable, vegetated, upland areas and/or filtered through a filter bag or sediment basin in accordance with RG Developers' Procedures. No heavily silt-laden discharge water would be allowed to flow into a wetland.

Construction equipment working in wetlands would be limited to that essential to clear the right-of-way, excavate the trench, fabricate and install the pipeline, backfill the trench, and restore the right-of-way. The specific method of construction used in wetlands would depend on the stability of the soils at the time of construction. Standard pipeline construction, similar to construction methods described for upland areas, with the use of timber mats, may be conducted in non-saturated wetlands. In areas of saturated soils or standing water, low-ground-weight construction equipment and/or equipment mats would be used to reduce rutting and the mixing of topsoil and subsoil. In unsaturated wetlands, the top 12 inches of topsoil from the trenchline would be stripped and stored separately from the subsoil. Trenchless construction techniques, such as conventional bore and horizontal directional drill (HDD) would also be used to cross under certain wetlands, as discussed below.

After the pipeline is lowered into the trench and backfilled, the disturbed areas would be graded to pre-construction contours and elevations. Prior to backfilling, trench breakers would be installed where necessary to prevent the subsurface drainage of water from wetlands. Where topsoil has been segregated from subsoil, the subsoil would be backfilled first, followed by the topsoil. For wetlands at the base of slopes, permanent slope breakers would be installed in upland areas adjacent to the wetland boundary. Equipment mats, terra mats, and timber rip-rap used for equipment support would be removed from wetlands following backfilling.

Temporary sediment barriers would be installed where necessary until revegetation of adjacent upland areas is successful. Restoration would be in accordance with RG Developers' Procedures and monitored until revegetation is successful. Once revegetation is successful, sediment barriers would be removed from the right-of-way and properly disposed.

Waterbody Crossings

The FERC defines a waterbody as any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes. RB Pipeline would implement the measures in the Project-specific Procedures to minimize the extent and duration of construction disturbance of waterbodies. RB Pipeline would cross waterbodies using methods including conventional wet open-cut, conventional open-cut (if dry at the time of crossing), flume, or trenchless crossings (i.e., conventional bore or HDD).

Waterbody crossings typically require extra workspaces on each side of the waterbody to stage construction, fabricate the pipeline, and store materials. These extra workspaces would be located a minimum of 50 feet from the waterbody edge, except where the adjacent upland consists of actively cultivated or rotated cropland or other disturbed land, or where site-specific requests for a reduced setback have been requested and approved (section 4.3.2 and appendices F and G).

Waterbodies crossed using wet open-cut methods would be installed within a construction right-of-way between 75 and 100 feet wide, depending on site-specific conditions and construction methods, as further addressed in section 4.3.2.2. Where waterbodies are dry at the time of crossing, they would be crossed using conventional open-cut methods. However, if flow becomes discernable, RB Pipeline would cross the waterbody in accordance with the Procedures.

Temporary equipment bridges would be placed across waterbodies to allow construction equipment to cross with minimal impact on the waterbody. Temporary equipment bridges may consist of prefabricated construction mats, rail flat cars, flexi-float or other temporary bridges, or flume installations. Flume installations include suitably sized culverts and a travel surface consisting of clean rock fill. At all temporary equipment bridge locations, care would be taken to minimize sedimentation of the waterbody and to install culverts in a way that would prevent scour.

RB Pipeline would place the pipeline a minimum depth of 3 feet below the stream bottom. Material excavated from the trench would be stockpiled at least 10 feet from the water's edge and generally used as backfill. All waterbody banks would be restored to pre-construction contours and elevations, and disturbed riparian areas would be revegetated. Post-construction maintenance would be limited so that a 25-foot-wide riparian strip along each waterbody bank would be allowed to revegetate to pre-construction conditions. Clearing within the riparian strip would be limited to a 10-foot-wide area centered on a given pipeline to facilitate operational surveys.

Flume Crossing Method

Although not currently proposed for use, RB Pipeline may elect to cross flowing waterbodies via flume crossing, if warranted and approved by FERC at the time of crossing. The flume crossing method consists of temporarily directing the flow of water through one or more flume pipes over the area to be excavated. This method allows excavation of the pipe trench across the waterbody underneath the flume pipes without disruption of water flow in the stream.

RB Pipeline would divert the stream flow through the flumes by constructing sand bag bulkheads to direct the flow through the flume pipes. The bulkheads and flume pipes would be removed following completion of pipeline installation, backfill of the trench, and restoration of stream banks. If topographic conditions would not allow for the pipe to be installed under the flumes, RB Pipeline may temporarily pump the water, raise the flume to place the pipeline, and reinstall the flume to finish the crossing.

Wet Open-cut Method

RB Pipeline would cross minor and intermediate waterbodies that are not state-designated for high aquatic life use or federally designated as critical habitat via open cut in accordance with its Procedures; major waterbodies would also be crossed via wet open-cut methods. Wet, open-cut crossings involve excavation of the pipeline trench, pipeline placement, and backfill in flowing conditions. Depending on the width of the waterbody, excavation would take place from equipment operating from the banks of the waterbody.

In accordance with the Project-specific Procedures, instream construction activities associated with minor waterbody crossings (i.e., those less than 10 feet wide) would be completed within 24 hours, and intermediate waterbody crossings (between 10 and 100 feet wide) would be completed within 48 hours, as practicable. Sediment barriers (silt fence and/or straw bales) would be installed at the waterbody crossing to minimize sedimentation into the waterbody from disturbed upland areas.

Trenchless Crossing Methods

RB Pipeline has proposed the use of trenchless crossing methods in areas of sensitive environmental resources, complex crossings, and surface features requiring avoidance. Trenchless methods result in the pipeline transiting under a feature with little to no surface disturbance, but generally require more staging workspace at either side of a feature. The methods currently being considered for use by RB Pipeline include conventional bore and HDD.

Conventional Bore

Conventional boring consists of creating a tunnel-like shaft for a pipeline to be installed below roads, waterbodies, wetlands, or other sensitive resources without affecting the surface of the resource. Bore pits would be excavated on both sides of the resource to the depth of the pipeline installation. A boring machine would then be used within the bore pit to tunnel under the feature of concern by using a cutting head mounted on an auger. The auger would rotate and be advanced forward as the hole is bored. The pipeline would then be pushed through the bore hole and welded to the adjacent section of pipeline. RB Pipeline proposes to cross 5 waterbodies and 64 roads using conventional bore methods (see appendices G and H, respectively).

Horizontal Directional Drill

The HDD method typically involves establishing workspaces in upland areas, where possible, on both sides of the feature(s) to be crossed and confining the work and equipment to these areas. The process commences with the drilling of a pilot hole in an arced path beneath the feature using a drill rig positioned on the entry side of the crossing. When the pilot hole is completed, reamers are attached and then used to enlarge the hole in one or more passes until its diameter is sufficient to accommodate the pipeline. As the hole is being reamed, a pipe section long enough to span the entire crossing is fabricated (staged and welded) on one side of the crossing (typically the exit side) and then hydrostatically tested to ensure the integrity of the welds. When the reaming is complete, the prefabricated and tested pipe section is pulled through the pre-reamed drilled hole back to the entry side. RB Pipeline would hand-clear a 2-foot-wide swath of vegetation over the path of the HDD to facilitate placement of guide wires to direct the path of the drill.

Throughout the drilling process, a slurry of bentonite clay (a naturally occurring, non-toxic substance) and water would be pressurized and pumped through the drilling head to lubricate the drill bit, remove drill cuttings, and hold the hole open. This slurry, referred to as drilling mud or drilling fluid, has the potential to be inadvertently released to the surface during an HDD. The pipeline route would be monitored, as would the circulation of drilling mud throughout the HDD operation, for indications of an inadvertent drilling mud release; RB Pipeline would immediately implement corrective actions if a release is observed or suspected. The corrective actions that RB Pipeline would implement, including the agencies it would notify and the steps it would take to clean up and dispose of a release, are outlined in RB Pipeline's HDD Contingency Plan, which is discussed in section 4.3.2.2.

RB Pipeline would obtain water for the drilling fluid from the waterbody being crossed, where applicable. Water for the remaining locations would be transported from permitted locations. Withdrawal of water to support HDD construction would be conducted using mobile equipment in accordance with applicable waterbody withdrawal permits. Clearing at these locations would be restricted to the hand-clearing of small-diameter shrub and herbaceous vegetation.

It is possible for HDD operations to fail, primarily due to the presence of unexpected geologic conditions along the path of the HDD, or if the pipe were to become lodged in the hole during pullback operations. Potential causes for abandoning a drill hole include the loss of drill bits or pipe down the hole due to a mechanical break or failure; a prolonged release of drilling mud that cannot be controlled; failure of the HDD pullback where a section of pipe cannot be retracted and has to be abandoned; or an inability to correct a severe curvature of the pilot hole drill path. RB Pipeline would be required to seek approval from the Commission and other applicable agencies prior to abandoning any HDD crossing in favor of another construction method; however, abandonment measures would include filling the drill hole(s) with drilling mud, grouting the upper 30 feet, and grading the surface to original contours. RB Pipeline's preferred alternative crossing method, in the event that any proposed trenchless crossing were to fail, would be developed in consideration of site-specific conditions, and could include a second HDD attempt, changes in drilling procedures, or open-cut construction.

The HDD construction method has been proposed for use at 19 locations (see table 2.5.2-1). Table 2.5.2-1 also identifies the volume of water that would be required for HDD construction of each crossing. RB Pipeline has provided preliminary HDD crossing plans, which we have reviewed and found acceptable. RB Pipeline would provide final crossing plans during detailed engineering, after geotechnical surveys have been completed. If geotechnical surveys indicate that an HDD is infeasible, RB Pipeline would consider alternative crossing methods. As the geotechnical surveys for proposed HDD locations have not been conducted, we have included a recommendation in section 4.1.1.2 that RB Pipeline provide them for review prior to construction.

Table 2.5.2-1
Proposed HDD Crossings along the Rio Bravo Pipeline

Entry MP	Exit MP	Crossing Length (feet)	Feature Crossed	Water Volume Required (gallons)[a, b]
18.8	19.2	1,600	Los Olmos Creek (SS-T05-001)	902,400
77.6	78.0	1,600	Unnamed waterbody (SS-T10-011)	902,400
79.0	79.3	1,600	Unnamed waterbody (SS-T10-010)	902,400
82.0	82.6	3,100	East Main Drain (SS-T10-003)	1,748,400
86.5	86.8	1,600	Donna Drain (SS-T10-008)	902,400
92.0	92.3	1,600	Unnamed waterbody (SS-T04-005)	902,400
93.0	93.7	3,600	North Floodway (SS-T02-004)	2,030,400
94.6	95.0	1,700	Unnamed waterbody (SS-T04-008)	958,800
98.7	99.0	1,600	Unnamed waterbody (SS-T04-006)	902,400
99.8	100.2	2,200	Arroyo Colorado (SS-T09-007)	1,240,800
101.2	101.5	1,600	Unnamed waterbody (SS-T14-004)	902,400
102.0	102.3	1,600	San Vincente Drainage (SS-T08-001) Ditch	902,400
115.6	115.9	1,600	Unnamed waterbody (SS-T04-007)	902,400
116.4	116.7	1,600	Unnamed waterbody (SS-T05-003)	902,400
118.7	119.3	3,200	Resaca de los Cuates (SS-T04-009), Farm Pond (HY-T04-003)	1,804,800
124.0	124.3	1,600	Unnamed waterbody (SS-T09-008)	902,400
130.5	130.8	1,600	Unnamed waterbody (SS-T09-001)	902,400
132.9	133.8	4,800	Channel to San Martin Lake (SS-T01-001)	2,707,200
134.5	135.5	5,600	Channel to Bahia Grande (SS-T02-001)	3,158,400

[a] Water required for the drilling mud is provided for both Pipelines 1 and 2.

[b] RB Pipeline would obtain water for the drilling fluid from either municipal sources or from the waterbody being crossed, where applicable. Water for the remaining locations would be transported from permitted locations.

Direct Pipe

The Direct Pipe procedure is another trenchless construction method that is similar to HDD, but is also combined with processes related to microtunnelling. A single, continuous process allows the trenchless installation of pre-fabricated pipeline simultaneously with development of the bore hole. A Direct Pipe installation is different from an HDD in that the initial cutterhead used is much larger, eliminating the reaming process. Direct Pipe installations may also be shorter and shallower than HDD installations because the bore hole is continuously cased, thereby limiting the risk of hole collapse and the inadvertent release of drilling fluids.

For the Direct Pipe method, excavation and hole boring are performed with a navigable microtunnelling machine and cutterhead. Temporary flushing pipes located inside the pipeline are used to transport drilling fluids to the cutterhead and earthen cuttings to the surface. The pressure used to advance the boring process and simultaneously install the pipeline is applied directly to the pipeline by a piece of equipment called a "pipe thruster." The force applied on the pipeline pushes the cutting head forward. Reliable installation and monitoring methods ensure accurate measurement of the pipe's location along the intended pathway. RB Pipeline is not currently proposing the use of the Direct Pipe crossing method; however, this method would be considered as an alternative to the HDD crossing method in areas if geotechnical surveys indicate an HDD crossing is not feasible.

Road and Utility Line Crossings

A total of 276 existing roads would be crossed by the Pipeline System during construction (see appendix H). Of these roads, 95 would be crossed by trenchless methods (64 by conventional bore and 31 by HDD). The remaining roads would be open cut, and the pipeline would be installed so that 3 feet of cover was maintained between the top of the pipe and the surface of the ground. Eight roads overlap proposed construction workspaces but would not be crossed by the centerline. The Pipeline System would also cross the Union Pacific Railroad at MP 69.9 via bore; we have recommended in section 4.12.3 that RB Pipeline consult with the Union Pacific Railroad Company to discuss concerns regarding the proposed crossing method.

For any road affected by Project workspaces, but not approved for use as an access road, RB Pipeline would put up signage to signify that the road could not be used by construction personnel. Travel across roads proposed for open-cut crossings, as well as roads within construction workspaces but not crossed by the pipeline, would be delayed or precluded during active construction. In addition, the pull-strings of two HDDs would temporarily encroach on roads (Palo Blanco Road at MP 94.2 and Parker Road at MP 101.9). At each of these locations, RB Pipeline indicated that sufficient alternative routes are available for local traffic during the road closure. RB Pipeline would coordinate with the local operator of the road to minimize impacts. If a landowner requests RB Pipeline to maintain open traffic flow on a given private road, or if a road is located within a contractor/pipe yard or aboveground facility, RB Pipeline would work with the landowner to create a temporary (or permanent) bypass. All impacted roads would be restored to pre-construction contours after construction has been completed.

The Pipeline System would cross numerous underground utilities (see table 2.5.2-2). Prior to construction, RB Pipeline would contact the Texas "One-Call" system to verify and mark all underground utilities (e.g., cables, conduits, and pipelines) along the pipeline route to minimize the potential for accidental damage during construction. For crossings of single utilities, RB Pipeline would excavate the pipeline trench to a depth that allows a minimum of 18 inches of clearance between the top of the proposed pipeline and the bottom of the foreign utility. If the utility is sufficiently deep, and if acceptable to the utility owner and compliant with the Occupational Safety and Health Administration, RB Pipeline may also install the proposed pipeline over the foreign utility.

Table 2.5.2-2
Buried Utility Crossing Locations

Location (MP)	Utility
Header System	
HS-0.1	Pipeline
HS-0.1	Pipeline
HS-0.1	Pipeline
HS-0.1	Pipeline
HS-0.1	Pipeline
HS-0.2	Pipeline
HS-0.2	Pipeline
HS-0.2	Pipeline
HS-0.2	Pipeline
HS-0.3	Pipeline
HS-0.3	Pipeline
HS-0.3	Pipeline
HS-0.3	Pipeline
HS-0.4	Pipeline
HS-0.4	Pipeline
HS-0.5	Pipeline
HS-0.6	Pipeline
HS-0.6	Pipeline
HS-0.7	Pipeline
HS-0.8	Pipeline
HS-0.8	Pipeline
HS-0.9	Pipeline
HS-0.9	Pipeline
HS-1.3	Pipeline
HS-2.1	Pipeline
HS-2.1	Pipeline
Pipelines 1 and 2	
0.0	Pipeline
0.4	Pipeline
0.5	Pipeline
0.9	Pipeline
0.9	Pipeline
3.3	Pipeline
3.4	Pipeline
11.7	Pipeline
12.8	Pipeline

Table 2.5.2-2 (continued) Buried Utility Crossing Locations	
Location (MP)	**Utility**
Header System (continued)	
13.7	Pipeline
15.6	Pipeline
18.6	Pipeline
19.5	Pipeline
20.3	Pipeline
25.5	Pipeline
25.5	Pipeline
27.5	Pipeline
27.8	Pipeline
27.9	Pipeline
30.7	Pipeline
30.7	Pipeline
32.2	Pipeline
32.2	Pipeline
40.8	Pipeline
59.9	Pipeline
68.5	Pipeline
69.8	Pipeline
71.7	Pipeline
72.4	Pipeline
79.7	Cable
88.0	Pipeline
91.0	Pipeline
92.8	Telephone
105.0	Pipeline
112.5	Cable
119.6	Pipeline
122.0	Pipeline
122.0	Pipeline
123.4	Cable
123.4	Pipeline
123.4	Pipeline
124.5	Pipeline
125.8	Pipeline
131.5	Pipeline
131.6	Pipeline
133.9	Pipeline

Excavations of foreign utilities would be conducted per the utility owner's specifications, and at the direction of the onsite representative, if present. In addition, RB Pipeline would only allow excavation by hand or hydrovac within 18 inches of foreign utilities. RB Pipeline plans to consult with the owners of foreign utilities crossed by the proposed Pipeline System during detailed engineering.

2.5.2.2 Aboveground Facilities

RB Pipeline has proposed to construct three compressor stations (one of which would be within the boundaries of the LNG Terminal), two booster compressor stations, eight metering sites, and assorted ancillary facilities along the Pipeline System. Facility sites would be cleared, graded, and compacted to create a level surface, as appropriate. Based on initial reviews by RG Developers' geotechnical engineers, shallow foundations consisting of spread and strip footings can be used to support relatively lightly loaded structures at all three compressor stations sites.

Mat foundations can be used to support relatively heavily loaded structures to be constructed at the Compressor Station 1 site, and likely at the Compressor Station 2 site, pending geotechnical investigations. Mat foundations at the Compressor Station 3 site were not recommended due to the low strength of upper cohesive soils. If a mat foundation is not suitable for the heavily loaded structures, then deep foundations would be used. Additionally, significant amount of settlements may occur for structures supported on shallow foundations at Compressor Station 3 site due to the presence of soft fill soils in the upper few feet; therefore, deep foundations were recommended.

Erosion and sediment controls would be established around disturbed areas prior to construction. Facility buildings would comply with local building codes, permit conditions, and regulatory requirements. Permanent parking areas and access roads would be constructed concurrently with their respective aboveground facility. Once all facilities have been installed, all aboveground and underground piping would be hydrostatically tested in accordance with 49 CFR 192, using water from municipal sources.

All areas used for construction, but outside of the operational footprint of the facility, would be finish-graded and seeded to stabilize soils. Final grading and landscaping plans for the aboveground facilities would be developed prior to construction. Outdoor lighting at compressor stations would be limited to that required for security and would be either directionally controlled or downward facing to minimize the visual impact on local residents and migratory birds.

2.6 OPERATION AND MAINTENANCE PROCEDURES

2.6.1 LNG Marine Traffic along the Waterway

Although LNG carriers and their operation are directly related to the use of the proposed LNG Terminal, they are not subject to the Section 3 authorization sought in this application. The LNG carriers arriving at the LNG Terminal must comply with all federal and international standards regarding LNG shipping. A detailed discussion of design and safety features of LNG carriers is presented in section 4.12.1.

Inbound LNG carriers would embark either one or two Brazos Santiago Pilots at Sea Buoy "RW 'BS' MO (A), which is offshore of South Padre Island. From the sea buoy, inbound LNG carriers would transit under command of the pilot(s). With tug support, the LNG carriers would travel up the BSC at speeds between 5 and 10 knots, for a total inbound transit time of about 2 hours. Upon arrival at the LNG Terminal, the LNG carriers would be turned in the turning basin and moored to the appropriate marine berth; these maneuvers are estimated to take an additional one hour. Following loading at the LNG Terminal, the pilot(s) would resume navigational control of the LNG carrier when the mooring lines are let go.

Loaded LNG carriers would transit outbound along the reverse route described for inbound LNG carriers. Transiting LNG carriers may have a moving security zone established for them, in accordance with Coast Guard regulations at 33 CFR 165.30. Due to potential safety/security zone exclusions, vessels would likely not be permitted to pass an LNG carrier transiting the BSC or maneuvering in the turning basin; however, the exact navigation protocol would be determined by the Coast Guard. The Coast Guard issued the LOR for the Rio Grande LNG Project on December 26, 2017, which stated that the BSC is considered suitable for LNG marine traffic. The Coast Guard would review each LNG carrier transit on a case-by-case basis to identify what, if any, safety and security measures are necessary to safeguard the public health and welfare, critical marine infrastructure and key resources, the port, the marine environment, and vessels.

The COE is responsible for as-needed maintenance dredging of the BSC, and would be responsible for the proposed deepening of the BSC. RG LNG would be responsible for maintenance dredging of its berthing area and the area of the turning basin that is outside of the navigable channel. Based on modeled shoaling rates, RG LNG estimates that up to 500,000 yd^3 of material would be removed from the berthing area and turning basin every 2 to 4 years. Any maintenance dredging required at the MOF would be minimal and would be conducted concurrently with that of the eastern marine facilities. Placement of the materials for maintenance dredging is proposed for the Maintenance ODMDS, but final placement would be determined in coordination with the BND and other applicable agencies. Dredging and dredged material placement are discussed further in sections and 4.2.3 and 4.3.2.2.

2.6.2 LNG Terminal

RG LNG would operate and maintain its facilities in compliance with 49 CFR 193, 33 CFR 127, NFPA 59A, and other applicable federal and state regulations. Before commencing operation of the LNG Terminal, RG LNG would prepare and submit to FERC for approval operation and maintenance manuals that address specific procedures for the safe operation and maintenance of the LNG storage and processing facilities. RG LNG would also prepare an operations manual that addresses specific procedures for the safe operation of the ship loading facilities in accordance with 33 CFR 127.305. Operating procedures are required to address normal operations as well as safe startup, shutdown, and emergency conditions.

The estimated 330 personnel employed during operation of the LNG Terminal would be trained to properly and safely perform their assigned duties. Operators would be trained in the handling of potential hazards associated with LNG, cryogenic operations, and the proper operation of all the equipment. The operators would meet all the training requirements of the Coast Guard, DOT, and other regulatory entities.

The LNG Terminal's full-time maintenance staff would conduct routine maintenance and minor overhauls. Major overhauls and other major maintenance would be handled by outside maintenance contractors specifically trained to perform the required services. All scheduled and unscheduled maintenance would be entered into a computerized maintenance management system.

2.6.3 Pipeline Facilities

RB Pipeline would operate and maintain its facilities in compliance with the DOT's regulations at 49 CFR 192; the Project-specific Plan and Procedures (including approved deviations from the FERC Plan and Procedures); FERC Certificate conditions; and applicable federal, state, and local regulations. Facilities would be periodically inspected and maintained as required by applicable regulations. Operation of the facilities would be monitored electronically on a continuous basis, and an emergency shutdown system would be installed. In the event of an incident along the Pipeline System, or at a compressor station, booster station, or metering site, one of the permanent employees in the vicinity would respond to the event. RB Pipeline would employ 10 permanent staff upon operational start-up of Pipeline 1, and another 10 permanent staff upon operational start-up of Pipeline 2.

In accordance with federal regulations (49 CFR 192.615), RB Pipeline would develop an Emergency Response Plan (ERP) for the Project, and would develop a detailed Operations, Maintenance, and Inspection Manual. The ERP would incorporate procedures for identifying an emergency event and establishing communication with local fire, police, and public officials. RB Pipeline would participate in the Texas "One-Call" program for the facilities, and it has already identified a public awareness program for its natural gas facilities.

Operational activities associated with the Pipeline System would be limited primarily to maintenance of the permanent easement and inspection, repair, and cleaning of the pipelines. RB Pipeline would maintain vegetation on the permanent easement in upland areas by mowing, cutting, and trimming, except in areas of actively cultivated cropland and in accordance with its Plan and Procedures.

The entire construction right-of-way would be allowed to revegetate but would generally be maintained in an herbaceous state. Large brush and trees within 15 feet of the pipeline with roots that could compromise the integrity of the pipeline coating would be selectively cut and removed from the permanent easement. Pipeline inspection would be accomplished by ground and aerial surveys, and in accordance with applicable laws and regulations.

2.7 SAFETY AND SECURITY PROCEDURES

2.7.1 LNG Terminal

2.7.1.1 Siting Requirements

Siting the LNG Terminal facilities with regard to ensuring that the site selection and location would not pose an unacceptable level or risk to public safety is required by DOT's regulations in 49 CFR Part 193, Subpart B. DOT reviews the information and criteria submitted by RG LNG to demonstrate compliance with the safety standards prescribed in Part 193, Subpart B and issues a LOD to the Commission on whether the proposed facilities would meet the DOT siting standards. The LOD will evaluate the hazard modeling results and endpoints used to establish exclusion zones, as well as RG LNG's evaluation on potential incidents and safety measures incorporated in the design or operation of the facility specific to the site that have a bearing on the safety of plant personnel and the surrounding public. The LOD will serve as one of the considerations for the Commission to deliberate in its decision to authorize, with or without conditions, or deny an application. Additional information regarding DOT siting requirements is presented in section 4.12.2.

2.7.1.2 Hazard Mitigation

If operational control of the facilities were lost, and operational controls and emergency shutdown systems failed to maintain the Project within the design limits of the piping, containers, and safety relief valves, a release could potentially occur. FERC regulations under 18 CFR 380.12(o)(1) through (4) require applicants to provide information on spill containment, spacing and plant layout, hazard detection, hazard control, and firewater systems. In addition, 18 CFR 380.12(o)(7) require applicants to provide engineering studies on the design approach, and 18 CFR 380.12(o)(14) requires applicants to demonstrate how they comply with 49 CFR 193 and NFPA 59A. As required by 49 CFR 193 through incorporation of NFPA 59A (2001) Section 9.1.2, fire protection must be provided for all DOT-regulated LNG facilities based on an evaluation of sound fire protection engineering principles, analysis of local conditions, hazards within the facility, and exposure to or from other property. NFPA 59A (2001) also requires the evaluation to determine type, quantity, and location of hazard detection and hazard control, passive fire protection, emergency shutdown and depressurizing systems, and emergency response equipment, training, and qualifications. All facilities, once constructed, must comply with the requirements of 49 CFR 193 and will be subject to DOT's inspection and enforcement programs. Additional information regarding hazard mitigation is presented in section 4.12.1.

2.7.1.3 Fail Safe Shutdown System

The LNG Terminal would have an emergency shutdown system with shutdown sequences and control devices designed to leave the facilities in a safe state. This system would be supported by an uninterrupted power supply (i.e., batteries). The emergency shutdown system would be used for major incidents and would result in either total plant shutdown or shutdown of processes and/or individual pieces of equipment, depending on the type of incident.

2.7.1.4 Security

The security requirements for the proposed project are governed by 33 CFR 105, 33 CFR 127, and 49 CFR Part 193, Subpart J – Security. 33 CFR 105, as authorized by the Marine Transportation Security Act, requires all terminal owners and operators to submit a Facility Security Assessment and a Facility Security Plan to the Coast Guard for review and approval before commencement of operations of project facilities. RG LNG would 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. The LNG Terminal would meet all necessary security measures required under those regulations, including security fencing, lighting, access control, and closed-circuit television. Additional information regarding security requirements is provided in section 4.12.1.

2.7.2 Pipeline Facilities

2.7.2.1 Pipeline System

The pipeline facilities must be designed in accordance with the DOT regulations of 49 CFR 192 for material selection and qualification; minimum design requirements; and protection from internal, external, and atmospheric corrosion. The regulations also define four area classifications, based on population density in the vicinity of a proposed pipeline, for the purpose of ensuring more rigorous safety requirements for populated areas.

Class locations are used to determine pipe wall thickness, hydrostatic test pressures, weld inspection and testing requirements, spacing of MLVs, depth of cover, and frequency of pipeline patrols and leak surveys. RB Pipeline's facilities, once constructed, would be subject to DOT's inspection and enforcement programs.

RB Pipeline would install pipeline identification markers at line-of-sight intervals and at crossings of roads, railroads, waterbodies, and other key points in accordance with DOT regulations. The markers would clearly indicate the presence of the pipeline, identify RB Pipeline as the pipeline operator, and provide telephone numbers where a RB Pipeline representative could be reached in the event of an emergency or prior to any excavation in the area by a third party.

2.7.2.2 Compressor Stations

To protect the public, company personnel, and property, each compressor and booster station would be equipped with several safety devices. One of these safety systems is an automatic emergency detection and shutdown system. When activated, the emergency shutdown system would shut down the facility and isolate certain areas of the compressor or booster station. The emergency shutdown system would include sensors for natural gas concentrations and ultraviolet sensors for detecting a possible ignition source. The system would also shut down if a fire is detected within the compressor station. Additional detail regarding the emergency shutdown system is provided in section 4.12.9. Aboveground facilities would be monitored electronically on a continuous basis and would be surrounded by chain-link security fence.

2.8 FUTURE PLANS AND ABANDONMENT

RG Developers do not have any foreseeable plans to expand or abandon any aspect of the Project. If the Project facilities are abandoned in the future, RG Developers would need to comply with the appropriate federal, state, and local regulations in effect at that time (including the FERC's abandonment regulations).

3.0 ALTERNATIVES

As required by NEPA and FERC policy, we evaluated alternatives to the Rio Grande LNG Project to determine whether any such alternatives would be reasonable and have significant environmental advantages compared with the proposed action. NEPA requires that federal agencies evaluate reasonable alternatives to a proposed major federal action. According to the CEQ, "reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant" (CEQ 1981). Further, the FERC has established several key criteria to evaluate potential alternatives identified for a given project. The evaluation criteria for selecting potentially reasonable and environmentally preferable alternatives include whether they:

- are technically and economically feasible and practical;
- offer significant environmental advantage over the proposed projects or segments of either project; and
- meet the project's objectives of constructing and operating a terminal to serve the domestic and export markets for LNG, including:
    - export of LNG via large LNG vessels to foreign markets, consistent with RG LNG's DOE authorization for FTA nations, and pending application for non-FTA nations; and
    - distribution of LNG in trucks for use as a fuel for long-haul trucking and other emerging domestic uses of LNG.

With respect to the first criterion, not all conceivable alternatives are technically feasible and practical. For example, some alternatives may not be possible to implement due to technological difficulties or logistics. For the second criterion, in conducting an alternatives analysis, the environmental advantages and disadvantages of the proposed action must be recognized in order to focus the analysis on reasonable alternatives that may reduce impacts and offer a significant environmental advantage. Finally, an alternative must at a minimum meet the proposed project's objectives within a timeframe that would allow contractual obligations to be met.

The range of alternatives analyzed include the No-Action Alternative, system alternatives, LNG Terminal site alternatives, LNG Terminal site fill material supply access route alternatives, pipeline configuration and route alternatives, and aboveground facility site alternatives.

As part of the No-Action Alternative, we considered the effects and actions that might result if the proposed Project were not constructed. We identified system alternatives to evaluate the ability of existing, modified, planned, or proposed LNG export terminals and pipeline systems to meet RG Developers' objectives. We also evaluated alternative sites for the LNG Terminal and pipeline route alternatives. For each of the alternatives, we evaluated a broad level of resource impacts (e.g., wetlands, waterbodies, acreage of right-of-way during construction/operation, etc.) and if no significant environmental advantage was identified, we did not evaluate the alternative for further consideration. However, if a possible significant environmental advantage was identified, we refined our analysis to compare the proposed Project and the specific alternative to include more detailed resource impacts (e.g., sensitive species habitat, vegetation type, etc.) for a more robust analysis in order to make our recommendation regarding the alternative.

RG Developers participated in our pre-filing process during the preliminary design stage of the Rio Grande LNG Project (see section 1.3). This process emphasized identification of stakeholder issues, as well as identification and evaluation of alternatives that could reduce environmental impacts. We analyzed each alternative based on public comments and guidance received from federal, state, and local regulatory agencies. Additional sources of information included RG Developers' field surveys, aerial photography, U.S. Geological Survey (USGS) topographic maps, the FWS' National Wetlands Inventory (NWI) maps, pipeline system maps, agency consultations, and publicly accessible databases. To ensure comparable results, consistent data sources were used when comparing a feature across alternatives (e.g., NWI data were used for wetlands comparisons, rather than a combination of NWI and field survey data). The scope, methodology, and results of our alternatives analyses are discussed in the following sections.

3.1 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, the Rio Grande LNG Project would not be constructed and RG Developers' objective of providing the proposed LNG and transportation capacity for domestic and export markets of LNG would not be realized. Similarly, the mission statement of the Port of Brownsville, which includes infrastructure expansion and the development of economic opportunities, would not be realized or would be delayed until other infrastructure projects were proposed, approved, and constructed. In addition, the potential adverse and beneficial environmental impacts discussed in section 4.0 of this EIS would not occur.

The development and production of gas supplies from conventional and unconventional gas formations has increased in recent years throughout many areas of the United States. With or without the No-Action Alternative, other LNG export projects are being and could further be developed in the Gulf Coast region or elsewhere in the United States, resulting in both adverse and beneficial environmental impacts. LNG terminal developments and pipeline system expansions of similar scope and magnitude to the proposed Project would likely result in environmental impacts of comparable significance, especially those projects in a similar regional setting.

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

Based on our consideration of environmental impacts and the evident lack of viable energy source alternatives, we have dismissed the No-Action Alternative as a reasonable alternative to meet the objectives of the Rio Grande LNG Project. Further, because the purpose of the Project is to construct and operate a terminal to serve the domestic and export markets for LNG, the development or use of renewable energy technology would not be a reasonable alternative to the proposed action.

3.2 SYSTEM ALTERNATIVES

We reviewed system alternatives to evaluate the ability of other existing, modified, planned, or proposed facilities to meet the stated objectives of the Rio Grande LNG Project and to determine if a system alternative exists that would have less significant adverse environmental impacts than those associated with the proposed projects. Our analysis of system alternatives for the LNG Terminal and pipeline facilities are presented in sections 3.2.1 and 3.2.2, respectively. By definition, implementation of a system alternative would make construction of all or some of the proposed facilities unnecessary; conversely, infrastructure additions or other modifications to the system alternative may be required to increase capacity or provide receipt and delivery capability consistent with that of the proposed facilities. Such modifications may result in environmental impacts that are less than, comparable to, or greater than those associated with construction and operation of the proposed facilities.

3.2.1 LNG Terminal Alternatives

For a system alternative to be viable, it must be technically and economically feasible, as well as offer a significant environmental advantage over the proposed Project. In the case of the Rio Grande LNG Project, it must also be compatible with RG Developers' purpose and objectives to construct a terminal to serve the domestic and export markets for LNG, consistent with RG LNG's DOE authorizations and applications. Because the stated purpose of the Project is to access natural gas from the Agua Dulce Hub in south Texas and export 27 MPTA of natural gas, our analysis of viable system alternatives was limited to the Texas Gulf Coast.

The other operational, approved, proposed, and planned LNG terminals along the Gulf Coast in Louisiana and Mississippi would likely require longer pipelines from the Agua Dulce Hub to these terminals and result in greater environmental impacts due to the substantially longer pipelines. Additionally, the other Gulf Coast LNG terminals would likely require expansions in order to meet the export volume proposed by the Rio Grande LNG Project. For these reasons we only included the Texas Gulf Coast LNG Terminals in our analysis of system alternatives.

RG Developers are proposing to export LNG to FTA and non-FTA nations. The DOE granted the FTA authorization on August 17, 2016. The non-FTA application is currently under review (see discussion in section 1.2.4). For RG LNG customers to obtain LNG from other LNG terminals that have DOE approval for export, those terminals would need to construct additional LNG facilities to meet the export capacity proposed by RG LNG, or as approved by the DOE authorizations, when applicable. We recognize that LNG capacity may not be fully subscribed at all facilities based on contracts executed as of the writing of this EIS. However, because the DOE's export approval is a determination that the export is in the public interest, we will not speculate that any portion of other LNG terminals' LNG capacity is in "excess" or available for use by RG LNG to meet its objectives.

An expansion of existing facilities would need a similar scope of facilities proposed for construction by RG LNG as part of the proposed Project, including pre-treatment and LNG facilities, additional storage, LNG truck loading, and marine transfer facilities. Adding, or expanding, LNG facilities at other LNG terminals to accommodate RG LNG's purpose and need would result in environmental impacts that are less than, equal to, or greater than the environmental impacts of the proposed facility and may not provide a significant environmental advantage over the proposed Rio Grande LNG Terminal. Each of the planned, proposed, or authorized projects along the Texas Gulf Coast are described below and were considered as a potential system alternative. Our analysis was predicated on the assumption that each project has an equal chance of being constructed and would therefore be available as a potential alternative. However, future Commission review and market forces will ultimately decide which and how many of these facilities are built. The following details the LNG facilities and status in the Texas Gulf Coast region that could provide LNG capabilities:

Approved by FERC/Under Construction:

- Corpus Christi LNG / Cheniere (CP12-507) – Corpus Christi;
- Freeport LNG / Sempra (CP12-509) – Freeport; and
- Golden Pass / Exxon (CP14-517) – Sabine Pass.

Proposed:

- Texas LNG Brownsville/Texas LNG (CP16-116) – Brownsville;
- Annova LNG/Annova LNG (CP16-480) – Brownsville; and
- Port Arthur LNG/Port Arthur LNG (CP17-20) – Port Arthur.

LNG facilities are under construction at Corpus Christi and Freeport LNG; the Corpus Christi LNG Terminal has also begun exporting LNG. Facilities may be constructed at some of the LNG terminals because they were either initially certificated for import or have expansion work on for exporting pending completion of regulatory review and permitting. Table 3.2.1-1 provides a summary of the approved and proposed LNG export facilities along the Texas Gulf Coast.

Table 3.2.1-1 Summary of LNG System Alternatives Along the Texas Gulf Coast				
Facility	**Proponent(s)**	**Location (TX)**	**FTA / Non-FTA[a]**	**Export Capacity (MTPA)[b]**
Rio Grande LNG	RG Developers	Brownsville	A / P	27.0
Corpus Christi LNG	Cheniere Marketing / Cheniere Corpus Christi	Corpus Christi	A / A	25.0
Freeport LNG	Freeport LNG / Freeport Developers	Freeport	A / A	20.4
Golden Pass LNG	Golden Pass LNG / ExxonMobil	Sabine Pass	A / A	15.6
Texas LNG	Texas LNG	Brownsville	A / P	4.0
Annova LNG	Annova LNG	Brownsville	A / NF	7.0
Port Arthur LNG	Port Arthur LNG / Sempra	Port Arthur	A / P	13.5

[a] Reflects the status of the DOE FTA and non-FTA applications: A = Approved; P = Pending; and NF = Not Filed.

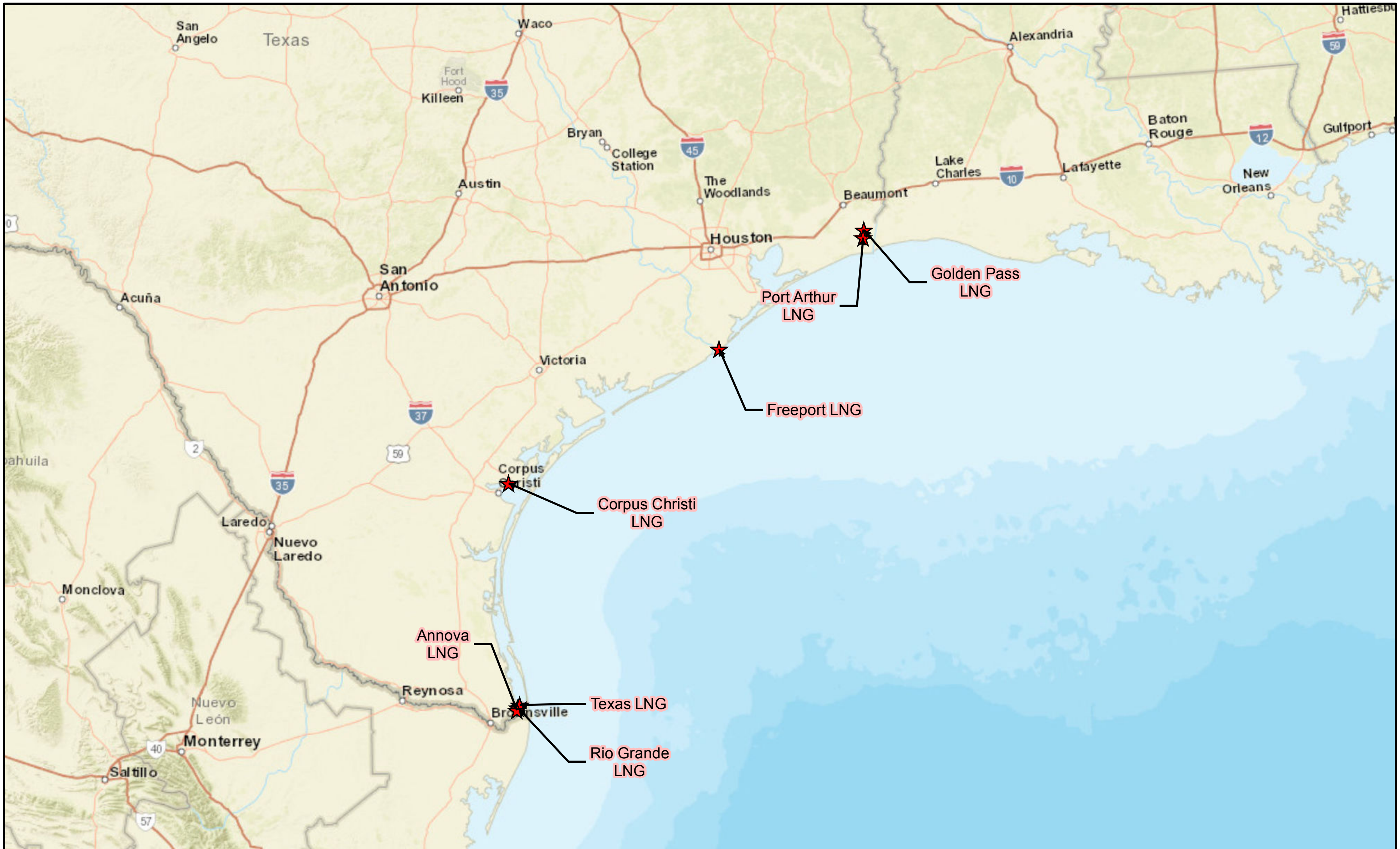
[b] The export capacity represents the total capacity approved or proposed for a project as a whole, which may include staged expansions by different project proponents.

3.2.1.1 Corpus Christi LNG

Corpus Christi LNG, LLC (Corpus Christi) is constructing an LNG export terminal about 130 miles north of the proposed Rio Grande LNG Terminal (see figure 3.2.1-1). The LNG export terminal is located in San Patricio County, along the northeast side of Corpus Christi Bay.

Originally, Corpus Christi's project was authorized as an import terminal; however, due to market changes, the import terminal was never constructed. On December 30, 2014, the FERC issued an Order authorizing Corpus Christi's LNG export project (CP12-507-000) and construction began in February 2015. The project consists of three LNG trains, three 160,000-m^3 LNG storage tanks, and two LNG berthing docks. The three LNG trains each have a 5 MTPA capacity, allowing for a cumulative 13.5 MTPA send-out capacity at the facility. The project also includes two compressor stations and an approximately 23-mile-long, 48-inch-diameter pipeline which connects the Corpus Christi LNG Terminal to five inter- and intrastate gas transmission lines which originate in south Texas. In total, approximately 1,000 acres of construction workspace is required for the facility operations.

On June 28, 2018, Cheniere Corpus Christi LNG, LLC and Cheniere Corpus Christi Pipeline, LP (Cheniere Corpus Christi) filed its FERC application for the proposed Stage 3 expansion (CP18-512-000 and CP18-513-000), which would consist of seven mid-scale liquefaction trains, one additional LNG storage tank, an approximately 21-mile-long natural gas pipeline with one compressor station to provide additional compression and other appurtenant facilities. The seven mid-scale liquefaction trains would allow for an additional 11.5 MTPA of LNG and approximately 160,000 m^3 of storage associated with the storage tank. If approved, Cheniere Corpus Christi anticipates the project would begin operations in 2021.



Legend

★ LNG System Alternative

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

N

0 50 100

Miles

Scale: 1:5,000,000

Rio Grande LNG Project

LNG Terminal System Alternatives

Figure 3.2.1-1

Any expansion of the existing and proposed facilities at the Corpus Christi LNG Terminal to accommodate the proposed capacity for the Rio Grande LNG Terminal would need to be fully evaluated by FERC and other applicable agencies, but such an expansion would likely result in similar or greater environmental impacts due to the increased footprint and added pipeline, and would not provide a significant environmental advantage over the proposed location. Therefore, it was not evaluated further as a system alternative.

3.2.1.2 Freeport LNG Terminal

The Freeport LNG Terminal and related expansion projects include three separate applications to FERC, including the original import terminal (CP03-75-000) and two LNG export terminal expansions (CP12-509-000 and CP17-470-000). The existing Freeport LNG Terminal is located on Quintana Island in Brazoria County, about 230 miles northeast of the proposed Rio Grande LNG Terminal site (see figure 3.2.1-1). The import terminal commenced operations in 2008. The Freeport LNG Terminal was granted authorization to re-export foreign-sourced LNG in 2009 and has a maximum send-out capability of approximately 1.5 Bcf/d of natural gas product.

Freeport LNG Expansion, L.P. and FLNG Liquefaction, LLC (collectively, FLEX) filed two separate DOE applications on December 17, 2010, to export approximately 1.4 Bcf/d of vaporized natural gas, each, to FTA nations and non-FTA nations over a 25-year period. DOE granted the FTA authorization on February 17, 2011, and the non-FTA authorization on November 14, 2014. Pursuant to subsequent applications, DOE granted an authorization for an additional approximately 1.4 Bcf/d to FTA nations (February 10, 2012), approximately 0.4 Bcf/d to non-FTA nations (November 14, 2014), and approximately 0.34 Bcf/d to non-FTA nations (December 19, 2016). Another application to export approximately 0.72 Bcf/d to non-FTA nations is under DOE review.

FERC issued an Order authorizing the project on July 30, 2014; and FLEX is currently constructing LNG, storage, and export facilities at the existing Freeport LNG Terminal on Quintana Island. These facilities require approximately 105 acres and will provide an export capacity of about 13 MPTA. However, on June 7, 2016, Freeport Development received authorization from the FERC to increase the total LNG production from the previously authorized 13 MTPA to 15.3 MTPA. FLNG currently anticipates the first LNG train to enter into service in 2018 with the remaining two trains entering into service in 2019.

On June 29, 2017 Freeport LNG Development, L.P.; FLNG LNG, LLC; FLNG LNG 2, LLC; and FLNG LNG 3, LLC (collectively, Freeport Development) filed an application with the FERC for the proposed Freeport LNG Expansion Project. This expansion project would consist of one additional LNG train with a capacity of approximately 5.1 MTPA and additional supporting infrastructure, utility, and auxiliary facilities. This request is currently pending authorization. If approved, Freeport Development anticipates the project would enter into service in 2020.

As a system alternative to meet the needs of RG LNG, Freeport LNG would require DOE approval to export added volumes to FTA and non-FTA nations, which would require review and authorization of the facilities and would not provide a significant environmental advantage. Any new project that would satisfy the needs of the Rio Grande LNG Project as a system alternative would require a separate NEPA evaluation, result in similar or greater environmental impacts and would not provide a significant environmental advantage over the proposed location. For these reasons, the Freeport LNG Project was not considered to be a reasonable alternative and was removed from consideration.

3.2.1.3 Golden Pass LNG Terminal

The Golden Pass LNG Terminal is an LNG import terminal operated by Golden Pass Products LLC ([GPP] CP04-386-000) located on the western shore of the Sabine Pass Channel, in Jefferson County, approximately 325 miles northeast of the proposed Rio Grande LNG Terminal site (see figure 3.2.1-1). The terminal occupies a 477-acre site consisting of five 155,000-m^3 LNG storage tanks and two LNG vessel berths. The Golden Pass LNG Terminal has a maximum send-out capacity of 2.5 Bcf/d, which sends out natural gas via the Golden Pass Pipeline. The Golden Pass Pipeline connects five interstate and four intrastate pipelines, which provide access to major markets on the Gulf Coast and across the midwestern and northeastern United States. On April 25, 2017, DOE granted an authorization to GPP to export approximately 2.2 Bcf/d of LNG to non-FTA nations over a 25-year period. On December 21, 2016, FERC authorized GPP to construct LNG and LNG export facilities at its existing Golden Pass LNG Terminal (CP14-517, CP14-518). These facilities will consist of three LNG trains; a 2.6-mile-long, 24-inch-diameter pipeline; three compressor stations; and modifications to existing interconnecting facilities to allow for bi-directional transportation of 2.6 Bcf/d of natural gas for LNG. The three LNG trains will each have a capacity of 5.2 MTPA for a cumulative send-out capacity of 15.6 MTPA. Construction of the project has not begun as of the date of this EIS.

As discussed above, GPP has already been granted approval to export products to FTA nations; however, any expansion of the existing and proposed facilities at the Golden Pass LNG Terminal to accommodate the proposed capacity for the Rio Grande LNG Terminal would need to be fully evaluated by FERC and other applicable agencies. Such an expansion would result in similar or greater environmental impacts and would not provide a significant environmental advantage over the proposed location based on the increased footprint and added pipeline that would be required; therefore, it was not evaluated further as a system alternative.

3.2.1.4 Texas LNG Brownsville

On April 14, 2015, Texas LNG Brownsville (Texas LNG) filed an application to construct an LNG terminal and export facilities on the BSC in the Port of Brownsville in Cameron County (CP16-116-000). This project would occupy about 625 acres adjacent to the Rio Grande LNG Terminal site, and would impact about 311.5 acres (see figure 3.2.1-1). The export terminal would consist of two LNG trains, two 210,000-m^3 LNG storage tanks, and one marine berth. The terminal would receive domestic feed gas from the Agua Dulce Hub via an intrastate pipeline. The Texas LNG Terminal would have a maximum send-out capacity of 4.0 MTPA. Texas LNG anticipated that construction would begin in 2018 with an in-service date of 2022. However, this timeline no longer appears feasible.

On September 24, 2015, Texas LNG received DOE approval for export of approximately 0.56 Bcf/d) of LNG to FTA nations over a 25-year period. Prior to this, on April 15, 2015, Texas LNG filed an application to export approximately 0.55 Bcf/d of LNG to non-FTA nations over a 25-year period; DOE authorization is pending.

As discussed above, Texas LNG has been granted approval to export products to FTA nations. Construction of this facility would require similar infrastructure as that required for the proposed Rio Grande LNG Terminal; however, the design and size of the Texas LNG facility would not have the capacity to produce the volume of LNG proposed by RG LNG without a completely new project being designed. Any expansion of the proposed facilities at the Texas LNG Terminal to accommodate the proposed capacity for the Rio Grande LNG Terminal would need to be fully evaluated by FERC and other applicable agencies, but such an expansion would likely not result in significant environmental advantage over the proposed location. Therefore, it was not evaluated further as a system alternative.

3.2.1.5 Annova LNG

Annova LNG Common Infrastructure, LLC, Annova LNG Brownsville A, LLC, Annova LNG Brownsville B, LLC, and Annova LNG Brownsville C, LLC (collectively, Annova) is proposing to construct an LNG export terminal on the BSC in Cameron County (CP16-480-000). This project would occupy about 650 acres on the south bank of the BSC across from the proposed Rio Grande LNG Terminal site, and would affect about 491 acres of land (see figure 3.2.1-1). The export terminal would consist of two LNG trains, two 210,000-m^3 LNG storage tanks, and one marine berth and would have a maximum send-out capacity of 7.0 MTPA. Annova LNG initially anticipated that construction of the project would begin in 2018, and would have an in-service date of 2021; however, this timeline no longer appears feasible. The Annova LNG Terminal would receive domestic feed gas from the Agua Dulce Hub via an intrastate pipeline is estimated to be constructed in 2021. On February 20, 2014, Annova received DOE approval for the export of LNG approximately equal to 0.94 Bcf/d of vaporized natural gas to FTA nations over a 30-year period.

The design and size of the Annova facility would not have the capacity to produce the volume of LNG proposed by RG LNG without a completely new project being designed. Any expansion of the proposed facilities of the Annova LNG Terminal to accommodate the proposed capacity for the Rio Grande LNG Terminal would need to be fully evaluated by FERC and other applicable agencies, but such an expansion would likely not result in significant environmental advantage over the proposed location. Therefore, it was not evaluated further as a system alternative.

3.2.1.6 Port Arthur LNG

Port Arthur LNG, LLC and Port Arthur Pipeline, LLC (collectively Port Arthur) are currently proposing to construct an LNG export terminal on the west side of the Sabine-Neches Waterway in Jefferson County. This project would occupy about 890 acres about 330 miles northeast from the proposed Rio Grande LNG Terminal site (see figure 3.2.1-1). The export terminal would consist of two LNG trains, three 160,000-m^3 LNG storage tanks, an NGL and refrigerant storage area, truck loading/unloading facility, and two LNG vessel berths. The two

LNG trains would each have a nominal capacity of 6.7 MTPA for a cumulative send-out capacity of 13.5 MTPA. In addition, the proposed terminal would receive natural gas via 35 miles of 42-inch-diameter pipeline, two compressor stations, metering stations, and other appurtenant facilities.

On March 31, 2015, Port Arthur received authorization to engage in the FERC pre-filing process (PF15-18-000) and anticipates an in-service date of 2023, if approved. On August 20, 2015, Port Arthur received DOE approval for the export of approximately 1.4 Bcf/d to FTA nations over a 25-year period. Prior to this, on March 20, 2015, Port Arthur filed an application with DOE to export an equivalent volume of LNG to non-FTA nations over a 20-year period; this authorization is pending. On November 29, 2016, Port Arthur filed its Section 3 application for the project with the Commission.

As discussed above, Port Arthur has already been granted approval to export products to FTA nations. The stated purpose and need of the Rio Grande LNG Project is to liquefy and export more than double the stated capacity of the Port Arthur Project. A system alternative to meet the needs of both projects would require redesign and engineering and an assessment of location and size of property. In addition, any expansion of the proposed facilities at the Port Arthur LNG Terminal to accommodate the proposed capacity for the Rio Grande LNG Terminal would need to be fully evaluated by FERC and other applicable agencies, but such an expansion would likely not result in significant environmental advantage over the proposed location. Therefore, it was not evaluated further as a system alternative.

3.2.2 Pipeline System Alternatives

To serve as a viable system alternative to RB Pipeline, the system would have to: (1) transport all or a part of the volume of natural gas required for LNG at the LNG Terminal, and (2) cause significantly less impact on the environment than the proposed pipeline.

Currently, there are no large diameter natural gas transmission pipelines operating within 40 miles of the proposed Rio Grande LNG Terminal site. The largest pipeline in the vicinity of the proposed LNG Terminal site is a local distribution company system, Texas Gas Service Company (TGS). Large natural gas transmission pipelines in the region include systems operated by Williams Transco and Spectra Energy's Texas Eastern Transmission Pipeline. Figure 3.2.2-1 shows the pipeline systems within the vicinity of the proposed Rio Grande LNG Project.

3.2.2.1 Texas Gas Service

The TGS system is a 10- and 16-inch-diameter pipeline system delivering gas to the local residential and commercial customers in Hidalgo and Cameron Counties. Local distribution systems are operated at lower pressures, such that upgrades for use by RB Pipeline would require a major rebuild of the system in order to meet the pressure and volume demands for the Rio Grande LNG Terminal. Additionally, much of the TGS system is located in areas adjacent to commercial and residential development, which would present certain constructability issues due to the space constraints associated with construction in developed areas. Therefore, the TGS system was eliminated from further consideration as a pipeline system alternative.

Legend

- Proposed Rio Bravo Pipeline
- Williams Transco North Padre Island Lateral
- Texas Eastern Pipeline
- ★ Rio Grande LNG Terminal

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User

N

0 15 30
Miles

Scale: 1:1,500,000

Rio Grande LNG Project

Pipeline System Alternatives

Figure 3.2.2-1

3.2.2.2 Texas Eastern Transmission Pipeline

The Texas Eastern Transmission Pipeline (Texas Eastern) is a 9,100-mile-long system that connects Texas and the Gulf Coast to the Northeast and has a capacity of 10.5 Bcf/d. Part of Texas Eastern's system crosses the proposed Pipeline System near MP 19.7 and continues south to Hidalgo, Texas, about 60 miles west of the proposed Rio Grande LNG Terminal site. Using the Texas Eastern Pipeline as an alternative would result in additional miles of pipeline to bring the gas east toward Brownsville. RB Pipeline is considering an interconnect with the Texas Eastern Pipeline, which has a total capacity of 0.6 Bcf/d; therefore, the Texas Eastern Pipeline does not have the available capacity to meet all of RG LNG's need for gas and would require looping[12] in order to meet the volume requirements for the proposed Project. Looping of the Texas Eastern Pipeline and the additional miles of pipeline needs to reach the Rio Grande LNG Terminal site would result in similar or greater environmental impacts when compared to the proposed pipeline. As such, the Texas Eastern Pipeline is not considered to be a viable system alternative to the proposed Rio Bravo Pipeline.

3.2.2.3 Williams Transco

The Transco Pipeline is a 1,800-mile-long pipeline from south Texas to New York. The Williams North Padre Island Lateral (NPIL) is a 24-inch-diameter east-west lateral pipeline that transports gas from offshore in the Gulf of Mexico to the Falfurrias Compressor Station about 15 miles west of the proposed Pipeline System near MP 25.0. The NPIL is a gathering pipeline for the Transco mainline that crosses the proposed RB Pipeline near MP 25.7.

RB Pipeline is considering an interconnect with the NPIL, which has a total capacity of 0.5 Bcf/d; therefore, the NPIL does not have the available capacity to meet all of the needs for gas and would require looping in order to meet the volume requirements for the Rio Grande LNG Project. Looping of the NPIL and the additional miles of pipeline needed to reach the Rio Grande LNG Terminal site would result in similar or greater environmental impacts when compared to the proposed pipeline. As such, we do not consider the Williams Transco system to be a viable system alternative to the proposed Pipeline System.

3.2.2.4 Valley Crossing Pipeline

Valley Crossing Pipeline, LLC (affiliate of Enbridge) is constructing the new 165-mile-long intrastate natural gas pipeline (Valley Crossing Pipeline or VCP) from the Agua Dulce Hub to Brownsville that would provide service to Mexico's Comisión Federal de Electricidad (CFE). The project, regulated by the RRC, would connect to the 1,000-foot-long Border Crossing Project (FERC Docket No. CP17-19) that would connect the intrastate VCP to the non-jurisdictional CFE pipeline (see figure 3.2.2-2). FERC issued the Presidential Permit granting authorization under Section 3 of the NGA on October 23, 2017. The project is expected to transport 2.6 Bcf/d and connect with the Sur de Texas – Tuxpan pipeline which would extend into Mexico. The project is estimated to be in service in October 2018.

---

[12] A pipeline loop is constructed parallel to an existing pipeline to increase capacity.

Legend

- Non-Jurisdictional Facilities Centerline
- Milepost
- US/Mexico Maritime Boundary
- Border Crossing Project

N
S

0 10 20 Miles

0 10 20 30 Kilometers

Rio Grande LNG Project

VCP System Alternative

Figure 3.2.2-2

Path: S:\Projects\31283_Arch Pipeline Project\MAPS\NR\mxd\Report\FERC Resource Reports\RR1B-1 - Location Map.mxd

VCP has a similar route as the proposed Rio Bravo Pipeline, with abutting rights-of-way between MP 35.6 and MP 70.0. VCP rejoins and overlaps the proposed right-of-way in the BND utility corridor between MP 132.3 and MP 135.4 before crossing the BSC and continuing offshore and connecting with the Border Crossing Project (see figure 3.2.2-2). VCP's route could easily supply the Rio Grande LNG Terminal; however, as stated in their purpose and need, RG Developers anticipate the need for 3.6 Bcf/d of natural gas at full capacity. VCP, which is currently under construction, will transmit 2.6 Bcf/d, and it is currently assumed that volume is subscribed by end users in Mexico. Therefore, VCP does not appear to have available volume of natural gas to supply the Rio Grande LNG Terminal. As such, VCP is not considered to be a more viable system alternative to the proposed Pipeline System and we did not analyze the VCP route as an alternative to the proposed pipeline route.

3.3 LNG TERMINAL SITE ALTERNATIVES

3.3.1 Alternative Terminal Sites along the Texas Coast

While there exists about 370 miles of Texas Gulf Coast, there are only a small number of accommodating port systems that could provide viable alternatives to the proposed Rio Grande LNG Terminal due to a lack of adequate shipping channels or developed industrial ports. The ports along the upper Texas Gulf Coast (Port Arthur, Houston/Galveston, and Freeport) are near capacity with existing oil and gas and commercial operations. Recent development in Corpus Christi provide limited available sites, which leaves Brownsville as the port system with the most available sites. The other bays and smaller ports along the coast do not support large commercial vessels and are used primarily for commercial and recreational fishing.

Based in part on the information provided by RG LNG, we evaluated site alternatives in the general area of the proposed LNG Terminal site. In order to meet the stated objectives of the Rio Grande LNG Project, we applied the following screening criteria to identify reasonable sites that could provide some environmental advantage over the proposed terminal site:

- Property Size – Based on the proposed design, approximately 700 to 1,000 acres are needed to build and operate the LNG Terminal to accommodate six LNG trains, four LNG tanks, and two marine jetties, with adequate space to maneuver the LNG vessels.
- Waterfront Access – Given the need to support LNG vessels and domestic waterway transportation of LNG, a location on waterfront property providing direct access to deep draft shipping channels (water depths greater than 42 feet below mean sea level) that can accommodate LNG vessels with a carrying capacity ranging from 125,000 to 185,000 m^3.
- Accommodating Port – A port system that could accommodate maritime traffic of up to six LNG vessels per week for full operation of the LNG Terminal.
- Natural Gas Pipelines and Transmission Lines - Sites proximate to existing interstate pipeline systems were considered preferable in order to provide natural gas to the LNG Terminal site.

- Road Access – Sites with access to state and federal highways were considered preferable in order to facilitate construction and also operation of the LNG Terminal and LNG trucking.

- Population Centers/Residences - Sites that are not in close proximity to population centers or residences were considered preferable in order to meet the regulatory requirement for LNG vapor dispersion and thermal radiation exclusion zones.

- Existing Industrial Yards for Support – Sites near existing industrial areas were considered preferable in order to provide support logistics and pre-assembly activities near the LNG Terminal site.

- Land Availability/Lease – One substantial challenge of siting an LNG facility is finding suitable property that is available for industrial development. Availability is critical because Section 3 of the NGA does not provide a project proponent the authority of eminent domain in acquiring the property for an LNG terminal. RG LNG prefers a site that allows for a long-term lease, with a minimum or 20 years.

Using the screening criteria described above, we evaluated four alternative sites for the LNG Terminal along the Texas Gulf Coast (Port Lavaca, Port of Corpus Christi – Ingleside, Port Aransas, and Powderhorn Ranch). The general locations of the four site alternatives along with the proposed site are shown on figure 3.3.1-1. A comparison of each alternative site to the proposed site is presented in table 3.3.1-1 and discussed below.

Table 3.3.1-1
Comparison of Alternative Rio Grande LNG Terminal Sites Along the Texas Gulf Coast

Screening Criteria	Proposed Site	Port Aransas	Corpus Christi - Ingleside	Port Lavaca	Powderhorn Ranch
Property size (acres)	984	220	550	100	5,000
Pipeline length (miles)	138	70	60	125	125
Waterfront access	Deep draft	Deep draft	Deep draft	Shallow	Shallow
Pipeline access	Available	Available	Available	Available	Available
Road access	Available	Available	Available	Available	Not available
Land availability with 1.5-mile buffer	Available	Not available	Not available	Available	Not available
Existing industrial support facilities	Available	Not available	Available	Available	Not available
Accommodating port	Available	Not available	Not available	Available	Available
Long-term lease available	Available	Not available	Not available	Available	Not available

Legend

Alternative Terminal Site

Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

N

0 20 40

Miles

Scale: 1:2,500,000

Rio Grande LNG Project

Alternative Terminal Sites
Along The Texas Coast

Figure 3.3.1-1

3.3.1.1 Port Aransas

The Port Aransas alternative site is on Harbor Island at the entrance of the Corpus Christi Ship Channel, about 0.5 mile across the channel from Port Aransas (see figure 3.3.1-1). The alternative site is located off a channel that can accommodate the deep draft LNG vessels and has good road and pipeline access. The Port Aransas location would require about a 70-mile-long pipeline that would require some marine installation, since the site is on an island about 5 miles from the mainland shore. The site is a brownfield site that has previously been used as an industrial shipyard; however, the site is only 220 acres and would not accommodate the siting needs for the LNG Terminal. The site is located within 0.25 mile of residential developments, less than 1 mile from the town of Port Aransas, and adjacent to a ferry terminal operated by TxDOT. The alternative location is near the junction of three shipping channels that are heavily used by commercial and recreational fishing vessels throughout the year; therefore, the addition of LNG shipping in the channel could likely lead to congestion within the three channels. Although the Port Aransas site meets three of the seven criteria for site selection, the lack of an accommodating port and long-term lease in addition to not meeting the other criteria, we find that the Port Aransas location does not meet the Project's needs and was not evaluated further as a viable alternative.

3.3.1.2 Corpus Christi – Ingleside

An alternative site in the Port of Corpus Christi was identified along the Ingleside Channel of Corpus Christi Bay. The alternative site is on the northeast side of the bay on the La Quinta Channel, less than 0.5 mile from the town of Ingleside, in San Patricio County (see figure 3.3.1-1). The Ingleside location would require about 60 miles of pipeline from the Agua Dulce Hub. The site, at 550 acres, does not meet the Project's requirement for placing the facilities. The port is nearly fully developed, with this location being the largest site available within an established industrial area. The shipping channel allows for the deep draft LNG vessels; however, the configuration of the site between existing developed sites limits the waterfront acreage and ability for the marine maneuvering and loading at the site. The close proximity to residential developments, schools, and parks also makes the site less desirable for developing an LNG terminal. The Corpus Christi – Ingleside site meets four of the seven criteria for site selection; however, the lack of an accommodating port and long-term lease along with the lack of a 1.5-mile buffer from the site, precludes the Corpus Christi – Ingleside location as a viable alternative site to the proposed LNG Terminal site.

3.3.1.3 Port Lavaca

The Port Lavaca alternative site is about 4 miles east of Port Lavaca, in Calhoun County, on Lavaca Bay (see figure 3.3.1-1). The alternative port site would require about 125 miles of pipeline from the Agua Dulce Hub. The small site (100 acres), however, is not of an adequate size to meet the requirements of the Project. Additionally, the shipping channel to the alternative site is about 36 feet deep which would not allow the deep draft LNG vessels to transit to the site without a significant amount of dredging being required. No other sites were available in Lavaca Bay that would meet the site requirements and because the location would not meet the needs of the Project, the site was not evaluated further.

3.3.1.4 Powderhorn Ranch

The Powderhorn Ranch alternative site is in the southern portion of the Matagorda Bay off of the Port Lavaca Shipping Channel in Calhoun County. The Powderhorn Ranch location, similar to the Port Lavaca alternative, would also require about a 125-mile-long pipeline from the Agua Dulce Hub. The 5,000-acre site is adjacent to the town of Port O'Conner (see figure 3.3.1-1). While this alternative site is of an adequate size to accommodate the siting of the LNG Terminal, it does not provide access to the deep draft LNG vessels.

The Powderhorn Ranch location is in a more remote area; therefore, access to pipelines, roads, and industrial support facilities are lacking compared to the other alternatives. Additionally, the alternative location is within 0.5 mile of residential developments and the town of Port O'Conner. Because of these factors, the Powderhorn Ranch location does not meet the Project's needs and was not evaluated further as a viable alternative.

3.3.2 Alternative Terminal Sites at the Port of Brownsville

RG LNG also identified alternative locations within the Port of Brownsville to site the LNG Terminal. The following discussion provides our analysis of the alternate sites provided by RG LNG that we considered warranted discussion in this EIS. The Port of Brownsville is a largely underutilized port, and large tracts of land within the port are available for industrial development.

Although multiple commenters expressed the desire to maintain the land adjacent to the BSC in an undeveloped state for the protection of the wildlife that use or traverse the land, the BND's mission statement for the Port of Brownsville includes infrastructure expansion, development of economic opportunities, and establishment of the port as a world class port (Port of Brownsville 2016a); therefore, maintenance of areas adjacent to the BSC as relatively undisturbed land is unlikely in the long-term.

RG LNG originally evaluated six areas (three areas along the north bank and three areas along the south bank) identified by the BND along the BSC for the siting of the LNG Terminal site (see figure 3.3.2-1). Each of these six areas met many of the key siting criteria discussed above. However, the following factors were used by RG LNG to narrow the choice of acceptable locations based on local conditions:

- Road Access – suitable road access to facilitate the construction and operation phases of the LNG Terminal.
- Population Centers/Residences – availability of land with a minimum of a 1.5-mile buffer distance from populated areas to provide reasonable separation from the facility.
- Wildlife Corridor – avoidance of the wildlife corridor established for the endangered ocelot.
- Land Availability/Lease – land available for the LNG Terminal site under a long-term lease (20 years minimum).

Legend

- Ocelot Passage Path
- Bahia Grande Pilot Channel
- Wildlife Corridor
- Proposed LNG Terminal Site (Site A)
- BSC Dredge Areas
- Proposed LNG Facility Sites

AERIAL IMAGERY: NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP) 2014 - http://datagateway.nrcs.usda.gov/.

N

0 1 2
Miles

Scale: 1:80,000

Rio Grande LNG Project

Alternative Terminal Sites
at The Port of Brownsville

Figure 3.3.2-1

Using the screening criteria described above, we evaluated these six alternative sites for the LNG Terminal along the BSC. The area that can be developed along the BSC is about 10 miles in length; therefore, we divided the northern and southern bank areas into three geographical areas (west, central, and east) about 3.3 miles in length each for our analysis. Because the BND has been actively seeking development along the ship channel, including other LNG terminals, some of the reviewed areas were not viable because there was not an adequately sized tract available due to other developments having contracts on the various tracts. The areas on the south side of the ship channel lack suitable road access, which would hinder both construction and operation. The South Bank-West area appears to have tracts of suitable size; however, the further west the tract, the more development occurs within the 1.5-mile buffer.

An LNG terminal (Annova LNG) is proposed within the South Bank-Central area, and that site has already been reconfigured to avoid the wildlife corridor. Tract sizes in the South Bank-East area appear to not be of adequate size to meet the Project's needs, due to the general presence of an open water bay system. Therefore, based on the initial screening criteria which required basic conditions be met for consideration of the Project, we analyzed four of the sites in greater detail, and the South Bank-West and South Bank-East sites were not evaluated further.

During the initial alternatives siting analysis, two proposed LNG terminals had leases with the BND on the north bank of the ship channel (Gulf Coast LNG and Texas LNG). With those two locations being unavailable, and the other tracts on the north bank not adequately sized or encroaching on the wildlife corridor or other existing facilities, the proposed site remained as the most preferred alternative along the ship channel. The Gulf Coast LNG site is no longer under lease; however, that site would be within the 1.5-mile buffer and the proposed site would still be preferred based on that criterion. A comparison of each alternative site to the proposed site is presented in table 3.3.2-1. The proposed site is the largest of the sites assessed along the BSC and would affect the greatest overall acreage; however, it is large enough to meet the needs of site development while having less of an effect on some resources when compared to other evaluated sites. The proposed site, along with the other north bank sites, avoids direct impacts on the FWS easement for an ocelot corridor and is further from known northern aplomado falcon nests compared to the south bank alternative locations. The south bank central and east sites are also within critical habitat for the piping plover. Additionally, the proposed site is further from cultural and historical sites than the other locations listed in table 3.3.2-1. None of the sites listed in the table provided any significant environmental advantages when compared to the proposed Rio Grande LNG Terminal nor could any of the sites fully satisfy the Project's purpose and need.

3.4 FILL MATERIAL SUPPLY ACCESS ROUTE ALTERNATIVES

The proposed LNG Terminal site would require grading, excavation/dredging, and fill to create a suitable surface to construct and operate the LNG Terminal. Although some materials excavated or dredged along the shoreline are proposed to be used on-site for fill, not all material is anticipated to be suitable for use. To complete activities at the LNG Terminal site, additional fill material would be obtained from the Port Isabel dredge pile, which is located about 1 mile to the east of the LNG Terminal site boundary. The Port Isabel dredge pile would be used to supply an estimated 3.5 mcy of fill material for grading and site preparation at the LNG Terminal site.

Table 3.3.2-1
Comparison of Alternative Rio Grande LNG Terminal Sites Along the Brownsville Ship Channel

Factors	North Bank West	North Bank Central (Proposed)	North Bank East[a]	South Bank West	South Bank Central[b]	South Bank East
Initial Screening Criteria						
Road access	Available	Available	Available	Not available	Not available	Not available
Land availability with 1.5-mile buffer	Available	Available	Not available	Available	Available	Available
Long-term lease available for appropriate-sized tract	Yes	Yes	Yes	No	Yes	No
Site Comparisons						
Size of available land (acres)	550	1,000	625	Not evaluated	655	Not evaluated
Distance to electric transmission line (miles)	2.5	2.4	1.6	Not evaluated	4.3	Not evaluated
Distance to nearest populated area (miles)	4.3	2.3	1.5	Not evaluated	2.2	Not evaluated
Distance to entrance of the BSC (miles)	11.4	5.7	5.1	Not evaluated	7.6	Not evaluated
Direct impacts to ocelot corridor	No	No	No	Not evaluated	Yes	Not evaluated
Aplomado falcon nests / observations within 0.25 mile (2000-2015)[c]	0	0	0	Not evaluated	1	Not evaluated
Direct impact on piping plover critical habitat	No	No	No	No	Yes	Yes
Foraging habitat for piping plover	Yes	Yes	Yes	Not evaluated	Yes	Not evaluated
Wetland impacts (acres)	23.6	191.8	284.0	Not evaluated	142.9	Not evaluated
Open water impacts (acres)	37.3	106.0	45.6	Not evaluated	5.5	Not evaluated
Distance to nearest cultural/historic site (miles)	1.7	3.2	2.4	Not evaluated	2.1	Not evaluated

a Site of the proposed Texas LNG Terminal.
b Site of the proposed Annova LNG Terminal.
c As suitable foraging habitat is known to be present at the North Bank Central site, foraging habitat is assumed present at each of the other sites due to proximity and review of aerial data.

To access the Port Isabel dredge pile, RG LNG has proposed to construct and use a temporary haul road that would allow large dump trucks to transit directly between the LNG Terminal site and the dredge pile; however, in order to possibly reduce impacts on wetland and open water habitats and aquatic species, we have considered two alternatives to the use of the haul road, including use of the existing SH-48 by dump trucks, and use of the BSC by barges. These options are discussed below.

Temporary Haul Road via Dump Truck (Proposed Action)

RG LNG has proposed a new 1.8-mile-long temporary haul road to transport fill material from the Port Isabel dredge pile to the LNG Terminal site. About 0.6 mile of the temporary haul road would be constructed on land leased by a third party (Texas LNG), and coordination between the two parties still must occur prior to road construction. The road would be about 35 feet wide, with 5-foot berms on each side, and would be used for a period of 27 months.

Construction of this road would affect 9.4 acres of wetlands and mud flats outside the boundary of the LNG Terminal site, including 1.9 acres within the eastern natural buffer area of the site. The temporary haul road would also impact 1.0 acre of open water. In addition to direct impacts on wetlands and open water within the footprint of the haul road, its use could temporarily cut off tidal exchange between the BSC and adjacent habitat, impeding the movement of aquatic species between the Vadia Ancha lagoon and the BSC. Further, its use could increase sedimentation of adjacent wetlands and mud flats.

To maintain tidal flow and minimize potential erosion and sedimentation into adjacent wetlands, RG LNG has proposed to install culverts along the temporary haul road as well as an earthen safety berm on each side of the road. Following its use, the temporary haul road would be restored to pre-construction conditions, and vegetated areas would be allowed to revegetate naturally. RG LNG is also evaluating the feasibility of planting estuarine marsh vegetation along the temporary haul road to ensure successful revegetation and for erosion control as additional mitigation.

State Highway 48 via Dump Truck

The use of a temporary haul road through wetlands would be a deviation to the Commission's Procedures (section VI.B.1.d) and would impact 9.4 acres of wetland and 10.4 acres of EFH. In addition, it would potentially reduce tidal flow between the BSC and aquatic habitats connected to the BSC. Therefore, we evaluated the alternative use of the existing roadway system to transfer materials from the Port Isabel dredge pile to the LNG Terminal site via dump trucks. This SH-48 Alternative would result in about 124 additional roundtrips (247 transits) per day for the first 27 months of construction. If used, the dump trucks would travel from SH-48 (about 3.6 miles) to SH-100 (about 0.5 mile), down Port Road (about 1.3 miles) until reaching the Port Isabel dredge pile.

Transit on SH-48 would be through rural/undeveloped land. Once on SH-100, more development and stop lights are present; Port Road passes by residential areas for about 0.4 mile before entering undeveloped/industrial areas.

RG LNG indicated that the haul road was preferable to use of SH-48, as it would result in decreased heavy truck traffic on the existing roadway system, thereby minimizing the potential for impacts on the existing roadways and also by decreasing air emissions associated with the longer route. RG LNG also voiced concerns regarding potential road damage resulting from the weight of the dump trucks and that the dump trucks would represent slow-moving traffic on a high-speed road.

Although dump trucks generally accelerate and decelerate slowly, RG LNG has already coordinated with TxDOT for access to the LNG Terminal, to include lanes for acceleration, deceleration, and turning, as well as traffic lights along SH-48, which would mitigate for slow-moving vehicles entering and leaving the LNG Terminal site. We also note that large semi-trucks already traverse these roads. Further, although air emissions from truck transits would increase, we believe that the impacts on air quality from the minimal increase in travel distance would also be minimal.

It is possible that improvements on Port Road may be required to support large dump trucks, and some improvements would be needed at the Port Isabel dredge pile for the trucks to access the spoil, which is contained within berms (this is also true for the proposed temporary haul road); however, we find that use or improvement of existing infrastructure is environmentally preferable to construction of the proposed temporary haul road that would traverse wetlands and waterbodies, even with RG LNG's additional proposed mitigation measures. Therefore, we have recommended below that RG LNG file additional information so that we can further evaluate this alternative.

Brownsville Ship Channel via Barge

During FERC's coordination with cooperating agencies, the FWS identified a third option to access the Port Isabel dredge pile. This third alternative includes use of barges to transport fill material to the MOF at the LNG Terminal, where it could be offloaded to trucks and distributed throughout the site as necessary. Docking facilities owned by the BND appear to be present in close proximity to the Port Isabel dredge pile such that there is the potential for RG LNG to transport fill materials via barge to the MOF for offloading.

Use of barges to transport fill materials would eliminate the proposed new haul road's impacts on wetlands and open waters, and the need for additional truck traffic along existing roadways. However, the number of barges required, and the feasibility of obtaining access to the required number of barges is unknown.

RG Developers are consulting with the COE to develop a Project-specific wetland restoration plan, and RG LNG has proposed mitigation to minimize the impacts of the proposed temporary haul road on adjacent waters and wetlands. However, construction of the temporary haul road would be a deviation from the Commission's Procedures (section VI.B.1.d), and would impact wetlands as described above and in section 4.4.2.1. We do not find the proposed haul road to be justified if better options are available. Therefore, **we recommend that:**

- **<u>Prior to the end of the draft EIS comment period,</u> RG LNG should file with the Secretary of the Commission (Secretary) a feasibility assessment for transporting fill material from the Port Isabel dredge pile to the LNG Terminal site via barge and via the existing system of roads. RG LNG's filing should include documentation of its consultations with the local transit authorities to identify any road improvements necessary for the road transport alternative.**

3.5 PIPELINE CONFIGURATION AND ROUTE ALTERNATIVES

3.5.1.1 Pipeline Configuration and Size

RB Pipeline has proposed dual 42-inch-diameter pipelines (rather than a single 42-inch-diameter pipeline) because, according to RB Pipeline, a single pipe would be incapable of delivering sufficient natural gas quantities required to meet the designed export needs of the Rio Grande LNG Project. As an alternative to the proposed configuration, and in order to reduce the Project footprint resulting from two pipelines, we reviewed the potential for use of a single, larger diameter pipeline. Key factors to consider included:

- availability of pipe size and associated components (e.g., fittings and valves);
- availability of construction equipment and experienced operators;
- environmental impacts; and
- reliability and safety.

At our request, RB Pipeline determined that, at a minimum, a 60-inch-diameter pipeline would be required to transport the natural gas volumes associated with Project. A single pipeline trench and right-of-way could provide certain advantages over dual pipeline trenches and rights-of-way. For example, trenches associated with the larger diameter pipeline construction easement could result in less cumulative soil disturbance than two adjacent pipelines. Also, the proposed construction schedule for installing the dual pipelines would result in multiple impacts on a given area over the multi-year construction period, which would increase impacts on wildlife; whereas, construction of the larger diameter pipeline would last over one construction period and potentially reduce impacts on wildlife and other resources (see related discussion on project timing below). On the other hand, construction of this non-standard pipeline diameter would present numerous construction difficulties and safety concerns. Construction equipment capable of handling a 60-inch-diameter pipe is not readily available in the United States. For example, side-boom tractors of sufficient size to transport a 60-inch-diameter pipe are currently unavailable in the United States and would likely need to be constructed for the Project. Further, additional construction equipment such as bending and welding machines would require retrofitting to handle 60-inch-diameter pipes. Fabrication of this specialized equipment would require significant lead time and increased capital costs, and would result in a significant delay in the commencement of Project construction activities.

The dual Pipeline System would provide uninterrupted gas flow compared to a single pipeline that could require shutting down or limiting gas delivery during maintenance and inspection activities. Shutdowns and reduced delivery volumes could lead to delays at the terminal with both LNG and shipping. Although the single, 60-inch-diameter pipeline may result in some environmental advantages, specifically as it would avoid multiple construction periods through a given area, the lack of equipment and skilled contractors required to install the larger diameter pipeline render this alternative infeasible from a construction standpoint; therefore, we did not consider the single pipeline alternative further.

Additionally, we considered concurrent construction of the dual 42-inch-diameter pipelines as opposed to each pipeline being constructed separately (about a year apart) in an effort to minimize the temporal effects of the proposed staged construction process. While RB Pipeline initially considered and rejected concurrent construction of the dual pipelines at HDD crossings, it has not considered concurrent construction for both complete pipelines. Concurrent construction of the pipelines would minimize the duration of disturbance within associated construction workspaces and could result in less temporal effects overall but would require more ATWS to accommodate an increase in equipment and staging. RB Pipeline asserts that a staged construction approach is more practicable and safer given the equipment and manpower needs for construction of each pipeline. The proposed sequential schedule for dual pipeline construction also follows the construction schedule and staged commissioning and operation of each of the six LNG trains. We find this acceptable; therefore, we do not recommend concurrent construction along the entire length of the pipelines.

3.5.1.2 Pipeline Route Alternatives

We received comments from the NPS regarding potential impacts from the Pipeline System on the King Ranch and near the Palo Alto Battlefield, both NPS-designated national historic landmarks. The King Ranch National Historic Landmark includes four operating divisions within five different counties (including a total of 825,000 acres), and cannot be completely avoided by the Project. However, RB Pipeline worked with the landowners to site the pipeline with existing infrastructure in the area, to the extent possible, thereby minimizing impacts on the Ranch. It appears that the King Ranch owners are agreeable to the proposed route. Cultural surveys have not been completed on the King Ranch; therefore, as stated in section 4.10 we are requiring that surveys and consultation under Section 106 of the NHPA be completed before construction can begin.

The Palo Alto Battlefield is about 2.7 miles (at its closest point) to the Rio Bravo Pipeline and over 10 miles from the LNG Terminal site and would not experience direct effects associated with the Project, as discussed in sections 4.8 and 4.10; therefore, we did not review any alternatives to further avoid the Palo Alto Battlefield National Historical Park/National Historic Landmark.

RB Pipeline reviewed potential pipeline alternatives as part of its routing process to minimize and avoid environmental impacts, and has been actively engaged with the King Ranch regarding pipeline routing. We did not receive any other comments or objections to the proposed route; as such, we did not evaluate alternatives for the pipeline routes.

3.6 ABOVEGROUND FACILITY SITE ALTERNATIVES

The pipeline would require compression at two locations along the proposed route, in addition to a third compressor station (Compressor Station 3) required at the LNG Terminal site. In order to meet the natural gas supply throughput requirements for the Pipeline System, compressor stations would be required at the northern origin of the pipeline following interconnects with the various pipeline systems in the Agua Dulce Hub area (Compressor Station 1) and north of the city of Raymondville (Compressor Station 2).

Availability of sufficient land for lease or purchase along the pipeline route at locations consistent with engineering requirements relating to safety and operability, while maintaining pipeline pressure along the route, were important factors in RB Pipeline's site selection process for the compressor stations. Environmental considerations included avoiding sensitive resources such as wetlands and endangered species, viewshed, and noise sensitive receptors. Additionally, locations that required minimal to no construction of new access roads were preferable to locations that required new access road construction.

Compressor Stations 1 and 2

In general, compressor station requirements are dependent on the length of the Project, the pressure of the existing feed source(s), and the distance traveled to achieve the required pressure at the receipt meter station. During Project design, RB Pipeline reviewed several potential compressor station locations along the pipeline route, looking at hydraulic requirements and potential impacts on the surrounding public and environmental resources in selecting its proposed sites.

Based on our analysis in this EIS, we have determined that the proposed sites for Compressor Stations 1 and 2 are acceptable locations and that construction would not result in significant environmental impacts. We did not receive any comments on or objections to the proposed sites, nor did we receive any suggested alternative locations. RB Pipeline's preliminary site investigations determined that the proposed sites were well-suited with regards to engineering and hydraulic constraints, and posed minimal environmental impacts. We agree, and as such did not evaluate site alternatives for the Compressor Stations 1 and 2.

Compressor Station 3

The proposed Compressor Station 3 site is within the LNG Terminal site, at the end of the Pipeline System. This particular compressor station is required to increase the gas pressure to the level needed at the Pipeline System's delivery point. Alternative locations outside of the LNG Terminal site were also considered by RG Developers during Project design; however, such offsite locations were ruled out because there would be less impact if the compressor station was included within the LNG Terminal site as opposed to being constructed on a separate 40-acre (or larger) parcel elsewhere. Additionally, for engineering purposes, there are benefits to having the compressor station as close to the delivery point as possible. Our analysis in section 4 of this EIS did not identify any environmental concerns specific to Compressor Station 3. For these reasons, we did not analyze any other alternative sites for Compressor Station 3.

4.0 ENVIRONMENTAL ANALYSIS

The environmental consequences of constructing and operating the proposed Project would vary in duration and significance. Four levels of impact duration were considered: temporary, short term, long term, and permanent. Temporary impacts generally occur during construction, with the resource returning to pre-construction conditions almost immediately afterward. Short-term impacts could continue for up to 3 years following construction. Impacts are considered long-term if the resource would require more than 3 years to recover. A permanent impact could occur as a result of any activity that modified a resource to the extent that it would not return to pre-construction conditions during the 30-year life of the Projects, such as within the footprint of the LNG Terminal. We considered an impact to be significant if it would result in a substantial adverse change in the physical environment.

In this section, we discuss the affected environment, general construction and operational impacts, and proposed mitigation for each resource. We evaluated the applicants' proposed mitigation measures to determine whether additional measures would be necessary to reduce impacts; if we deemed additional measures to be appropriate, we have included them as bulleted, boldfaced paragraphs in the text. We will recommend that these measures be included as specific conditions to any authorization that the Commission may issue. Conclusions in this EIS are based on our analysis of the environmental impacts and the following assumptions:

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

4.1 GEOLOGIC CONDITIONS, RESOURCES, HAZARDS, AND MITIGATION DESIGN MEASURES

4.1.1 Geologic Setting

The Rio Grande LNG Project would be in the West Gulf section of the Coastal Plain physiographic province (U.S. Geological Survey [USGS] 2000). The Coastal Plain lies along the Atlantic seaboard and Gulf Coast of the United States, stretching 100 to 200 miles inland and 100 to 200 miles offshore, to the edge of the continental shelf. This belt of Late Cretaceous to Holocene sedimentary rocks comprises an elevated sea bottom with low topographic relief dipping seaward. In Texas, the Coastal Plain includes a system of alternating synclines (troughs) and anticlines (peaks) oriented perpendicular to the coastline (Hosman 1996). The surficial geology underlying the region is composed of Quaternary Holocene and Pleistocene-aged sediments made of alluvium of the Rio Grande and coastal deposits of dune, estuary, lagoon, deltaic, tidal-flat, beach, and barrier island environments (Page et al. 2005). The geologic setting of the pipeline facilities is discussed below; however, the geologic setting of the LNG Terminal and discussion of geologic hazards is presented in section 4.12.5.5.

4.1.1.1 Pipeline Facilities

The pipeline facilities cross the interior of the West Gulf section of the Coastal Plain physiographic province, where elevations range from about 135 feet NAVD 88 along the Header System in Jim Wells County to 5 feet NAVD 88 near the terminus of the Pipeline System at the Compressor Station 3 site. RB Pipeline performed geotechnical investigations to evaluate subsurface soil and groundwater conditions at Compressor Station 1. This investigation indicated that materials consisted of clays, sands, and silts to a depth of 60 feet. Depth to surficial groundwater was 30 feet below ground surface at Compressor Station 1. Although RB Pipeline conducted geotechnical investigations of its originally proposed Compressor Station 2 location, the site was re-located based on pipeline route shifts, and additional investigations must be conducted. RB Pipeline has also indicated that it will conduct geotechnical investigations at the booster stations and HDD sites to verify the feasibility of construction at the proposed locations, and would submit those surveys for our review and approval, along with HDD contingency plans in the event of failed HDD attempts (see section 4.3.2). Therefore, **we recommend that:**

- **<u>Prior to construction of Compressor Station 2, Booster Stations 1 and 2, and the HDD locations</u>, RB Pipeline should file with the Secretary, results of its geotechnical investigations for each of these sites, including any recommended mitigation measures RB Pipeline would adopt as part of the final engineering design.**

4.1.2 Mineral Resources

Nonfuel mineral resources produced in Texas consist mainly of cement, crushed stone, sand, and gravel (USGS 2015a). The nearest nonfuel mineral resource to the Project is the Brownsville Mill, located about 5.4 miles southwest of the pipeline facilities in Cameron County; no such resources are located within 0.25 mile of the Project (USGS 2016a). Oil and gas production is prevalent throughout Texas, including in the Project area.

The pipeline facilities would cross multiple areas of active oil and gas development. There are 265 oil and gas wells within 0.25 mile of the pipeline facilities (RRC 2015). Of these, a total of 57 wells are listed as active, and 15 are permitted but not drilled (table 4.1.2-1). No active oil and gas wells or well sites with active permits are located within the construction workspace of the pipeline facilities or access roads. The remaining wells are listed as dry or plugged or are cancelled permit locations, five of which are within the construction workspace of the pipeline facilities or meter stations.

Table 4.1.2-1 Active and Permitted Oil and Gas Wells within 0.25 Mile of the Pipeline Facilities			
Component / MP	**Distance from Pipeline Centerline (feet)**	**Well Number[a]**	**Status**
Header System			
HS-0.0	445	42046	Gas well
HS-0.2	1,122	41913	Oil / gas well
HS-0.2	2,185	41910	Oil / gas well
HS-0.3	2,461	42049	Oil well
HS-0.4	1,962	41909	Oil / gas well
HS-0.4	1,119	41832	Permitted location
HS-0.5	2,765	42050	Oil / gas well
HS-0.5	821	41901	Oil / gas well
HS-0.7	1,905	41900	Oil / gas well
HS-0.8	1,203	41958	Gas well
HS-1.0	566	1213612	Gas well
HS-1.2	1,117	41781	Oil / gas well
HS-1.4	848	41906	Oil / gas well
HS-1.5	687	42819	Permitted location
HS-1.7	844	42242	Oil well
HS-1.7	765	42255	Oil well
HS-1.8	78	42241	Oil well
HS-1.9	1,664	42244	Oil well
HS-2.3	796	42282	Permitted location
HS-2.4	970	42281	Gas well
Pipelines 1 and 2			
0.0	987	41897	Oil / gas well
0.0	5,096	42042	Oil well
0.0	4,529	41879	Oil / gas well
0.0	4,327	42227	Oil / gas well
0.0	4,223	41880	Oil / gas well
0.0	4,148	42040	Oil / gas well
0.0	3,350	41893	Oil / gas well
0.0	3,122	41895	Oil / gas well
0.0	2,936	41894	Oil / gas well
0.2	3,289	41891	Oil / gas well
0.4	2,338	41890	Injection / disposal from oil / gas

Table 4.1.2-1 (continued) Active and Permitted Oil and Gas Wells within 0.25 Mile of the Pipeline Facilities			
Component / MP	**Distance from Pipeline Centerline (feet)**	**Well Number[a]**	**Status**
0.5	3,400	42023	Injection / disposal from oil
0.7	648	41948	Gas well
1.3	1,883	42032	Oil well
2.5	1,155	41831	Permitted location
Pipelines 1 and 2 (continued)			
3.6	3,477	21336	Gas well
4.0	4,381	21412	Oil / gas well
4.1	4,209	1242717	Oil well
4.1	4,872	21361	Oil well
4.2	5,988	1115130	Gas well
4.2	4,796	21414	Oil well
4.4	7,472	1086288	Gas well
4.6	2,584	21283	Permitted location
4.6	6,440	1103943	Gas well
5.0	8,481	1059130	Gas well
5.0	10,134	21509	Gas well
5.0	6,914	1072214	Gas well
5.2	9,713	1067674	Gas well
5.4	9,282	1076777	Gas well
24.0	1,125	20933	Permitted location
30.3	985	20752	Gas well
35.0	1,286	20705	Gas well
36.1	1,229	20702	Gas well
36.3	705	20758	Gas well
43.3	2,079	2399	Permitted location
45.5	919	2397	Permitted location
60.0	472	2238	Permitted location
63.4	1,330	2236	Permitted location
69.7	103	1964	Permitted location
71.9	774	1050517	Oil / gas well
71.9	477	1151864	Oil well
72.8	656	1101662	Gas well
73.0	810	1101662	Sidetrack well surface location[b]
73.1	469	1104492	Permitted location
74.2	1,312	1796	Gas well

Table 4.1.2-1 (continued) Active and Permitted Oil and Gas Wells within 0.25 Mile of the Pipeline Facilities			
Component / MP	**Distance from Pipeline Centerline (feet)**	**Well Number[a]**	**Status**
85.1	700	1132222	Oil / gas well
85.3	266	1090056	Oil well
85.5	744	1086605	Oil well
88.5	155	1053319	Permitted location
93.4	751	985	Permitted location
93.4	852	984	Permitted location
134.6	729	1206698	Gas well

Source: RRC 2015.

[a] API well number, if assigned.

[b] A sidetrack well is a secondary wellbore drilled away from the original hole. A sidetracking operation may be done intentionally or may occur accidentally. Intentional sidetracks might bypass an unusable section of the original wellbore or explore a geologic feature nearby.

4.1.3 Geologic Hazards

Geologic hazards are natural, physical conditions that can result in damage to land and structures or injury to people. Such hazards typically include seismicity (such as earthquakes, surface faults, tsunamis, and soil liquefaction), subsidence, flooding and storm damage, and shoreline erosion and landslides. Conditions necessary for the development of other geologic hazards, including avalanches, volcanism, and karst terrain, are not present near the proposed LNG Terminal or pipeline facilities. In general, the potential for geologic hazards to significantly affect construction or operation of the pipeline facilities is low.

4.1.3.1 Seismicity

Earthquakes and Surface Faults

The majority of significant earthquakes around the world are associated with tectonic subduction zones, where one crustal plate is overriding another (e.g., the Japanese islands), where tectonic plates are sliding past each other (e.g., the San Andreas Fault in California), or where tectonic plates are converging (e.g., the Indian sub-continent). Relative to these highly active tectonic regions, Texas and the surrounding areas are seismically quiet. A belt of hundreds of mostly seaward-facing faults, collectively known as the Gulf-margin normal faults, occur along the Gulf of Mexico. However, these faults occur in sediments and poorly lithified rocks, which may not be able to endure the stress required for the propagation of significant seismic ruptures (Crone and Wheeler 2000). Historically, only sporadic, low-magnitude seismic events have been recorded within the Gulf-margin normal faults. The nearest recorded earthquakes to the pipeline facilities occurred in 2010 more than 100 miles from the Compressor Station 3 site and 16 to 20 miles from the pipeline facilities in Jim Wells and Nueces Counties. The magnitudes of these earthquakes were between 3.8 and 3.9 (USGS 2015b). Additional earthquakes with similar magnitudes have occurred in Mexico more than 100 miles southwest of the Compressor Station 3 site.

RB Pipeline conducted a desktop assessment of faulting along the proposed Pipeline System, which indicated the possible presence of seven concealed growth faults between MP 45.1 and MP 135.5 (Page et al. 2005). Although additional faults may be located north of MP 38, mapping is not available. No aboveground facilities would be constructed in the vicinity of mapped faults. The growth faults crossed by the pipeline occur in unconsolidated sediments, where vertical movement of up to 0.1 inch per year may be expected. RB Pipeline would install monuments at potential fault locations at the onset of construction to evaluate differential settlement that may occur, and would continue to monitor settlement during operations. If settlement becomes a hazard, the pipeline would be excavated and new bedding installed beneath it, and RB Pipeline would repair or replace any section of defective pipe.

USGS seismic hazard mapping indicates that the peak ground acceleration (PGA) for the pipeline facilities, with 2 percent probability of exceedance in 50 years, ranges from about 3.0 percent of gravity at Compressor Station 1 and 1.5 percent of gravity where the Pipeline System terminates at the Compressor Station 3 site (USGS 2008). Because PGAs less than 9 percent of gravity would result in moderate to no perceived shaking and very light to no potential damage, it is unlikely that the pipeline facilities would be affected if a small earthquake were to occur (USGS 2006a).

Soil Liquefaction

Soil liquefaction is a phenomenon often associated with seismic activity in which saturated, non-cohesive soils temporarily lose their strength and liquefy when subjected to forces such as intense and prolonged ground shaking. Areas susceptible to liquefaction generally include sandy or silty soils along rivers, streams, lakes, and shorelines, or in areas with shallow groundwater. The soil conditions necessary for liquefaction to occur are present at the proposed LNG Terminal site and pipeline facilities.

At Compressor Station 1, results of the geotechnical investigation concluded that the soils present at the sites are not susceptible to liquefaction. Soil conditions necessary for liquefaction (sandy or silty textures and a shallow water table) do occur along the pipeline route; however, the potential for soil liquefaction to occur is very low due to the low potential for seismicity in the Project area. Because of the presence of saturated sediments beneath the LNG Terminal site, structures constructed at the Compressor Station 3 site could be susceptible to liquefaction under sufficiently strong ground motion. However, the relatively low levels of seismic activity and possible ground motion predicted for the LNG Terminal site and compressor station indicate that liquefaction factors would be limited, and the risk of soil liquefaction at the Compressor Station 3 site is minimal. To determine the liquefaction potential at the modified location of Compressor Station 2 and the two booster stations, we have recommended that RB Pipeline provide the results of geotechnical investigations prior to construction (see section 4.1.1.1).

4.1.3.2 Subsidence

Common causes of ground subsidence include the presence of karst terrain, underground mining, and substantial groundwater or fluid withdrawal. Underground mining poses risks to engineered structures due to the potential for the overlying strata to collapse into the voids formed by the extraction of minerals. Based on a review of available information, there are no underground mining activities or potential to encounter karst terrain in the Project area (USGS 2014, USGS 2016a). Therefore, subsidence associated with these causes is not anticipated.

Subsidence could occur near the pipeline facilities due to oil and gas extraction. As discussed in section 4.1.2.2, these facilities would be within active oil and gas fields. In addition, the pipeline facilities would be within 200 feet of 13 water supply wells for groundwater withdrawals from the Gulf Coast Aquifer (see section 4.3.1). The largest groundwater withdrawals from the Gulf Coast Aquifer occur in the Houston area, and have resulted in irreversible subsidence (Texas Water Development Board [TWDB] 2006). However, the Kenedy County Conservation District, which includes portions of the adjacent counties, indicates that current groundwater uses are not sufficient to cause dewatering in the local clay (Kenedy County Groundwater Conservation District 2017).

4.1.3.3 Flooding and Storm Damage

The Federal Emergency Management Administration (FEMA) produces flood insurance rate maps for municipalities across the nation. The maps are divided into zones with assigned probabilities of experiencing a flood event during any 1-year period. The 100-year flood represents a flood water level that, based on an analysis of the historic record, is likely to be equaled or exceeded every 100 years, meaning that there is a 1 percent chance that the water level will be equaled or exceeded in any individual year during a flood event. FEMA also produces maps where mapped probability of flooding is 0.2 percent during a 1-year period, which corresponds to an average flooding recurrence interval of 500 years.

Flash floods typically result from intense rapid precipitation in upstream areas that leads to extensive short-duration runoff into the stream channel. The greatest potential for flash flooding is associated with high intensity, short duration storm events, which are usually accompanied by significant precipitation over a short period of time. The rainfall rate would need to be a minimum of 3.5 inches per hour to generate flash flooding in counties crossed by the Project (NOAA 2016a).

Based on a review of FEMA flood insurance rate maps, about 24.7 miles of the pipeline route are within the 100-year floodplain; these areas are predominantly located along washes, waterbodies, and arroyos crossed by the pipeline route (FEMA 2017a,b). Although flooding itself does not generally present a risk to pipeline facilities, bank erosion and scour could expose the pipeline or cause sections of pipe to become unsupported. All pipeline facilities are required to be designed and constructed in accordance with 49 CFR 192. These regulations include specifications for installing the pipeline at a sufficient depth to avoid possible scour at waterbody crossings. Typically, the trench would be sufficiently deep to provide for a minimum of 3 feet of cover over the pipeline at waterbodies.

The sites for Compressor Stations 1 and 2 and Booster Stations 1 and 2 are not within the 100- or 500-year floodplains (FEMA 2017a, b). Compressor Station 3 would be in a flood zone but would be within the flood protection levee at the Terminal site, thus minimizing potential flood hazard. Contractor/Pipe Yard 3 and MLV 1 would also be in the 100-year floodplain. To avoid potential damage to equipment by flooding, and to minimize the potential for contamination in the event of a flood, critical infrastructure and potential sources of contamination would be elevated. Further, RB Pipeline would implement its SWPPP to reduce potential impacts on soils from spills of hazardous materials used during construction.

4.1.3.4 Shoreline Erosion and Landslides

Due to the Project area's low landslide incidence and susceptibility, the pipeline facilities would not be subject to landslide hazards (Radbruch-Hall et al. 1982). Where steep slopes occur along waterbodies (e.g., along man-made canals), RB Pipeline would implement erosion and sediment control measures to protect slope stability (see section 4.3.2).

4.1.4 Blasting

Based on available soils and geologic maps, and the geotechnical investigations conducted by RG Developers to date, we do not anticipate that any blasting would be required for construction of the pipeline facilities (or LNG Terminal). Should blasting be required, RG Developers would submit a blasting plan to FERC for approval before initiating blasting activities and would be required to comply with applicable state and federal regulations.

4.1.5 Paleontology

The surficial geologic materials of the Project area are generally young (Holocene to late-Pleistocene epochs). The fossil-bearing formation nearest the surface in the Project area is the Lissie Formation, which may contain Pleistocene-age vertebrate fauna (USGS 2016a). The Lissie Formation is overburdened by the Pleistocene-age Beaumont Formation and Holocene-aged alluvium in the Project area (Baker 1995). Therefore, construction and operation of the LNG Terminal and pipeline facilities would not likely affect paleontological resources.

4.1.6 General Impacts and Mitigation

Impacts on topography and geology associated with the pipeline facilities would be limited to 93.1 acres of land that would be permanently converted to industrial use at the aboveground facilities. Temporary workspaces and the pipeline easements would be restored to pre-construction conditions, limiting geological impacts to temporary disturbance of slopes resulting from grading and trenching operations. RB Pipeline would minimize impacts by returning contours to pre-construction conditions to the maximum extent practicable. At the aboveground facilities, grading and filling may be required to create a safe and stable land surface to support the facility.

As discussed above, none of the active or permitted well sites are within or adjacent to the proposed aboveground facilities. Active oil and gas wells in the Project vicinity generally have alternative access routes; however, operators of active oil and gas wells may experience delays on access roads to the wells as a result of pipeline construction, particularly if construction activities are crossing the primary access to a well. To avoid impacts, RB Pipeline has stated that owners of the wells would be contacted prior to construction to discuss any potential impacts and necessary mitigation measures.

Results of the geotechnical investigation concluded that a shallow foundation system would adequately support lightly loaded structures at the aboveground facilities; however, at the heavily loaded and settlement-sensitive structures at Compressor Station 1, deep foundations consisting of piles are recommended. No potentially liquefiable soils occur within 100 feet of the surface. Geotechnical investigations for Compressor Station 2, the booster stations, and proposed HDD locations are pending; however, we have recommended in section 4.1.1.1 that the results of these investigations be provided prior to construction.

The potential for geologic hazards to impact the pipeline facilities would be low. Further, the pipeline facilities must be designed and installed in accordance with DOT standards, including those in 49 CFR 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards. RB Pipeline would routinely monitor the geotechnical integrity of its facilities as part of its current operations and maintenance activities, and take any corrective actions necessary to repair damage during the life of the Project.

No additional ground would be excavated during operation of the Project; therefore, no operational impacts are expected related to geologic hazards. Based on the above discussion, and in consideration of RB Pipeline's proposed mitigation, we conclude that the pipeline facilities would not significantly affect or be affected by geological conditions in the area.

4.2 SOILS

4.2.1 Existing Soil Resources

The soils affected by the proposed Project were identified and assessed using the NRCS Soil Survey Geographic (SSURGO) database (NRCS 2015a). The SSURGO database is a digital version of the original county soil surveys developed by the 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 provide the proportionate extent of the component soils and their properties for each soil map unit.

4.2.1.1 LNG Terminal

Soils at the LNG Terminal site and associated offsite facilities are mapped as Barrada clay, Lomalta clay, Point Isabel clay loam, Sejita silty clay loam, and Twinpalms-Yarborough complex. These soils do not contain bedrock or other root restrictive layers within 60 inches of the surface. Barrada clay consists of very poorly drained soils with 0 to 1 percent slopes that formed in clayey soil over loamy alluvium and storm washover sediments on wind-tidal flats and enclosed depressions. Lomalta clay consists of very poorly drained soils with less than 1 percent slopes that formed in clayey alluvium on low coastal plains. Point Isabel clay loam consists of well drained soils with 1 to 8 percent slopes that formed in calcareous loamy and clayey eolian deposits on coastal ridges. Sejita silty clay loam consists of poorly drained soils with 0 to 1 percent slopes that formed in calcareous loamy and clayey eolian deposits in tidal flats. The Twinpalms-Yarborough complex consists of soils with 0 to 3 percent slopes. Parent material is sandy dredge spoil and/or loamy dredge spoil likely dredged during construction of the BSC in the 1930s. The Twinpalms component consists of non-hydric, poorly drained soils. The Yarborough component consists of frequently flooded hydric soils.

4.2.1.2 Pipeline Facilities

The pipeline facilities would cross 82 different soil series types, including the five mapped at the LNG Terminal site. The soil series types that would be crossed by the pipeline facilities are listed in appendix I.

4.2.1.3 Standard Soil Limitations

Soils that would be affected by the Project were evaluated to identify special characteristics, such as those designated as prime farmland, those that could affect construction, or those that could increase the potential for adverse construction-related soil impacts. The soil characteristics evaluated include hydric characteristics, erosion potential, the potential for compaction, and revegetation concerns. No soils with shallow depth to bedrock, rocky soils, or soils highly prone to erosion by water occur in the Project area. Table 4.2.1-1 summarizes the amount of prime farmland and the characteristics of soils that would be affected by the Project.

Prime and Important Farmland

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is available for these uses (NRCS 2015b). This designation includes cultivated land, pasture, woodland, or other land that is either used for food or fiber crops, or are available for these uses. Urbanized land, built-up land, and open water cannot be designated as prime farmland. Prime farmland typically contains few or no rocks, is permeable to water and air, is not excessively erodible or saturated with water for long periods, and is not subject to frequent, prolonged flooding during the growing season. Soils that do not meet the above criteria may be considered prime farmland if the limiting factor is mitigated (e.g., by draining or irrigating). Farmland of statewide importance includes areas that produces high yields of crops when managed in accordance with best farming methods. Farmland of statewide importance includes all prime farmland as identified by the NRCS, as well as land that meets specific state-designated criteria (NRCS 1985). None of the soils associated with the LNG Terminal site and related facilities are prime farmland. About 846.2 acres of the soils that would be affected by the pipeline facilities are designated as prime or important farmland, of which 97.9 acres would be affected by aboveground facilities and access roads.

Hydric Soils

Soils that form under conditions of extended saturation, flooding, or ponding during the growing season may develop anaerobic conditions in the upper horizon, and are considered to be hydric (61 FR 29050). These soils are typically indicative of areas with a high mean water table and wetlands. Due to extended periods of saturation, hydric soils can be prone to compaction and rutting. About 525.7 acres and 726.2 acres of the soils at the LNG Terminal site and pipeline facilities, respectively, are hydric.

Table 4.2.1-1 Characteristics of Soils Associated with the Rio Grande LNG Terminal and Pipeline Facilities[a]						
Facilities	**Total Soils Impact (acres)**	**Prime and Important Farmland[b]**	**Hydric Soils[c]**	**Wind Erodible[d]**	**Compaction Prone[e]**	**Revegetation Concerns[f]**
LNG TERMINAL						
LNG Terminal[g]	750.4	0	207.4	0	708.2	708.2
MOF and berthing / turning basin dredge area	68.7	0	0	0	0	0
Temporary haul road[h]	11	0	6.2	2.4	7.4	7.4
Port of Brownsville temporary storage area	20.8	0	14.6	0	20.8	20.8
Port Isabel temporary storage area	4	0	4	4	4	4
Port Isabel dredge pile	293.4	0	293.4	293.4	293.4	293.4
Bulk water loading area	0.1	0	0.1	0	0.1	0.1
LNG Terminal Total	1148.4	0	525.7	299.8	1,033.9	1,033.9
PIPELINE FACILITIES						
Pipeline System and ATWS						
Header System and Pipeline 1[i]						
Header System ROW	30.9	27.6	11.5	3.2	30.9	0.0
Header System ATWS	2.0	2.0	0.8	0.0	2.0	0.0
Pipeline 1 ROW	1,948.0	623.5	514.8	768.6	1,932.3	934.5
Pipeline 1 ATWS	49.6	20.4	11.7	8.7	48.2	25.4
Subtotal	2,030.5	673.4	538.8	780.5	2,013.3	959.9
Pipeline 2[i]						
Pipeline 2 ROW	1,948.0	623.5	514.8	768.6	1,932.3	934.5
Pipeline 2 ATWS	49.6	20.4	11.7	8.7	48.2	25.4
Subtotal	1,997.6	643.9	526.6	777.3	1,980.5	959.9
Access Roads[j]						
Header System Access Roads	15.8	14.5	3.4	0.0	15.8	0.0
Pipelines 1 and 2 Access Roads	106.2	40.4	23.2	43.6	106.1	44.3
Subtotal	122.0	54.9	26.6	43.6	121.9	44.3
Contractor / Pipe Yards						
Contractor / Pipe Yard 1	135.6	74.9	2.0	64.6	135.6	60.7
Contractor / Pipe Yard 2	25.5	0.0	11.2	25.5	25.5	11.2
Contractor / Pipe Yard 3	136.1	0.0	135.9	0.0	136.1	136.1
Subtotal	297.2	74.9	149.1	90.1	297.2	208.0
Aboveground Facilities						
Header System						
Metering Site HS-1	2.1	2.1	2.0	0.0	2.1	0.0
Metering Site HS-2	1.4	1.4	1.2	0.0	1.4	0.0
Metering Site HS-3	2.0	2.0	0.0	0.0	2.0	0.0
Metering Site HS-4	1.4	0.1	1.3	1.3	1.4	0.0
Subtotal	6.9	5.6	4.5	1.3	6.9	0.0

Table 4.2.1-1 (continued)
Characteristics of Soils Associated with the Rio Grande LNG Terminal and Pipeline Facilities[a]

Facilities	Total Soils Impact (acres)	Prime and Important Farmland[b]	Hydric Soils[c]	Wind Erodible[d]	Compaction Prone[e]	Revegetation Concerns[f]
Pipelines 1 and 2[k]						
Compressor Station 1	37.2	37.2	7.1	0.0	37.2	0.0
Compressor Station 2	28.6	0.0	0.0	28.6	28.6	9.2
Interconnect Booster Station 1	9.7	0.0	0.0	9.7	9.7	0.0
Interconnect Booster Station 2	9.9	0.0	0.0	9.9	9.9	0.1
MLVs	0.8	0.3	0.2	0.4	0.8	0.5
Subtotal	86.2	37.5	7.3	48.6	86.2	9.8
Aboveground Facilities Subtotal	93.1	43.0	11.7	49.9	93.1	9.8
Header System and Pipeline 1 Total[l]	2,542.8	846.2	726.2	964.1	2,525.5	1,222.0
Pipeline 2 Total[m]	2,487.2	796.7	706.2	959.6	2,470.0	1,222.0
Pipelines 1 and 2[n]	2,487.2	796.7	706.2	959.6	2,470.0	1,222.0
Pipeline System Total[o]	2,542.8	846.2	726.2	964.1	2,525.5	1,222.0
Rio Grande LNG Project Total[o]	3,691.2	846.2	1,251.9	1,263.9	3,559.4	2,255.9

a The totals shown in this table may not equal the sum of the addends due to rounding. Total acreage does not equal the total impact acreage for the Project as not all soils are classified with limitations and certain soils are classified as having multiple limitations.

b As designated by the NRCS (2015a). Includes soils that are considered prime and farmland of statewide importance if a limiting factor is mitigated (e.g., artificial drainage).

c As designated by the NRCS (2015a), based on percent of map unit designated as hydric.

d Soils with a wind erodibility group classification of 1 or 2 (severe). No soils with a hazard of severe water erosion soil loss from unsurfaced roads and trails, as designated by the NRCS (2015a).

e Includes soils with moderate to severe compaction potential based on fine texture and poor drainage class.

f Soil series that have surface texture of sandy loam or coarser, are moderately well to excessively drained, have steep slopes (greater to or equal to 9%), and soils near the coast with high salinity (NRCS 2015a).

g Acreages for the LNG Terminal site include those acreages associated with Compressor Station 3 and the marine facilities.

h Placement of this access road is a deviation to the FERC Procedures (see section 4.4.2.1).

i Pipeline right-of-way soil totals include the entire 75-foot-wide permanent right-of-way between entry and exit points for the HDD locations, which are excluded from the assessment of impacts on land use (section 4.8) and vegetation (section 4.5).

j Access road soils include the total acreage of soils that would be affected construction of the Project added to those that would be permanently maintained during operations. A majority of access roads are existing.

k These facilities would originally be disturbed during the construction of Pipeline 1. Although use and modification of these facilities would occur during the construction of Pipeline 2, no additional operational footprint would be required.

l All impacts associated with construction of the Header System and Pipeline 1, including right-of-way, ATWS, contractor/pipe yards, aboveground facilities, and access roads.

m All impacts associated with construction of Pipeline 2, including right-of-way, ATWS, contractor/pipe yards, aboveground facilities, and access roads.

n This total includes the footprint of Pipelines 1 and 2, and associated aboveground facilities, rather than the sum of their individual components, as the affected acreage for Pipeline 2 entirely overlaps with the affected acreage proposed for Pipeline 1.

o This total includes all pipeline facilities, including the Header System, Pipelines 1 and 2, and associated aboveground facilities, without overlap.

Wind Erodible Soils

Erosion is a continuing natural process that can be accelerated by human disturbance. Factors such as soil texture, structure, slope, vegetation cover, rainfall intensity, and wind intensity can influence the degree of erosion. Wind-induced erosion often occurs on dry and non-cohesive soil where vegetation cover is sparse and strong winds are prevalent. Based on the soil properties reviewed, 299.8 and 964.1 acres of the soils affected by the LNG Terminal and pipeline facilities, respectively, are considered highly susceptible to erosion by wind.

Compaction Potential

Soil compaction modifies the structure and reduces the porosity and moisture-holding capacity of soils. Construction equipment traveling over wet soils could disrupt soil structure, reduce pore space, increase runoff potential, and cause rutting. The degree of compaction depends on moisture content and soil texture. Fine-textured soils with poor internal drainage that are moist or saturated are the most susceptible to compaction and rutting. About 1,033.9 acres of soils at the LNG Terminal site and 2,525.5 acres of soils affected by the pipeline facilities, are prone to compaction due to fine textures and poor drainage class.

Revegetation Concerns

Successful restoration and revegetation are important for maintaining soil productivity and protecting the underlying soil from potential damage, such as erosion. The revegetation potential of soils in the Project area was evaluated based on the soil surface texture, slope, salinity, and drainage class. Drier soils have less water to aid in the germination and eventual establishment of new vegetation. Coarser textured soils have a lower water holding capacity following precipitation, which could result in moisture deficiencies in the root zone and unfavorable growing conditions for many plants. Saline soils can inhibit plants from absorbing adequate water and nutrients, limiting revegetation potential. Based on the soil properties reviewed, we expect that 1,033.9 acres of soils affected by the LNG Terminal and 1,220.0 acres of soils affected by the pipeline facilities would have low revegetation potential (see table 4.2.1-1).

4.2.2 Soil Impacts and Mitigation

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

4.2.2.1 LNG Terminal

Preparation of the LNG Terminal site would include adding material such as cement or lime to stabilize soils, depositing fill to increase ground elevation, and installing aggregate material to provide a safe and level work surface. These activities would permanently alter the soils and increase the potential for erosion until the LNG Terminal is constructed and the remaining exposed soils are stabilized and revegetated.

The LNG Terminal site would be graded to two main platform elevations: an elevation of 10 feet NAVD 88 would be established throughout the majority of the site (including the LNG trains and ground flares), and a lower surface elevation of 9 feet NAVD 88 would be established for the area of the stormwater holding ponds and LNG storage tanks. RG LNG would construct a storm surge protection levee surrounding the LNG Terminal site with elevations ranging from 17 to 19 feet NAVD 88. About 623,000 yd^3 of material would be excavated along the shoreline and within the BSC by land-based equipment for the construction of the marine facilities. This material would be directly placed at the LNG Terminal site for fill where needed to meet the design elevations. Additional fill would be obtained from the Port Isabel dredge pile (discussed below) and from dredging.

As described in detail in section 2.5.1.4, about 39,000 yd^3 of material would be dredged from the MOF and either used as fill at the LNG Terminal site or pumped via temporary pipeline to an approved dredged material disposal site. About 7.2 mcy would be dredged from the marine berths and turning basin to provide adequate under keel clearance for LNG carriers, of which about 0.6 mcy would be used as fill at the LNG Terminal site. The remainder would be placed at approved dredged material placement sites using either a hydraulic dredge and temporary pipeline, a mechanical dredge, or a combination of both; a temporary pipeline, if required, would be placed on the channel bed and allowed to settle of its own weight. Dredging at the LNG Terminal site would be completed by RG LNG in coordination with the BND and the COE and in accordance with permits issued by the COE.

To minimize shoreline erosion, the LNG Terminal waterfront along the BSC would be stabilized from the MOF to the berths and turning basin. The channel embankments and slope of the shoreline to a depth of -2 feet MLLW would be graded to a 1:3 slope, stabilized with bedding stone overlain by geotextile fabric, and then covered with rip-rap. In the marine berths and turning basin, where vessel activity could erode the underwater channel slopes, the shoreline would be dredged to a 1:3 slope and stabilized with rip-rap to a depth of -43 feet MLLW. RG LNG would maintain the integrity of the shoreline protection throughout the operational life of the LNG Terminal. All dredging and shoreline stabilization would be conducted during site preparations in Stage 1 of construction.

To reduce the impacts of construction on soils, RG LNG would implement measures outlined in the Project-specific Plan and Procedures, which include measures to control erosion and sedimentation and to ensure proper restoration of disturbed areas following construction. None of the soils at the LNG Terminal site are designated as prime farmland. Portions of the LNG Terminal site that would be vegetated during operation, such as the levees, would be seeded per NRCS recommendations to prevent erosion. Additional mitigation measures would include the installation and maintenance of temporary erosion and sedimentation controls to prevent sediment flow from construction areas into adjacent, undisturbed areas, and regular monitoring and inspection of disturbed areas until final stabilization is achieved.

RG Developers stated that water use would be the predominant means of controlling wind erosion in disturbed areas having soils with high wind erodibility. Although the use of approved chemicals, as well as mulch along the Pipeline System, are noted as potential mitigation measures, no specific chemicals or application rates are included in the Terminal and

Pipeline System Fugitive Dust Control Plans.[13] At our request, RB Pipeline contacted the NRCS to determine if alternative forms of dust control were recommended or appropriate. The NRCS indicated that wind erosion is a concern in Willacy and Cameron Counties, but that use of chemicals is not permitted given the potential threat to threatened and endangered species. Cover crops are generally used to control wind erosion in these counties. To account for agency input into fugitive dust control, **we recommend that:**

- **<u>Prior to construction of the Project</u>, RG Developers should file their final Fugitive Dust Control Plans for the LNG Terminal and Pipeline System with the Secretary, for review and written approval by the Director of OEP. The final plans should specify that no chemicals may be used for dust control in Willacy and Cameron Counties.**

Immediately adjacent to the LNG Terminal site boundaries, and within the larger property leased by RG LNG, about 233.8 acres would be preserved as natural buffers. Of that, 10.5 acres would be dredged for a planned expansion of the Bahia Grande Channel that is unrelated to the Rio Grande LNG Project. Implementation of the Project-specific Plan and Procedures and construction of the levee during Stage 1 of construction would protect adjacent areas from sedimentation.

An additional 329.3 acres would be temporarily impacted during use of two temporary offsite storage/parking areas, the proposed temporary haul road, and the Port Isabel dredge pile. RG LNG would implement its Plan and Procedures to minimize soil impacts associated with these facilities. Upon completion of construction, the offsite storage and parking areas would be restored to pre-construction conditions and revegetated, as applicable, in accordance with its Plan and Procedures.

Construction and use of the temporary haul road could result in sedimentation of adjacent wetlands and open water; however, as construction of the temporary haul road would not be in accordance with the FERC Procedures, we have asked RG LNG to assess the feasibility of certain options that could avoid the need for construction of the haul road (see section 3.4). The Port Isabel dredge pile would be used to supply an estimated 3.5 mcy of fill material for grading and site preparation at the LNG Terminal site. The soils at this site are comprised of dredge spoil and are prone to compaction. RG LNG would use timber mats and low ground pressure equipment to minimize potential rutting and compaction during wet soil conditions at the Port Isabel dredge pile.

To prevent contamination of soils within nearby wetlands, waterbodies, and other sensitive resources, RG LNG would implement its SWPPPs and SPCC Plans[14] during construction and operation of the LNG Terminal. These plans outline potential sources of releases at the site, measures to prevent a release to the environment, and initial responses in the

---

[13] RG Developers' Pipeline System and Terminal Fugitive Dust Control Plans are available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20160505-5179.

[14] RG LNG's SWPPP and SPCC Plans are available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20160901-5281.

event of a spill. In addition, the levee would protect areas adjacent to the LNG Terminal site from potential contamination due to spills of hazardous materials during construction and operation. As discussed in section 4.2.3, previous sediment sampling indicated the lack of contaminated sediments within the BSC; however, it is possible that unanticipated contamination would be encountered during construction and dredging activities. Therefore, RG LNG would conduct any requested dredged material sampling and testing in accordance with applicable permit conditions and would implement its *Unanticipated Contaminated Sediment and Soils Discovery Plan*[15] if contaminated materials were encountered. This plan requires a cessation of work upon identification of contaminated sediments or soils, notification of the appropriate regulatory authorities, and treatment of the contaminated materials to the satisfaction of the applicable agencies prior to resuming work in the area.

RG LNG has stated that it would implement its operational SWPPP and SPCC Plan during operation of the LNG Terminal. As of this writing, RG Developers have submitted draft versions of the SWPPPs and SPCC Plans for construction of the LNG Terminal and Pipeline System, as well as a draft version of the *Unanticipated Contaminated Sediment and Soils Discovery Plan* for the Project. Because RG Developers have not yet provided final versions of these plans, nor has RG LNG provided copies of its operational SWPPP and SPCC Plan, **we recommend that:**

- **<u>Prior to construction of the Project</u>, RG Developers should file with the Secretary, for review and written approval by the Director of the OEP, final versions of their SWPPPs and SPCC Plans for construction and operation of the Project, as well as the final version of the *Unanticipated Contaminated Sediment and Soils Discovery Plan*.**

Given the impact minimization and mitigation measures described above, and our recommendation to provide final plans prior to construction, we conclude that impacts on soils due to construction and operation of the LNG Terminal would be permanent, but minor.

4.2.2.2 Pipeline Facilities

Pipeline System and Additional Temporary Workspace

<u>Header System and Pipeline 1</u>

As shown in table 4.2.1-1, construction workspace for the Header System and Pipeline 1 would impact prime and important farmland (673.4 acres), hydric soils (538.8 acres), soils susceptible to wind erosion (780.5 acres), compaction prone soils (2,013.3 acres), and soils with revegetation limitations (959.9 acres). Following construction of Pipeline 1, the right-of-way would be restored to pre-construction conditions and seeded per NRCS recommendations.

---

[15] RG LNG's *Unanticipated Contaminated Sediment and Soils Discovery Plan* is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp,, by searching Docket Number CP16-454 or CP16-455 and accession number 20160928-5172.

Pipeline 2

Construction of Pipeline 2 would commence approximately 18 months after the installation and restoration of Pipeline 1. As Pipeline 2 would be constructed within the same disturbed areas as Pipeline 1, it would impact similar soil types as described for the Header System and Pipeline 1.

General Impacts and Mitigation

To reduce the impacts of construction on soils, RB Pipeline would implement the measures outlined in its Plan and Procedures. To prevent soil erosion in particular, RB Pipeline would implement the following measures:

- installation and maintenance of temporary erosion and sedimentation control structures during construction;
- installation and maintenance of permanent erosion controls following construction, such as trench breakers and slope breakers, where applicable;
- use of mulch on slopes where needed (except in cultivated cropland or wetlands), concurrent with or immediately after seeding to stabilize the soil surface and to reduce wind erosion;
- use of dust suppression to control and minimize wind erosion in accordance with its draft Pipeline System Fugitive Dust Control Plan, including watering appropriate areas every 3 days and additional measures determined in consultation with the NRCS (see section 4.2.2.1);
- revegetate disturbed areas within six working days of final grading (weather and soil conditions permitting), with seed mixes developed in consultation with the NRCS, or as requested by the landowner; and
- regular monitoring and inspection of disturbed areas until final stabilization is achieved, as identified in RG Developers' Plan and Procedures.

Potential impacts on compaction prone and hydric soils include soil rutting and compaction due to construction equipment. RB Pipeline would use equipment mats or low ground pressure equipment in saturated wetlands to minimize the potential for compaction and rutting. In severely compacted areas on agricultural land, RB Pipeline would decompact soils by tilling in accordance with its Plan. Mixing of topsoil with subsoil could alter nutrient availability and soil chemistry, thereby inhibiting revegetation. Therefore, up to 12 inches of topsoil would be segregated over the trenchline in wetlands and over the trenchline and spoil side of the right-of-way in cultivated or rotated cropland and other areas as requested by landowners.

Disturbed areas would be seeded in accordance with NRCS-recommended seed mixes, rates, and dates; these seed mixes would include species suitable for saline soils, where applicable. RB Pipeline does not propose seeding in cultivated cropland unless requested by the landowner. Where applicable, and in accordance with written recommendations obtained from the NRCS, land management agencies, or landowner, RB Pipeline would add fertilizer and soil pH modifiers into the top 2 inches of soil. Soil additives would not be used in wetlands without written documentation of approval from the appropriate state or federal agency.

The Rio Bravo Pipeline would cross through multiple soil series know to have shrink-swell, or smectitic soils which are soils that expand and contract during periods of rain and drought and may form cracks in the ground. RB Pipeline has indicated that shrink-swell soils are interspersed throughout the route with no high concentration areas, and that the requirements of the Occupational Safety and Health Administration and industry standards would be followed during construction through these soils to avoid impact on the pipelines.

Workspaces associated with construction of the Pipeline System would be restored to pre-construction conditions and replanted using an NRCS-recommended native seed mix (or as requested by the landowner), and would therefore retain their former productivity. Except where encumbered by aboveground facilities, as described below, prime and important farmland would be restored following construction. Given the impact minimization and mitigation measures described in the Project-specific Plan, Procedures, and draft Pipeline System Fugitive Dust Control Plan, which would be finalized prior to construction, we conclude that impacts on soils due to construction and operation of the Pipeline System would be temporary and minor.

Aboveground Facilities

The aboveground pipeline facilities would include three compressor stations, two booster stations, eight metering sites, and additional appurtenant facilities. Ground disturbance for each of these facilities would be completed in conjunction with the Header System and Pipeline 1. Impacts from Compressor Station 3 are discussed above, as it would be within the boundaries of the LNG Terminal site. As shown in table 4.2.1-1, the aboveground facilities would impact 93.1 acres of soil, including 43.0 acres of prime or important farmland. RB Pipeline would implement measures outlined in its Plan and Procedures, as summarized above, to minimize impacts on soils at the aboveground facilities during construction. Following construction, land within construction workspaces but outside of the compressor and interconnect booster station footprints (about 32.4 acres) would be allowed to revert to pre-construction conditions, but would be retained by RB Pipeline. Land within the operational footprint of the facilities (53.0 acres) would be converted to industrial use, representing a permanent, but minor, impact.

Contractor/Pipe Yards

Three contractor/pipe yards would be used during construction of the pipeline facilities, resulting in impacts on 297.2 acres of soils beneath open and agricultural land (see table 4.2.1-1). Necessary modifications at these sites would be limited to the placement of limestone and/or gravel on geotextile fabric to allow stable storage areas for materials and to minimize ground impacts from stockpiled pipe. The construction of dirt berms ranging from 1 to 2 feet in height would be required to elevate the pipe stored at these locations for ease of lifting and handling by equipment such as a forklift.

RB Pipeline proposes to construct the dirt berms with native soils from the respective site. Following construction, the berms would be removed through the process of leveling the site to pre-construction contours. RB Pipeline would implement measures outlined in its Plan and Procedures, as summarized above, to minimize impacts on soils at the contractor/pipe yards. Following construction of Pipeline 2, these yards would be restored and would revert to their original use.

Access Roads

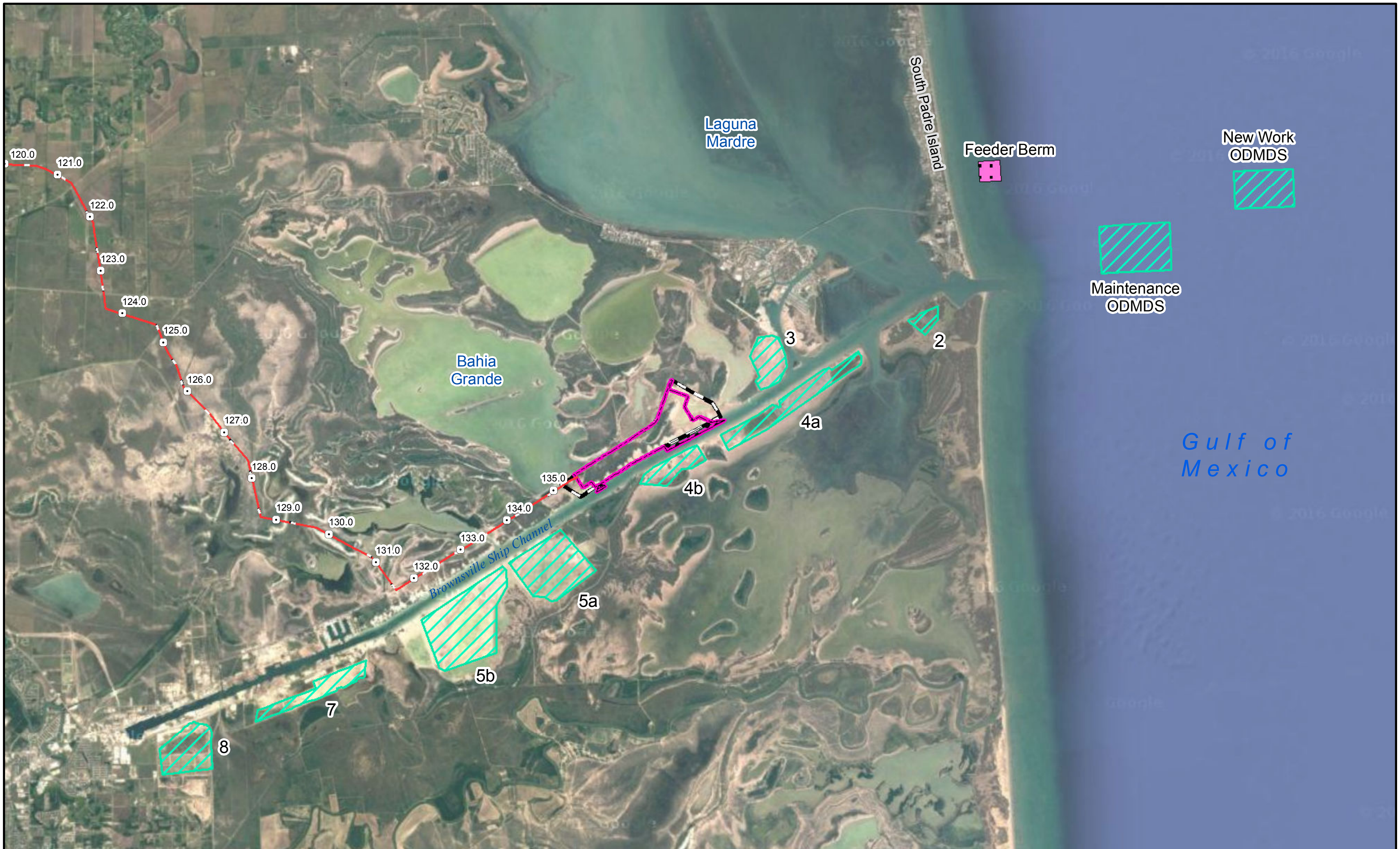
RB Pipeline proposes to use a total of 64 roads (including 52 temporary and 12 permanent access roads) to access the right-of-way during construction. Expansion of two existing, permanent access roads and construction of five new, permanent access roads would result in permanent impacts on soils, similar to those described for the aboveground facilities.

4.2.3 Dredged Material Disposal Sites

RG LNG developed a draft Dredged Material Management Plan that describes the scope of work and practicable disposal locations for dredged material placement, both for new dredging related to facility construction, and for 30 years of future maintenance dredging at the marine berths and turning basin. RG LNG estimates about 7.2 mcy of dredged and excavated material would be generated during construction of the LNG Terminal. An additional 0.25 to 0.5 mcy of dredged material is expected to be generated every 2 to 4 years from maintenance dredging activities. In addition to placement of some dredged material at the LNG Terminal site (for site stabilization), RG LNG identified 12 potential sites for dredged material placement, including eight upland placement areas, two ODMDS, and two existing nearshore beach nourishment sites. RG LNG is also considering other beneficial uses of dredged material. The final management and disposition of dredged material will be determined by RG LNG's consultation with federal, state, and local resource agencies and applicable stakeholders, including the BND, COE, EPA, NMFS, FWS, and the TCEQ. RG LNG's initial proposed locations for the placement of dredged materials was either at the New Work ODMDS or a combination of two Port of Brownsville upland placement areas (PAs 5a and 5b), with some material from the MOF possibly being placed at PA 4b. Placement of materials from maintenance dredging is currently proposed for upland placement areas (PAs 4a, 4b, 5a, or 5b), the Maintenance ODMDS, or the Feeder Berm. A description and comparison of these sites is provided below, and the locations are depicted in figure 4.2.3-1.

4.2.3.1 LNG Terminal Site

As described in section 2.5.1.4, material from land-based excavation and dredged material from construction of the MOF would be placed within the LNG Terminal site for leveling and grading; some material dredged from the MOF could also be placed at PA 4b (see section 4.2.3.2). The LNG Terminal site could only accommodate about 0.6 mcy of material for grading operations. In addition, based on initial testing, much of the dredged material from the MOF, berth, and turning basin would not meet the compositional characteristics required for use as construction fill in structure-bearing areas of the site. Therefore, RG LNG proposes to use the LNG Terminal site for the placement of 0.6 mcy of dredged materials in non-structure bearing areas or to construct the levee; the remaining volume would be placed in an alternative upland placement area (PA) or ODMDS, as described below.



Legend

- Feeder Berm
- Dredge Spoil Placement Area
- LNG Terminal Site
- Proposed LNG Terminal Boundary
- BSC Dredge Areas
- Proposed Rio Bravo Pipeline

N

0 1.5 3
Miles

Scale: 1:160,000

Rio Grande LNG Project

Dredge Disposal Locations Considered for Placement of Dredged Materials

Figure 4.2.3-1

4.2.3.2 Upland Placement Areas

There are eight upland placement areas located along the BSC (see figure 4.2.3-1). Seven of the placement areas are owned and operated by the BND, and one is partially owned and managed by the Port Isabel-San Benito Navigation District. Each of the placement areas has available capacity to receive dredged material from the Rio Grande LNG Terminal site; however, the Brazos Island Harbor Channel Improvement Project (Brazos Island Harbor Project; the project to deepen the BSC, as described in section 4.3.2) is anticipated to dispose of about 12 mcy of material into the placement areas. In addition, adjacent or nearby proposed LNG projects would also require dredged material placement. As the majority of placement areas are owned and operated by the BND, the BND is conducting a study of the ongoing maintenance projects and new proposed projects to address the growing need for upland placement along the ship channel. At this time, no new placement areas have been proposed by the BND. While the final determination of the placement areas used by the Project will be based on the results of the BND's study, RG LNG has identified PAs 5a and 5b as practicable disposal sites. Due to the proximity to the LNG Terminal site to PAs 5a and 5b, hydraulic methods could be used to dredged materials that would be disposed at these locations. Improvements to the levees at upland placement areas may be required to accommodate the additional capacity of dredged material. For example, use of both PAs 5a and 5b would require the existing levees to be raised by less than 10 feet whereas using only one of these placement areas would require a 10- to 20-foot increase in levee height.

4.2.3.3 Ocean Dredged Material Disposal Sites

There are two ODMDS available for offshore disposal, including the New Work ODMDS and the Maintenance ODMDS. The New Work ODMDS is about 350 acres in size, and is about 4.4 miles from the shore, in a dispersive environment; there is no volumetric limit on capacity for this site. If determined appropriate for use, the EPA would develop a Site Management and Monitoring Plan, which would include monitoring requirements that the EPA would require RG LNG to implement.

The Maintenance ODMDS is about 352 acres in size and about 1.9 miles from the shore at the entrance to the BSC. Due to its location at the entrance to the ship channel, material placed in the Maintenance ODMDS is more likely to become suspended and settle at the entrance; therefore, the discharge location within the ODMDS must be monitored. As long as materials are discharged within the approved area, the Maintenance ODMDS is capable of receiving large volumes of material; a maximum volume has not been established. Both the New Work and Maintenance ODMDS have a current Site Management and Monitoring Plan.

Although the responsible agencies (the EPA and COE) have acknowledged the need for additional capacity in available placement areas, use of the ODMDS would require an approved dredged material disposal site alternatives analysis for review and approval by the COE.

4.2.3.4 Nearshore Beach Nourishment Sites and Beneficial Uses

Two beach nourishment placement sites are available to receive dredged material from maintenance dredging of the BSC, including the Feeder Berm and direct disposal on the beach of South Padre Island. The Feeder Berm is a 313-acre beneficial use site about 2 miles north of the jetty and about 0.5 mile offshore; materials placed at this location migrate inshore to replenish the adjacent beach. The City of South Padre Island directly places sand on the beaches in an effort to minimize the effects of erosion. Both the Feeder Berm and South Padre Island sites are only approved for receiving beach quality sand; therefore, material from new work dredging for the Rio Grande LNG Terminal site would not be suitable for placement at either site. However, the Feeder Berm could be used for placement of maintenance dredged material, if testing indicates that the material is suitable beach quality sand prior to placement. Material from maintenance dredging of the BSC is generally placed in the nearshore Feeder Berm, or directly onto South Padre Island beaches (COE 2014). RG LNG is also considering potential beneficial uses of dredged material for the creation of clay core dunes on South Padre Island, creation of a parking area for a kite park proposed by the City of South Padre Island, or use as the base material for a second planned Feeder Berm, which has not been constructed.

4.2.4 Soil Contamination

Based on a review of the EPA’s Toxic Release Inventory Program sites in Texas, no hazardous waste sites are within 1 mile of the Project (EPA 2014). As stated in section 4.2.1.1, the LNG Terminal site includes soils dredged from the BSC as a result of channel dredging activities unrelated to the proposed Project. Contaminated soil sampling studies in the channel were conducted by the TCEQ and the COE in 2012 and 2014, respectively. No contaminated sediments were identified during these studies and therefore no contaminated soils are expected to be encountered during construction or operation of the Project (TCEQ 2012 and COE 2014). However, RG LNG would test dredged materials in accordance with applicable permit requirements and would implement its *Unanticipated Contaminated Sediment and Soils Discovery Plan* if contaminated materials were encountered. Further, RG Developers would implement their SWPPPs and SPCC Plans to reduce potential impacts on soils from spills of hazardous materials used during construction and operation, which would be finalized prior to construction per our recommendation in section 4.2.2.1.

4.3 WATER RESOURCES

4.3.1 Groundwater Resources

4.3.1.1 Existing Groundwater Resources

The Rio Grande LNG Project is within the Coastal Lowlands Aquifer System, which underlies about 35,000 square miles of the low-lying coastal plain in Texas, and comprises Oligocene- to Holocene-aged overlapping mixtures of sand, silt, and clay (Ryder 1996). The aquifer system was formed in three depositional environments: continental (alluvial plain), transitional (delta, lagoon, and beach), and marine (continental shelf). The Coastal Lowlands Aquifer System is wedge-shaped, and thickens and deepens toward the Gulf of Mexico.

In Texas, the Coastal Lowlands Aquifer System is generally referred to as the Gulf Coast Aquifer, and much of it is classified as a major aquifer by the TWDB (Ryder 1996, TWDB 2011). Major aquifers produce large amounts of water over large areas. The Gulf Coast Aquifer has five permeable zones and two confining units. The mostly sandy unconfined permeable units of the Chicot and Evangeline aquifers form the uppermost deposits of the Gulf Coast Aquifer. The Chicot aquifer is between 0 and 250 feet deep at the northwestern extent of the Project area in Jim Wells County and extends to approximately 1,200 feet deep within southeastern extent of the Project area. The Chicot aquifer overlies the Evangeline aquifer, which reaches depths of up to 3,800 feet (TWDB 2007, 2011, 2012). The Chicot and Evangeline aquifers are separated from the deeper Jasper aquifer by the Burkeville confining unit, which is primarily composed of clay and silt (Ryder 1996, TWDB 2007). The Catahoula confining unit is the deepest unit in the Gulf Coast Aquifer and comprises primarily of clay deposits.

The largest groundwater withdrawals from the Gulf Coast Aquifer occur in the Houston area, and have resulted in irreversible subsidence (TWDB 2006). In the Project vicinity, most of the groundwater does not meet drinking water quality standards due to salinity and high total dissolved solids; in localized areas, high nitrate, sodium, chloride, and boron also affect groundwater quality (TWDB 2007). However, groundwater from the Gulf Coast Aquifer is the primary water supply source in the Project area within Kenedy, Kleberg, and Jim Wells Counties (USGS 2016b, TWDB 2012). In the southern extent of the Project area, including Cameron and Willacy Counties, surface water from the Rio Grande River is the primary source of drinking water (Paine 2000).

The EPA defines a sole or principal source aquifer as one that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. To be defined as a sole source aquifer, there cannot be an alternative drinking water source that could supply all those who depend on the aquifer with drinking water (EPA 2016a). The Rio Grande LNG Project area is not underlain by a sole source aquifer; the nearest EPA-designated sole source aquifer is the Edwards Aquifer, located about 150 miles from the Project area (EPA 2008).

The TCEQ establishes local groundwater conservation districts to manage groundwater resources within their jurisdictions; management activities include permitting water wells, and developing and implementing a comprehensive management plan. The Header System and portions of Pipelines 1 and 2 are located within the Kenedy County Groundwater Conservation District.

In addition, the TCEQ manages a Source Water Assessment and Protection Program in accordance with the Safe Drinking Water Act to protect the quality of public drinking water supplies, including ground and surface water supplies (Texas Natural Resources Conservation Commission 1999). The TCEQ delineates a wellhead protection area around each public water supply well, after which a management plan is developed that may include an inventory of potential sources of contamination and implementation of best management practices (BMPs) for prevention of contamination.

LNG Terminal

The Rio Grande LNG Terminal site is within the Coastal Lowlands Aquifer System, but is not within the portion classified by the TWDB as a major aquifer (the Gulf Coast Aquifer). As discussed in section 4.1.3.1, RG LNG performed geotechnical studies to evaluate subsurface groundwater conditions at the LNG Terminal site and found that depth to surficial groundwater was between -0.5 and 1.5 feet NAVD 88. However, groundwater in Cameron County is not generally suitable for use as drinking water due to high salinity, likely resulting from saltwater intrusion from the Gulf of Mexico (Paine 2000). Therefore, drinking water in the vicinity of the LNG Terminal site is primarily surface water from the Rio Grande and associated reservoirs (see section 4.3.2).

There are no public or private water supply wells within 0.25 mile of the LNG Terminal site or temporary offsite storage/parking sites, and no wellhead protection areas occur in the vicinity of the LNG Terminal site (TWDB 2016a, TCEQ 2016a). The nearest drinking water supply well is about 1.5 miles from the LNG Terminal site. The LNG Terminal site is not within a designated TCEQ Groundwater Conservation District. In addition, the TCEQ has not documented historic groundwater contamination cases at the LNG Terminal site; the nearest documented groundwater contamination occurred in 2009 in Port Isabel, about 0.5 mile from the Port Isabel storage area and 2.8 miles from the LNG Terminal site (TCEQ 2015a).

Pipeline Facilities

The entire Header System, and Pipelines 1 and 2 from MP 0.0 to MP 79.7, overlie the Gulf Coast Aquifer. Groundwater is a major source of water supply (including drinking water) in this portion of the Project area, in contrast to the southern extent of the pipelines where surface water from the Rio Grande is the primary water supply source. Drinking water is primarily sourced from groundwater in Kenedy, and Kleberg Counties, from surface water in Jim Wells County, and from the Rio Grande in Cameron and Willacy Counties (TWDB 2016a, Paine 2000).

The Header System and Pipelines 1 and 2 from MP 0.0 to approximate MP 70.8 are located within the Kenedy County Groundwater Conservation District. In Texas, groundwater conservation districts are required to develop and implement groundwater management plans to provide for efficient use of groundwater, prevent degradation of water quality, control and prevent groundwater waste, and meet other goals established in the Texas Water Code. Water within the Kenedy County Groundwater Conservation District is primarily used for municipal water supply, irrigation, livestock, and mining (including oil and gas development) (TWDB 2012).

According to publicly available geospatial data, 13 water supply wells are within 200 feet of pipeline facilities; no springs are within 200 feet of the pipeline facilities. Table 4.3.1-1 identifies the public and private water supply wells within 200 feet of the pipeline facilities. No wellhead protection areas or source water protection areas occur within 0.25 mile of the pipeline facilities.

Table 4.3.1-1 Public and Private Water Supply Wells within 200 feet of Pipeline System Workspaces					
Well ID	**Approximate MP**	**Well Type[a]**	**Well Depth (feet)**	**Distance from Nearest Construction Workspace (feet)**	**Direction from Pipeline System Workspace**
Pipelines 1 and 2					
166739	5.9	Industrial	815	0.0	N/A
307750	7.5	Livestock	520	195.3	Northeast
8342802	20.4	Withdrawal of water	686	94	West
8827903	78.9	Withdrawal of water	1,416	85.1	Northeast
262623	119.4	Domestic	Unknown	139.4	North
Access Roads					
8358202	31.2	Withdrawal of water	718	121	Southwest
1370029	0.0	Public water supply	650	10.8	West
1370029	0.0	Public water supply	580	100.4	North
8440205	0.0	Withdrawal of water	600	75.0	South
8440202	0.0	Withdrawal of water	722	120.7	South
8440104	0.0	Withdrawal of water	435	186.1	South
8333401	5.0	Withdrawal of water	556	9.4	North
8341202	9.0	Withdrawal of water	525	110.4	West

Sources: TCEQ 2015a; TWDB 2016a, 2016b.

[a] Well Type is the principle use or the purpose for which the well was constructed as identified in the TWDB's Groundwater Database Report (TWDB 2016b) and Submitted Drillers Reports Database (TWDB 2015). Monitoring and observation wells are not included. Wells for water withdrawal may include a variety of water uses.

As stated above, much of the groundwater in the Project vicinity does not meet drinking water quality standards due to salinity and, in localized areas, high nitrate, sodium, chloride, and boron (TWDB 2007). The TCEQ has documented four cases of historic groundwater contamination within 1 mile of the pipeline, all of which were associated with oil and gas activity. Of those, one case is under corrective action at the existing King Ranch Gas Plant about 0.9 mile from Compressor Station 1 at MP 0.0; the other sites were investigated and no permit or regulatory violations were identified (TCEQ 2015a).

4.3.1.2 Groundwater Impacts and Mitigation

Construction of the Rio Grande LNG Project would primarily involve surficial or shallow localized excavation, except where piles would be installed at the LNG Terminal site; therefore, shallow groundwater could sustain impacts from excavation and backfilling. In addition to the individual impacts of the LNG Terminal and the pipeline facilities, which are discussed below, overall construction and operation of the proposed Project could result in contaminated groundwater from inadvertent spills or the disturbance of existing contaminated sediment or soil that could impact groundwater.

Shallow groundwater areas could be vulnerable to contamination resulting from inadvertent surface spills of hazardous materials used during construction and operation of the Project. If not cleaned up, contaminated soil could continue to leach and add pollutants to groundwater long after a spill has occurred. Implementation of RG Developers' Plan and Procedures and SPCC Plans would reduce the potential for groundwater contamination resulting from a spill during construction and operation. These draft plans address storage and transportation of hazardous materials, identify preventative measures to reduce the likelihood of a spill, and include measures for clean-up of an inadvertent spill; we have recommended that these plans be finalized prior to construction in section 4.2.2.1. We have reviewed RG Developers' draft SPCC Plans and determined that the protocols adequately address the storage and transfer of hazardous materials and the response to be implemented in the event of a spill.

In the event that contaminated groundwater is encountered during construction, RG Developers would implement the measures in their draft *Unanticipated Contaminated Sediment and Soils Discovery Plan*, which would be finalized prior to construction per our recommendation in section 4.2.2.1. In the event of an unanticipated discovery of contamination, RG LNG would:

- stop work in the vicinity of suspected contamination;
- use flagging and/or fencing to restrict access to the potentially contaminated site;
- notify an EI, who would then notify the potentially responsible party and document the discovery; and
- implement any necessary corrective actions in coordination with appropriate regulatory agencies prior to resuming work.

LNG Terminal

The majority of the construction activities associated with the LNG Terminal would involve shallow, localized excavation; however, concrete and steel piles would be installed to support terminal structures. These piles would be driven to an elevation of about -50 feet, at which depth the pilings would be entirely within the upper permeable layer of the Coastal Lowlands Aquifer System. Because the pilings would not cross an aquifer confining layer, their installation would not result in the mixing of groundwater between permeable layers of the aquifer system. Soils would be compacted and encumbered within the footprint of the LNG Terminal site, which may alter groundwater flow and recharge. However, RG LNG plans to construct a drainage system and stormwater ponds to manage stormwater onsite, and the relatively small amount of new impervious surface at the LNG Terminal site is not expected to affect overall groundwater recharge rates in the vicinity of the Project. Additional detail on the stormwater management system is provided in section 4.3.2.2.

RG LNG has proposed to use two storage areas, which may require modification prior to their use. In addition, RG LNG has proposed to construct a new temporary haul road to the Port Isabel dredge pile; as construction of this road would occur in wetlands, it is discussed further in section 4.4. The measures that RG LNG has proposed to minimize potential impacts of the LNG Terminal on groundwater, including implementation of its Plan and Procedures and SPCC Plan, would apply to these areas as well. Because use of these facilities would be temporary and limited to the construction period, impacts on groundwater quality and recharge are not anticipated.

Water for construction and operation of the LNG Terminal would be purchased from local municipal water districts and, once complete, the new BND water supply header (see section 1.4.3). The supply header, which would be sourced from the Brownsville Public Utilities Board, would include both surface water from reservoirs along the Rio Grande River and groundwater from wells located west of Brownsville. During construction of the LNG Terminal, up to 3.1 million gallons of water would be required per month. Operation of the LNG Terminal is expected to require about 3.7 million gallons of water per month based on typical usage (see section 4.3.2.2). The Brownsville Public Utilities Board has stated that it has sufficient capacity to meet the construction and operational needs of the LNG Terminal without affecting water availability for other uses (Brownsville Public Utilities Board 2016). No new groundwater wells would be required for construction and operation of the LNG Terminal; therefore, the LNG Terminal is not expected to affect the quantity of available groundwater.

Pipeline Facilities

<u>Pipeline System and Additional Temporary Workspace</u>

Header System and Pipeline 1

Construction of the Header System and Pipeline 1 could alter groundwater flow and recharge due to clearing and grading of the pipeline right-of-way, excavation of the trench, and soil compaction. Following construction, RB Pipeline would implement the measures in its Plan and Procedures, including installation of permanent erosion controls and decompaction of soils, where applicable, to minimize impacts on groundwater. RB Pipeline would restore the ground surface as closely as practicable to original contours and revegetate any previously vegetated, exposed soils to ensure restoration of pre-construction overland flow and recharge patterns.

Pipeline 2

Construction of Pipeline 2 would commence about 18 months after Pipeline 1 is placed in service, but would be collocated with Pipeline 1 and would have identical impacts on groundwater.

General Impacts of the Pipeline System

The trench for the Pipeline System would be excavated to a depth to allow a minimum of 3 feet of soil cover between the top of the pipe and the ground surface. Depending on minimum cover requirements, the trench would be about 7 feet below the ground surface. Where groundwater is near the surface, excavations may intersect the water table and could cause increased turbidity and fluctuations in groundwater levels. In addition, groundwater may enter the trench in areas with a high water table. Trench dewatering would be conducted in accordance with the Project-specific Plan and Procedures. All dewatering activities would occur in a manner that would not cause erosion or silt-laden waters to enter nearby sensitive features (e.g., waterbodies or wetlands). Water would be discharged through energy dissipation devices, such as hay bale structures or filter bags, to a well vegetated upland location. Because of the relatively small amount of water removed, the short duration of the activity, and the local discharge of the water, groundwater levels would quickly recover after pumping stops.

As discussed in section 4.3.1.1, 13 water supply wells are located within 200 feet of the pipeline facilities; no springs have been identified within 0.25 mile of the pipeline facilities. One industrial water well was identified within the proposed construction workspace at MP 5.9 (within King Ranch), in an area where field surveys have not yet been completed. RB Pipeline is working with the landowner to verify the location of this well and to identify site-specific mitigation measures or acceptable compensation, as appropriate. To minimize the potential for groundwater contamination, RB Pipeline would prohibit refueling within 200 feet of any water supply well. For wells within 150 feet of Project workspaces, RB Pipeline would offer to perform pre- and post-construction monitoring for changes in well water quality and yield that could not be attributed to naturally occurring conditions. Testing would be offered prior to construction of both Pipeline 1 and Pipeline 2. If it is determined that a water supply well was adversely affected by Project activities, RB Pipeline would work with the landowner to determine appropriate compensation.

As discussed in section 4.1.4, shallow bedrock is not expected along the Pipeline System; therefore, no blasting is proposed, and impacts on groundwater wells from blasting would not occur. In addition, all water required for construction of the Pipeline System would be obtained from permitted surface water sources; therefore, the Pipeline System is not expected to affect the quantity of available groundwater.

Aboveground Facilities

The Pipeline System would include three compressor stations, two booster stations, eight metering sites, and additional appurtenant facilities. Ground disturbance for each of these facilities would be completed in conjunction with the Header System and Pipeline 1. Impacts from Compressor Station 3 are discussed above, as it would be within the boundaries of the Rio Grande LNG Terminal site. The measures that RB Pipeline has proposed to minimize impacts of the pipelines on groundwater, including implementation of its Plan and Procedures and SPCC Plan, would also apply to aboveground facilities.

Following construction of the aboveground facilities, construction workspaces would be restored and revegetated. Areas that are permanently converted from vegetated land to industrial uses with impervious cover would result in a localized reduction in groundwater infiltration. However, the relatively small amount of new impervious surface is not expected to affect overall groundwater recharge rates in the area.

RB Pipeline estimates that operation of Compressor Stations 1 and 2 would each require about 200 gallons of water per day, and that about 75 gallons of water per day would be needed for operation of each booster station. RB Pipeline plans to obtain all water required for construction and operation of the aboveground facilities from municipal sources. However, RB Pipeline is considering the potential to use groundwater during operation of Compressor Stations 1 and 2 if municipal water is not available. If determined to be necessary, RB Pipeline would provide a detailed groundwater resources and aquifer pumping analysis for our review and approval.

Contractor/Pipe Yards

RB Pipeline has proposed to use three contractor/pipe yards, located in agricultural or open land. Depending on the condition of the site, surface grading, limestone fill placement, and construction of dirt berms may be required. Modifications at contractor/pipe yards could result in similar minor, indirect, and localized impacts on groundwater as those described for the pipeline facilities. With implementation of the Project-specific Plan, Procedures, and SPCC Plan, no adverse impacts on groundwater are anticipated from use of the proposed pipe storage and contractor/pipe yards, including Contractor/Pipe Yard 2, which is located within the Kenedy County Groundwater Conservation District.

Access Roads

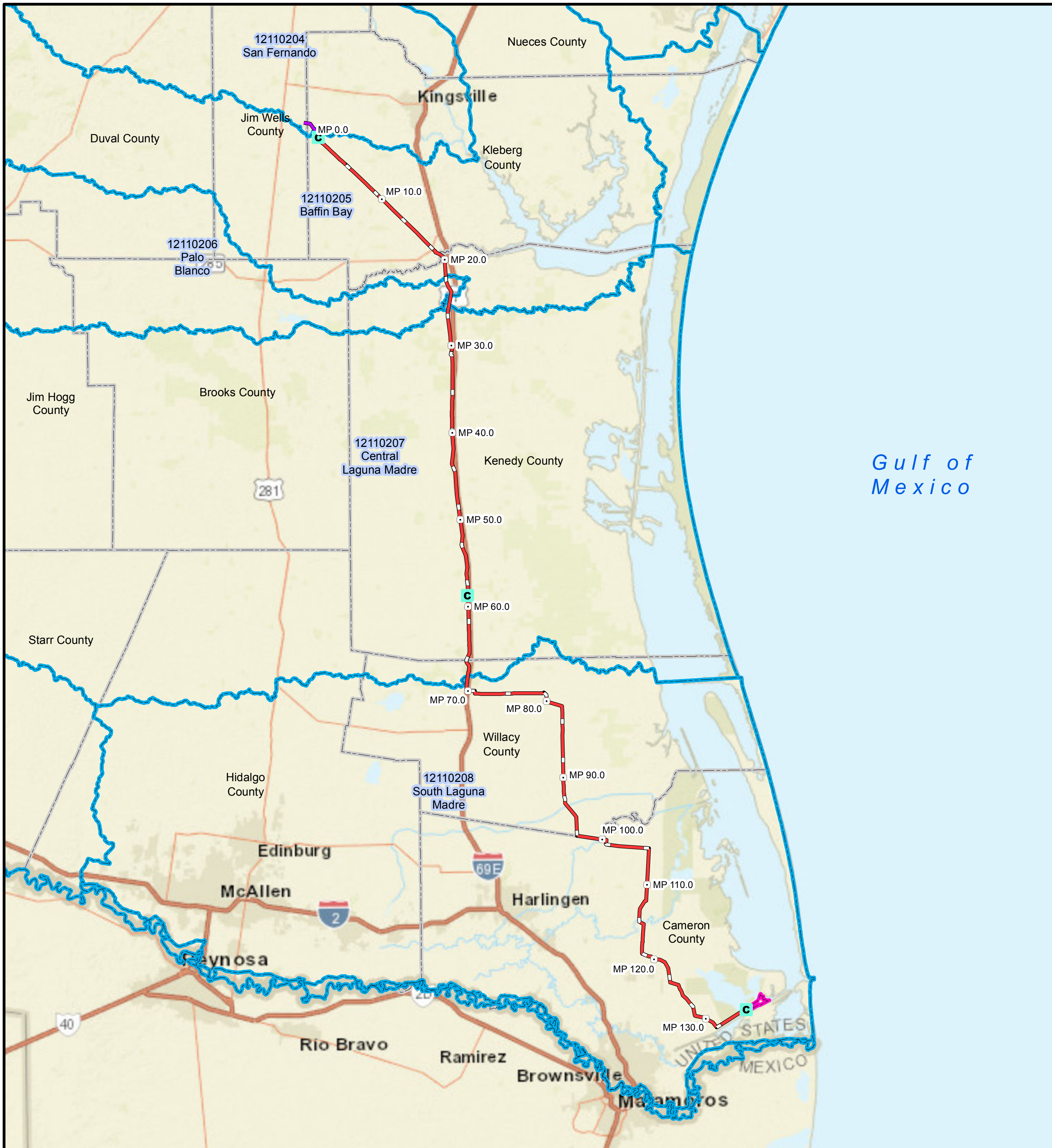
RB Pipeline would require the use of new and existing temporary and permanent access roads for construction and operation. The access roads would be in the same general vicinity of the Pipeline System, and eight water supply wells are within 200 feet of proposed access roads (see table 4.3.1-1). The measures that RB Pipeline has proposed to minimize potential impacts of the pipeline on groundwater, including pre-and post-construction well testing and implementation of its Plan and Procedures and SPCC Plan, would apply to these areas as well. Therefore, we do not expect the construction or operation of access roads to impact groundwater resources.

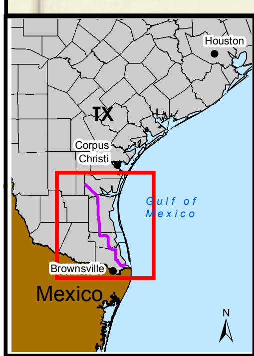
While construction of the Rio Grande LNG Project could result in temporary impacts on groundwater quality and recharge, implementation of RG Developers' Plan and Procedures and SPCC Plans would reduce the potential for groundwater impacts, including contamination. During operations, the relatively small amount of new impervious surface associated with the Project is not expected to affect overall recharge rates. In addition, water required for operations would be obtained from municipal sources, and the Rio Grande LNG Project would not impact the quantity of available groundwater.

4.3.2 Surface Water

4.3.2.1 Existing Surface Water Resources

Watersheds are delineated based on surface water flow along natural hydrologic breaks. The Rio Grande LNG Project would be situated in five watersheds, identified by their 8-digit hydrologic unit code (HUC). HUC-8 watersheds represent a distinct hydrologic feature, part or all of a surface drainage basin, or a combination of drainage basins which are shown in figure 4.3.2-1 and described in table 4.3.2-1. Watersheds can be further subdivided into subwatersheds, which are identified by a 12-digit HUC.





Legend

- Milepost
- Proposed Header System
- Proposed Rio Bravo Pipeline
- Proposed Compressor Station
- Proposed LNG Terminal Boundary
- Watershed
- County Boundary

0 10 20
Miles

N

Scale: 1:1,000,000

Basemap Source: Esri, DeLeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China, Esri Thailand, Tom Tom, 2013

Rio Grande LNG Project

Watersheds Crossed by the Rio Grande LNG Project

Figure 4.3.2-1

Table 4.3.2-1 Watersheds Crossed by the Rio Grande LNG Project			
Watershed HUC ID	**Watershed Name**	**Size (acres)**	**Description**
12110204	San Fernando	864,000	The San Fernando watershed drains portions of Kleberg and Jim Wells Counties in the Project area. The major waterbody is San Fernando Creek, which drains into Alazon Bay, a northern branch of Baffin Bay.
12110205	Baffin Bay	1,376,000	The Baffin Bay watershed includes southern Kleberg and northern Kenedy Counties, and drains into Baffin Bay.
12110206	Palo Blanco	646,400	The Palo Blanco watershed includes portions of Jim Wells and Kenedy County in the Project area; Palo Blanco Creek is the major waterbody in this watershed, which terminates west of the Pipeline System.
12110207	Central Laguna Madre	2,336,000	The Central Laguna Madre watershed drains to the central portion of the Laguna Madre, and waterbodies in this watershed are predominantly intermittent and ephemeral. Most of Kenedy County and the northern extent of Willacy County occur in this watershed in the Project area.
12110208[a]	South Laguna Madre	1,894,400	The South Laguna Madre watershed includes portions of Kenedy and Willacy Counties, as well as Cameron County, in the Project area. The Arroyo Colorado, BSC, Rio Hondo, and other waterbodies drain into the southern portion of the Laguna Madre.
Source: TPWD 2016a. [a] The LNG Terminal site is in the South Laguna Madre watershed.			

The Project area includes freshwater (those waterbodies with less than 0.5 percent salinity), estuarine (tidal habitats with variable salinity), and marine waterbodies (open ocean habitats with salinity higher than 3 percent) that are classified as perennial, intermittent, or ephemeral (Cowardin et al. 1979). Perennial waterbodies flow or contain standing water year-round and are typically capable of supporting populations of fish and macroinvertebrates. Intermittent waterbodies flow or contain standing water seasonally, and are typically dry for part of the year. Ephemeral waterbodies generally contain water only in response to precipitation. The COE regulates the discharge of dredged or fill material on navigable waters under Section 10 of the Rivers and Harbors Act, and on Waters of the United States under Section 404 of the CWA. Waterbodies affected by the Rio Grande LNG Project are listed in appendix G and described below.

Surface Water Quality Standards and Designated Uses

Section 303(d) of the CWA requires that each state establish, review, and revise water quality standards for surface waters. Water quality standards are developed to enhance or maintain water quality, protect the public health or welfare, and provide for the designated uses of the waters of the state. In fulfilling this obligation, the TCEQ identifies waterbody segments (divisions of major rivers, bays, and estuaries) for which it establishes surface water quality standards, monitors waterbody segments with established standards to assess quality, and implements mitigation to protect or restore water quality. Not all waterbodies are designated as segments. Segments are classified into designated use categories, and water quality parameters are monitored to determine whether those designated uses are fully, partially, or not supported.

Designated uses are defined in the Texas Administrative Code [TAC] Title 30, Chapter 307, and include:

- recreational uses, including primary contact recreation (i.e., swimming, wading by children), secondary contact recreation (i.e., fishing, canoeing, and kayaking), and noncontact recreation (i.e., birding, hiking, and biking);
- domestic water supply, including public water supply and aquifer protection; and
- aquatic life, including minimal, limited, intermediate, high, and exceptional aquatic life and oyster waters.

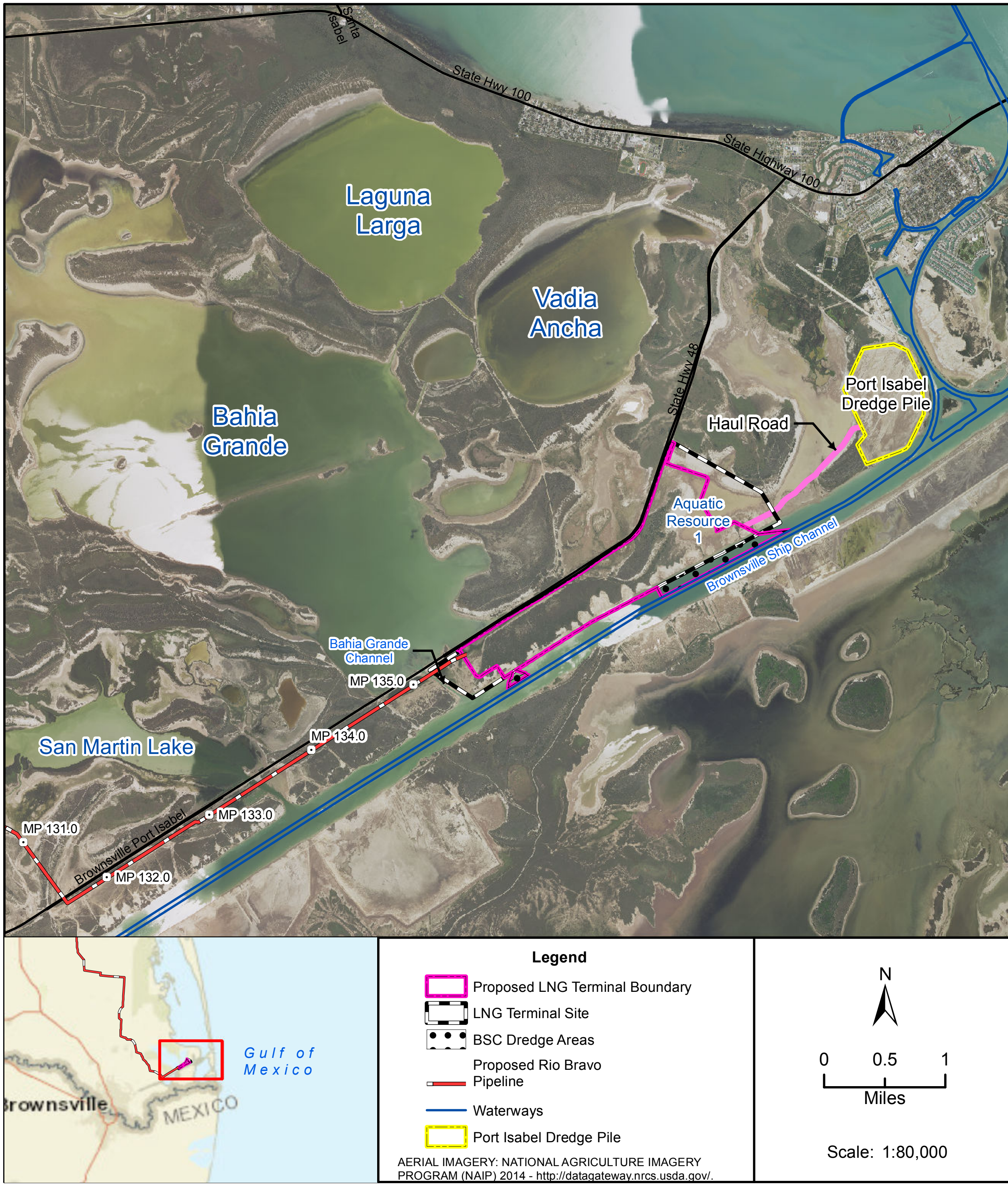
Additional water quality criteria are also designated for chemical parameters, pH, temperature, toxic materials, and nutrient content. In addition, some water quality designations are presumed for certain categories of waterbodies, even where they are not designated as segments. For example, all tidal waterbodies are designated for primary contact recreation. For the purposes of this analysis, estuarine waterbodies were assumed to be tidal. In addition, sustainable fisheries include those waterbodies with the potential to have sufficient fish production or fishing activity to create significant long-term human consumption of fish; all designated waterbodies and all bays, estuaries, and tidal rivers are considered to have sustainable fisheries. Waters that fail to meet their designated beneficial use are considered as impaired and are listed under the State's 303(d) list of impaired waters.

Sensitive Waterbodies

For the purposes of this analysis, we defined sensitive surface waters as those that do not meet the water quality standards for their designated uses, outstanding or exceptional quality waterbodies, those containing habitat for threatened and endangered species, waterbodies that support fisheries of special concern, and waterbodies crossed within 3 miles upstream of potable water intake structures. No National Wild and Scenic Rivers, rivers listed on the Nationwide Rivers Inventory, or outstanding national resource waters would be crossed by the Project (U.S. Department of Interior 2017, NPS 2016a, TAC Title 30, Chapter 307).

LNG Terminal

Multiple members of the public expressed concern regarding impacts on surface water resources in the vicinity of the LNG Terminal site, which is in the South Laguna Madre Watershed (see table 4.3.2-1). Figure 4.3.2-2 identifies the waterbodies in the vicinity of the LNG Terminal site, including those that would be passed by vessels transiting to the site. RG LNG identified surface water resources at the LNG Terminal site during field surveys completed in March and April 2015.



Rio Grande LNG Project

Waterbodies in the Vicnity of the Rio Grande LNG Terminal

Figure 4.3.2-2

The LNG Terminal site is on the north shore of the BSC. The BSC is a man-made, marine navigation channel that connects to the Gulf of Mexico and forms the western terminus of the Gulf Intracoastal Waterway system. The BSC, along with its Entrance Channel and Jetty Channel, form the Brazos Island Harbor. Vessels entering the BSC from the Gulf of Mexico transit the Entrance Channel and Jetty Channel, which collectively extend about 2.4 miles into the Gulf of Mexico; vessels then enter the BSC, which extends about 17 miles inland to the Port of Brownsville turning basin (COE 2014). Marine transportation, including the route for LNG carriers transiting to the LNG Terminal site, is further described in section 4.9.8. The constructed bottom of the federally authorized channel of the BSC is about 250 feet wide at the LNG Terminal site, and is maintained at a depth of -42 feet MLLW (COE 2014). The channel and surrounding waters are about 1,200 feet wide.

In 2014, the COE finalized a feasibility study to determine whether the Brazos Island Harbor should be modified via the Brazos Island Harbor Project (Brazos Island Harbor Project). The COE found that a plan to deepen the main channel of the BSC to -52 feet MLLW would be in the national interest and would not result in significant environmental impacts (COE 2014). The Port of Brownsville has submitted an application to the COE – Galveston District under application number SWG-2016-00038 to implement the Brazos Island Harbor Project (COE 2016). About 68.7 acres within the BSC would be impacted by LNG Terminal construction. Within the LNG Terminal site is one shallow estuarine open water lagoon with estuarine emergent marsh and mudflats around its perimeter (Aquatic Resource 1, see section 4.4.1.1).

The western boundary of the LNG Terminal site is the Bahia Grande Channel, which was constructed in 2005 to connect the BSC and the Bahia Grande to restore tidal exchange to the Bahia Grande (FWS 2015a). The Bahia Grande is a 6,500-acre shallow bay, located north of SH-48 and the LNG Terminal site, and is one of three basins, along with the Laguna Larga and Little Laguna Madre, that form the Bahia Grande system. In the 1930s, the construction of SH-48 and placement of dredged material from construction of the BSC isolated the Bahia Grande from the Lower Laguna Madre and altered the hydrology of the system (COE 2014). The Bahia Grande system was primarily dry after its isolation due to high rates of evaporation and the loss of tidal exchange with the Lower Laguna Madre (Ocean Trust 2009). In the year 2000, the FWS acquired the Bahia Grande Unit of the Laguna Atascosa NWR, made up of 21,700 acres of water, wetlands, and land between the cities of Laguna Vista and Brownsville (FWS 2015a). As part of a comprehensive restoration plan, channels were constructed between the basins in the Bahia Grande system, and future plans include widening the Bahia Grande Channel from about 34 feet to 250 feet in order to increase tidal exchange via the BSC (Ocean Trust 2009, FWS 2010a). The Bahia Grande and Lower Laguna Madre are hypersaline due to the shallow water, limited freshwater inflow, and limited surface water exchange with the Gulf of Mexico (COE 2014). The Laguna Madre is a long, narrow lagoon between the Texas mainland and South Padre Island, extending from the Corpus Christi Bay into Mexico. As shown in figure 4.3.2-2 above, the Lower Laguna Madre is connected to the north side of the BSC, and its entrance would be passed by vessels transiting to the LNG Terminal site. The Bahia Grande and Laguna Madre were identified as resources of concern in scoping comments, along with other surface water features in the Project vicinity. On the south side of the BSC, South Bay is a 3,500-acre waterbody that forms the southernmost bay in the Laguna Madre system. South Bay is managed by the TPWD as a Texas Coastal Preserve (TPWD 2016b).

Surface Water Quality Standards and Designated Uses

Table 4.3.2-2 identifies the designated uses and impairment status of waterbodies near the LNG Terminal site, including those that would be transited by vessels during construction and operation of the Project. The BSC is designated as impaired for recreational use due to the presence of bacteria, the Lower Laguna Madre is designated as impaired for the presence of bacteria affecting oyster waters (those waters that may produce edible species of clams, oysters or mussels), and the Gulf of Mexico is impaired due to the presence of mercury in edible tissue (TCEQ 2014).

Table 4.3.2-2
Waterbodies in the Vicinity of the Rio Grande LNG Terminal Site

Waterbody Name	State Water Quality Designation	Fishery Designation	Impairment Status	Reason for Impairment
BSC	Noncontact Recreation[a]	Exceptional Aquatic Life Use	Impaired	Bacteria
Aquatic Resource 1[b]	No designation	No designation	N/A	N/A
Bahia Grande	Primary Contact Recreation 1[c]	Sustainable Fishery[d]	N/A	N/A
Bahia Grande Channel	Primary Contact Recreation 1[c]	Sustainable Fishery[d]	N/A	N/A
Lower Laguna Madre	Primary Contact Recreation 1[c]	Exceptional Aquatic Life Use / oyster waters	Impaired	Bacteria (oyster waters)
South Bay	Primary Contact Recreation 1[c]	Exceptional Aquatic Life Use / oyster waters	N/A	N/A
Gulf of Mexico	Primary Contact Recreation 1[c]	Exceptional Aquatic Life Use / oyster waters	Impaired	Mercury in edible tissue

Sources: TCEQ 2016c, TCEQ 2014, TAC Title 30, Chapter 307.

[a] Noncontact recreation is defined as activities that do not involve a significant risk of water injection, such as those with limited body contact incidental to shoreline activity, including birding, hiking, and biking.

[b] Aquatic Resource 1 is the open water lagoon within the LNG Terminal site.

[c] Primary Contact Recreation 1 is defined as activities that are presumed to involve a significant risk of ingestion of water, such as wading by children, swimming, and surfing. This is presumed to apply to all tidal waterbodies. For the purposes of this analysis, estuarine waterbodies were assumed to be tidal.

[d] Sustainable fisheries include those waterbodies with the potential to have sufficient fish production of fishing activity to create significant long-term human consumption of fish; all designated waterbodies and all bays, estuaries, and tidal rivers are considered to have sustainable fisheries.

Contaminated sediments are not known to occur at the LNG Terminal site or in areas that would be dredged for construction. The COE conducted chemical analyses of samples taken from the BSC in 2012, and did not identify contaminated sediments where dredging to deepen the BSC would be conducted (COE 2014).

Sensitive Waterbodies

Sensitive waterbodies in the vicinity of the LNG Terminal site and along vessel routes include the Laguna Madre, South Bay, and Bahia Grande. The Laguna Madre is one of just a few hypersaline lagoons in the world, and provides important habitat for wintering waterfowl. It also supports estuarine fisheries, as discussed in sections 4.6.1 and 4.6.2 (USGS 2006b). The southernmost bay associated with the Lower Laguna Madre System, South Bay, has been designated as a Texas Coastal Preserve by the TPWD. The shore of South Bay is fringed by black mangroves that support nesting waterbirds, and the bay provides habitat for 41 species of finfish and 9 species of shellfish (TPWD 2016b). The Bahia Grande was historically a large and productive wetland and open water system connected to the Laguna Madre, and it is part of an ongoing coastal wetland restoration project (FWS 2015a).

In addition to those waterbodies noted above, portions of the BSC, Aquatic Resource 1, the Laguna Madre, the Bahia Grande Channel, and South Bay have been designated as EFH. Marine and estuarine waterbodies may also contain suitable habitat for state and federally listed species. Waterbodies containing fisheries of special concern and EFH are discussed in section 4.6.2 and 4.6.3, respectively; impacts on federally listed species are discussed in section 4.7.1. The LNG Terminal site is not within 3 miles of surface drinking water intakes, outstanding natural resource waters, or other sensitive waterbodies.

Pipeline Facilities

RB Pipeline identified surface water resources along the Pipeline System during initial field surveys conducted in 2015 and 2016. Where field survey access is not available (about 44 percent of the pipeline facilities), environmental information was estimated from aerial imagery, field delineation data from adjacent parcels along the Pipeline System, and other available GIS-based information including hydrography, hydric soils, and wetland data. RB Pipeline will conduct surveys for the remaining areas once site access is obtained.

Appendix G identifies the waterbodies that would be potentially affected by the pipeline facilities, including the waterbody name, location, description, waterbody type, water quality classification, and crossing width (where applicable). The pipeline facilities would cross freshwater and estuarine waterbodies that are classified as perennial, intermittent, and ephemeral.

<u>Surface Water Quality Standards and Designated Uses</u>

Appendix G identifies the designated uses and impairment status of waterbodies crossed by the pipeline facilities. The Arroyo Colorado, a tidally influenced waterbody crossed at MP 100.1, is designated as impaired for aquatic life due to low levels of dissolved oxygen and for primary contact recreation due to the presence of bacteria (TCEQ 2014). Sediment contamination associated with runoff from agriculture, which is also present in the Arroyo Colorado, is associated with probable adverse effects on aquatic life (EPA 2004, EPA 1993). Additional impairments have been identified about 10 miles upstream of the pipeline crossing of the Arroyo Colorado where the waterbody is non-tidal, including elevated concentrations of manganese and a fish consumption advisory due to concentrations of mercury and polychlorinated biphenyls in edible tissue (TCEQ 2012, TPWD 2016c). No additional waterbodies crossed by the Pipeline System are listed as impaired.

Sensitive Waterbodies

As discussed in section 4.6.2, the Pipeline System would cross two waterbodies containing EFH, including the Bahia Grande Channel and the Channel to San Martin Lake. The same marine and estuarine waterbodies designated as EFH contain suitable habitat for state and federally listed species. Waterbodies containing fisheries of special concern and EFH are discussed in section 4.6.3; impacts on federally listed species are discussed in section 4.7.1. No active public water supply intakes are within 3 miles of the Pipeline System (TCEQ 2016b).

4.3.2.2 Surface Water Impacts and Mitigation

LNG Terminal

Table 4.3.2-2 describes the surface waters that would be affected by construction and operation of the LNG Terminal. Potential construction and operational impacts on surface waters include the effects of dredging and dredged material placement; construction of LNG Terminal facilities, including the marine berths and turning basin; vessel traffic; site modification and stormwater runoff; water use, including hydrostatic testing and operation of the firewater system; and spills or leaks of hazardous materials.

Construction and operation of the LNG Terminal would result in permanent impacts on 174.8 acres of open water, including impacts on the BSC and the open water lagoon within the LNG Terminal site (Aquatic Resource 1). A total of 75.8 acres of open water would be converted to industrial/commercial land for construction of the LNG Terminal, and an additional 68.7 acres of open water within the BSC would be dredged for the MOF, marine berths, and turning basin. The remainder (30.2 acres) would be modified to create the firewater canal or marine facilities. RG LNG would be required to mitigate for the permanent loss of open water resources, and proposes to preserve open water within an off-site wetland mitigation area about 1 mile south of the Project on the south side of the BSC. RG LNG's proposed mitigation is further discussed in section 4.4.2.4.

Neither the storage areas nor the Port Isabel dredge pile would affect waterbodies. The temporary haul road would temporarily impact 1.0 acre of open water outside the boundaries of the LNG Terminal site, as well as wetlands (see our discussion in section 3.4).

Dredging and Dredged Material Placement

Public scoping comments expressed concern regarding water quality impacts due to dredging and dredged material placement associated with the Project. RG LNG proposes to dredge 25.2 acres of open water within the LNG Terminal site property to create the marine facilities. About 0.4 acre of open water would be within the firewater intake canal. In addition to the dredging and excavation proposed within the LNG Terminal site property boundary, RG LNG would dredge about 68.7 acres of open water for the MOF, marine berths, and turning basin, resulting in a total of 94.3 acres of dredging. Detailed plans for dredging and dredged material management are included in RG LNG's Dredged Material Management Plan, the options for material placement are discussed in section 4.2.3.

The MOF would be dredged to a depth of -10 feet MLLW (plus -2 feet of overdredge allowance) and would generate about 39,000 yd^3 of dredged material. During construction of the marine berths and the turning basin, about 6.5 mcy of material would be dredged and about 0.6 mcy removed by land-based excavation. The marine berths and turning basin would be dredged to a depth of about -45 feet MLLW (-43 feet plus -2 feet of overdredge allowance). RG LNG proposes to conduct all dredging and excavation during Stage 1 of Project construction as part of site preparation. Dredging for the MOF would require about 2 weeks; dredging of the remaining marine facilities would occur over a period of 14 months. Dredging would permanently modify the profile of the BSC, and would convert existing mudflats to open water as discussed in section 4.4.2.1.

Dredging would result in impacts on water quality in the BSC, including increased suspended solid and turbidity levels, as well as potential resuspension of contaminated sediments. Increased suspended solid and turbidity levels could reduce light penetration through the water column, which could lower the rate of photosynthesis, introduce organic material and/or nutrients that could lead to an increase in biological oxygen demand and reduce dissolved oxygen, and alter water circulation and flow patterns. Along the banks of the BSC where dredging would occur near the surface of the water, such as dredging for the MOF, greater turbidity impacts could result since sediments suspended near the top of the water column would take longer to settle. Where dredging would be necessary at the western extent of the LNG Terminal site, suspended sediment could be transported to the Bahia Grande via the Bahia Grande Channel. In addition, changes to the BSC channel depth and contours from dredging could impact water surface elevations and tidal flow. Impacts of dredging and dredged materials on seagrass beds and oyster beds are not anticipated; impacts on these and other aquatic resources are addressed in section 4.6.2.

The dredged material would be dominated by cohesive clay sediments, which would settle slowly relative to sand and would contribute to higher turbidities during and immediately following active dredging; conditions would be expected to return to pre-construction conditions within a few hours of the end of dredging (COE 2014). RG LNG would conduct dredging using a small hydraulic cutter suction dredge at the MOF and a large hydraulic cutter suction dredge or mechanical dredge at the marine berths and turning basin. The hydraulic dredging method uses a cutter head to break up sediment, and then uses suction to capture the slurry of water and sediment, which is transported via pipe to the disposal area. The use of suction minimizes turbidity from resuspension of the sediment in the water column and other water quality impacts. The dredge pipe associated with hydraulic dredging would be placed on the channel bed and allowed to settle by its own weight. Any disturbance of sediments and resulting turbidity associated with placement of the dredge-pipe would be temporary and negligible.

Mechanical dredging would result in greater temporary impacts on surface water quality, as it typically involves a clamshell dredge that is lowered to the sediment, closed, and then lifted to deposit dredged material on the dredge vessel; no suction line would be used to collect the disturbed sediments. All dredging would be conducted using equipment designed to meet the Texas state water quality standards and in accordance with applicable COE permit requirements, which would require that construction activities be performed in a manner to minimize turbidity in the work area and otherwise avoid adverse effects on water quality and aquatic life. To ensure compliance with applicable permit requirements, RG LNG's dredging contractor would monitor turbidity and, in the event that water quality standards are not met during dredging, additional measures specific to the dredge method would be implemented to adhere to the permit. For example, mitigation for mechanical dredging could include equipment maintenance to rectify any mechanical issues that could result in materials loss, or to enhance containment capabilities. Mitigation measures for hydraulic dredging may include slowing the rate of dredging or performing equipment maintenance to ensure piping connections are not loose. RG LNG could install silt curtains to manage turbidity for either mechanical or hydraulic dredging.

The COE determined that dredging and dredged material placement for 14.1 mcy of new work material associated with deepening the main channel of the BSC for the Brazos Island Harbor Project would temporarily increase turbidity during construction dredging, maintenance dredging, and when dredged material is disposed at ODMDS (COE 2014). Based on the results of hydrodynamic modeling conducted for the proposed widening, the COE determined that the Brazos Island Harbor Project would result in only negligible differences in surface water conditions (including tidal velocity, water surface elevations, and tidal range in the Laguna Madre).

RG LNG similarly conducted hydrodynamic modeling to evaluate the impacts of the Project dredging on water conditions, including current speed. Project-related impacts on hydrology and hydrodynamics were identified in scoping comments. Current speed within the BSC and marine facilities was predicted under three configurations, each of which included the proposed Project facilities: existing BSC conditions; deepening the main channel of the BSC to -52 feet MLLW; and widening the turn at the Brazos Santiago Pass. Currents in the Project area are primarily wind-driven, and the COE estimates that current velocities average 0.6 knot (1.0 foot per second) at the Gulf of Mexico, and are about 0.1 knot near the Project site (COE 2012). RG LNG estimated the maximum current velocity within the proposed marine facilities would be 0.3 knots; Current velocities in the main channel of the BSC near the Project would be similar. RG LNG, through its hydrodynamic model, determined that construction of the LNG Terminal, including dredging for marine facilities, would result in negligible changes in average current speeds within the Bahia Grande Channel, and would therefore not significantly increase water flow through the Bahia Grande Channel. A significant increase in water flow would affect turbidity or salinity levels during operation, and such an increase would occur in the event that the Bahia Grande channel is expanded, which is proposed as part of plans to restore tidal flow to the Bahia Grande as described above. Further, RG LNG conducted sediment modeling to determine shoaling rates within the marine facilities. The results of sediment modeling are described below.

Further, and as discussed in section 4.2.3, sediment sampling conducted by the COE for the Brazos Island Harbor Project indicated the lack of contaminated sediments within the BSC; however, it is possible that unanticipated contamination would be encountered during construction. Therefore, RG LNG would conduct any requested dredged material sampling and testing in accordance with applicable permit conditions and would implement its *Unanticipated Contaminated Sediment and Soils Discovery Plan*[16] if contaminated materials were encountered.

---

16 RG LNG's *Unanticipated Contaminated Sediment and Soils Discovery Plan* is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20160928-5172.

This plan requires a cessation of work upon identification of contaminated sediments or soils, notification of the appropriate regulatory authorities, and treatment of the contaminated materials to the satisfaction of the applicable agencies prior to resuming work in the area. Because the volume of material to be dredged for the Rio Grande LNG Terminal is less than half the volume proposed for the Brazos Island Harbor Project, which was deemed by the COE to result in negligible impacts on surface water conditions, and because contaminated sediments are not known to occur within the BSC, impacts on surface water conditions from dredging at the LNG Terminal site are also expected to be negligible.

As discussed in section 4.2.3, dredged materials could be placed in upland or offshore placement areas. Where dredged material is placed in upland areas, return water could enter waterbodies and impact water quality, resulting in a temporary increase in suspended sediment and turbidity. RG LNG would be required to comply with state water quality requirements under Section 401 of the CWA for any return water from dredged material placement.

Because of the long length of piping that would be required to transport dredged material from the LNG Terminal site to the ODMDSs or Feeder Berm, hydraulic dredging would not be feasible and dredging would need to be conducted via mechanical means. Placement of dredged material in an ODMDS or at the Feeder Berm would result in a temporary increase in suspended sediment and turbidity at the placement site. If dredged material from maintenance dredging is determined to be suitable for use at the Feeder Berm, it could have a positive impact on the shoreline of South Padre Island by contributing to beach nourishment. The final management of dredged material will be determined by the BND and COE, in consultation with other federal, state, and local resource agencies and interested stakeholders, including the EPA, NMFS, FWS, and the TCEQ. Because the impacts on surface water quality would be adequately mitigated through adherence to applicable COE permits and the state water quality requirements for dredging and dredged material management, including measures to protect water quality, we conclude that dredging and dredged materials placement for construction of the LNG Terminal would have only temporary and minor impacts on water quality.

RG LNG's hydrodynamic modeling found that future shoaling rates within the LNG berths and turning basin would be between 7.2 and 9.2 inches per year; therefore, during operations, RG LNG anticipates that maintenance dredging would be required to maintain minimum water depths sufficient for operation every 2 to 4 years. Each maintenance dredging would be expected to remove about 250,000 to 500,000 yd^3 of material. Maintenance dredging is primarily planned for the marine berths and turning basin; if maintenance dredging is required for the MOF, it would be conducted concurrently. Material removed during maintenance dredging would be disposed in one of four upland disposal sites (PA 4a, 4b, 5a, or 5b), the maintenance material ODMDS, or the Feeder Berm in accordance with RG LNG's Dredged Material Management Plan.[17] The BSC is already subject to maintenance dredging by the COE,

---

[17] RG LNG's Dredged Material Management Plan is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession numbers 20161006-5114 and 20161018-5113. Additional information regarding potential beneficial uses of dredged material are included in RG LNG's Mitigation Alternative Analysis is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20171117-5156.

which is conducted approximately every 4.5 years (COE 2014). Although maintenance dredging would result in a temporary increase in suspended sediments, the impacts of maintenance dredging would be temporary and limited to the vicinity of dredging activity within the BSC. All dredging would be conducted in accordance with applicable COE permit requirements. Therefore, we conclude that the impacts on water quality due to maintenance dredging would be temporary or minor.

LNG Loading and Ship Berthing Facilities

Where practicable, RG LNG would construct marine facilities, including over-water facilities, from the shoreline to minimize impacts on surface water resources. The jetty for Marine Berth 1 would be completed prior to dredging, and construction of Marine Berth 2 would be completed using land-based activities as practicable. Onshore equipment would be used to install the platform, piping, and equipment for each marine berth. The majority of pile-driving would be conducted on land; however, a total of four piles would be driven in-water using barge-mounted and other marine equipment (two at the MOF and two for the fixed aid to navigation). Private aids to navigation may be required.

In-water construction and sediment displaced during pile-driving would result in temporary and localized increases in suspended sediment levels (see section 4.6.2 for pile-driving impacts on aquatic resources). Impacts would be confined to the period of in-water activity and shortly thereafter. Permanent or long-term water quality impacts are not anticipated.

Vessel Traffic

Shoreline Erosion and Resuspension of Sediments

Barges and support vessels would deliver construction materials and equipment to the MOF and Port of Brownsville during LNG Terminal construction. RG LNG estimates that about 880 marine deliveries would take place during the first 5 years of construction. No deliveries are currently anticipated during the remainder of the construction period, though sporadic deliveries could occur as needed. During operation, about 312 LNG carriers would call on the LNG Terminal per year (about 6 LNG carriers per week; see section 4.9.4).

Vessel traffic during construction and operation along the BSC, in the turning basin, and in the berthing areas could increase shoreline erosion and suspended sediment concentrations due to increased wave action. Turbidity resulting from suspension of sediments could reduce light penetration and photosynthetic oxygen production, as noted in scoping comments. Disturbance could also introduce chemical and nutrient pollutants from sediments, if present.

The channel embankments and slope of the LNG Terminal site along the BSC, the marine loading berths, and the turning basin would be modified during construction and the shoreline would be stabilized using rip-rap to minimize the potential for erosion due to vessel traffic (see section 4.1.3.4). All dredging and shoreline stabilization would be conducted during site preparations in Stage 1 of construction, and would be complete prior to the first LNG carriers calling on the LNG Terminal. By reducing the potential for increased turbidity from vessel activities, RG LNGs' plan for shoreline stabilization measures would also reduce the potential for suspended sediment to be transported into the Bahia Grande via the Bahia Grande

Channel. Further, current speeds within the BSC near the terminal site are estimated to be similar to pre-Project conditions, thereby reducing the potential for increased erosion due to stronger currents after construction. Although the FERC does not have jurisdiction over the transit of LNG carriers through the BSC, final permitting for the Brazos Harbor Channel Improvement Project should account for the impacts of these larger vessels on the stability of unarmored shorelines due to vessel passage and reflective wave energy.

The BSC is a deep-draft navigation channel that connects the deepwater Port of Brownsville to the Gulf of Mexico via the Brazos Santiago Pass, and is an established shipping corridor. The Port of Brownsville is managed by the BND, and the BSC is maintained by regular dredging (COE 2014). Similarly, LNG carriers transiting the Gulf of Mexico during operation of the Project would use established shipping channels to reach the BSC. As such, the use of waterways by LNG carriers, barges, and support vessels during construction and operation of the LNG Terminal would be consistent with the planned purpose and use of active shipping channels. Impacts on shipping channels, including the BSC, would be minor. Impacts on vessel traffic as a result of the Project are discussed in section 4.9.9.2.

Ballast Water Discharge

During construction, barges and other vessels delivering materials to the Rio Grande LNG Terminal may use ballast pumps to maintain the barge level during loading and unloading. During operation, LNG carriers serving the LNG Terminal would likely arrive with empty cargo tanks prepared to be loaded with LNG for export. LNG carriers with empty cargo tanks ride higher in the water and can experience challenges associated with navigation due to the extra ship surface area above the water line. LNG carriers are more susceptible to wind and are less efficient due to reduced propeller, rudder, and propulsion system performance. To reduce or eliminate the challenges of navigating the ship without cargo aboard, water is often taken in from the surrounding waters and placed in ballast tanks to provide additional draft and improve navigation. To maintain a constant draft, ballast water is typically discharged below the water surface as the LNG cargo is loaded. This procedure would likely occur aboard LNG carriers calling on the LNG Terminal.

RG LNG estimates that up to 10 million gallons of ballast water would be discharged for each LNG carrier calling on the Rio Grande LNG Terminal. Discharge of ballast water would take place over a 20- to 24-hour period during LNG loading. The volume of discharge per vessel would be negligible compared with the total volume of the BSC (estimated to be about 25 billion gallons).

As required by Coast Guard Regulations under 33 CFR 151.2026, vessels equipped with ballast tanks must implement one of five options to control nonindigenous species in waters of the United States. Examples of these strategies include retaining ballast water on board, minimizing discharge or uptake at certain times and locations, and exchanging ballast water with mid-ocean seawater. Ships that have operated outside of the U.S. Exclusive Economic Zone must either retain their ballast water on board or undergo a mid-ocean (greater than 200 nautical miles from shore/water depth greater than 2,000 meters) ballast water exchange in accordance with applicable regulations. The International Maritime Organization has adopted this regulation and requires each vessel to install and operate a ballast water management system.

The composition of ballast water would vary as compared to the water in the BSC depending on its origin and the conditions in the BSC at the time of discharge. The discharge of ballast water to the BSC could affect water quality by changing the salinity, pH, temperature, and dissolved oxygen level.

Open ocean ballast water would have a salinity between 33 and 37 parts per thousand, which is similar to the salinity in the BSC. The pH of ballast water would be indicative of seawater, and would therefore be similar to the pH in the BSC, which receives tidal flow from the Gulf of Mexico. Ballast water is stored in the ship's hull below the waterline; as a result, discharged water temperatures are not expected to deviate markedly from ambient water temperatures. Dissolved oxygen is dependent on many factors, including water temperature, water depth, phytoplankton, wind, and current. Water that is collected within the ballast tanks of a ship would lack many of these important influences and could suppress dissolved oxygen levels. Ballast water is expected to be anoxic (i.e., lacking all oxygen), but could contain dissolved oxygen levels; if so, levels would be lower than the surface water of the BSC. Overall, impacts on salinity, pH, temperature, and dissolved oxygen levels from ballast water discharges would be negligible. Impacts of ballast water discharge on aquatic resources are addressed in section 4.6.2. Because vessels would be required to comply with U.S. laws and regulations governing ballast water discharges, we conclude that impacts on surface water quality resulting from ballast water discharge would be minor.

Cooling Water Discharge

During operation, LNG carriers use water to cool the main engine, other machinery, and for hotel services. Ship cooling water would be withdrawn and discharged below the water line on the sides of the ship through screened water ports, known as "sea chests." Cooling water would be withdrawn from, and returned to, the BSC. RG LNG estimates that between 250,000 and 500,000 gallons per hour would be used by an LNG carrier docked at the LNG Terminal site (a total of between 5 and 12 million gallons for vessels docked for 20 to 24 hours). The volume of cooling water used per vessel would be negligible compared with the total volume of the BSC.

Impacts on surface waters as a result of cooling water intake and discharge would be primarily limited to an increase in water temperature in the vicinity of the LNG carrier. Cooling water return temperatures vary widely depending on the type of LNG carrier and mode of operation. Based on a review of available information for a similar project in the Gulf of Mexico, we anticipate that cooling water discharged at the LNG Terminal site could range between 2.7 and 7.2 °F warmer than ambient water temperatures (FERC 2015). Due to the limited temperature differences, the relatively small volume of discharge compared to the total water within the BSC, and location within an active port that is already subject to withdrawals and discharges of vessel engine cooling water, we anticipate that the increased water temperature levels would diminish shortly after discharge and, therefore, would have temporary and minor impacts on water quality. Impacts of cooling water intake and discharge on aquatic resources are addressed in section 4.6.2.

Engine cooling water would also be discharged by LNG carriers transiting the Gulf of Mexico to call at the proposed LNG Terminal; however, due to the volume of water within the Gulf of Mexico and the use of established shipping lanes where frequent vessel traffic would increase the speed at which the warmer water would be diluted to ambient temperatures, we conclude that increased water temperatures would have a negligible impact on water quality within the Gulf of Mexico.

Site Construction and Stormwater Runoff

Ground disturbance for construction of the LNG Terminal could result in sedimentation of adjacent waterbodies via stormwater runoff. In addition to stormwater runoff, excess water from dust control, vehicle washdown, and other construction activities onsite would generate wastewater runoff. During operation, the amount of impervious surface that would be constructed for the LNG Terminal would result in an increased volume of stormwater runoff.

RG LNG would install erosion and sediment controls in accordance with its Plan and Procedures prior to beginning construction of the LNG Terminal. An EI would monitor field conditions daily in areas of active construction to ensure that the erosion and sediment controls were properly installed, adequate, and functional. Measures to control erosion and sedimentation during construction are discussed in detail in section 4.2.2.1 and in RG LNG's draft SWPPP, which we have recommended be finalized prior to construction (see section 4.2.2.1).

To manage runoff at the LNG Terminal site, RG LNG would construct a stormwater levee, drainage system, and stormwater ponds. The stormwater levee would be constructed surrounding the LNG Terminal site to protect the site from flooding, which is further discussed in section 4.1.3.3. When construction and operation at the LNG Terminal are concurrent, RG LNG would implement temporary erosion controls per its Plan and Procedures and would operate the permanent stormwater controls planned for the site. The entire levee and four stormwater ponds, as well as the drainage systems for Stage 1 facilities, would be constructed during Stage 1 to protect the site from storm surge and to manage stormwater flows. The drainage system would be expanded during each stage of construction to include the newly constructed facilities. The remaining two ponds would be constructed during Stages 3 and 5. The site would be graded to allow for gravity drainage.

During construction and operation of the LNG Terminal, stormwater runoff would be discharged to the BSC via the drainage system and ponds, and would not be directed to the hypersaline Bahia Grande. Where stormwater could be contaminated by spills or leaks of hazardous materials, such as near the liquefaction trains and truck loading areas, it would be directed through an oil water separator prior to discharging to the BSC. Releases from stormwater ponds to the BSC would be controlled to reduce potential shoreline scour.

During construction, a concrete batch plant would be built and used outside of the planned stormwater levee. Runoff wastewater generated by dust suppression and equipment washing at the concrete batch plant could enter adjacent waterbodies and impact water quality. Therefore, RG LNG would designate contained areas for equipment washing and would dispose of wastewater generated at the concrete batch plant offsite to minimize potential impacts on water quality.

Facility Water Use

Water for construction and operation of the Rio Grande LNG Terminal would be purchased from local municipal water districts and, once complete, the new BND water supply header. Water sourced from the Brownsville Public Utilities Board via the supply header would include both surface water from reservoirs along the Rio Grande River and groundwater from wells located to the west of Brownsville. The Brownsville Public Utilities Board has stated that it has sufficient capacity to meet the construction and operation needs of the Project without affecting water availability for other uses (Brownsville Public Utilities Board 2016).

Onsite Water Use

During peak construction of the LNG Terminal, about 3.1 million gallons of water would be required per month. RG LNG estimates that water would be trucked to the LNG Terminal site from the beginning of construction until the BND potable freshwater supply header is operational during the second quarter Year 1. During the 7-year construction period, the peak monthly water usage would about 5.6 million gallons, with the highest water usage occurring in Year 6, when construction of liquefaction trains would be concurrent with operation.

Water sourced from the BND potable freshwater supply header would be used during operation for drinking water, service water to supply utility hoses and safety showers, and for use in the liquefaction process. Freshwater would also be used for the freshwater firewater tank, as discussed below. Operation of the LNG Terminal would be expected to use about 3.9 million gallons of water per month. Normal freshwater usage would be 84.7 gpm during LNG Terminal operation; peak usage would be about 317.7 gpm. Because the Brownsville Public Utilities Board has stated that it has sufficient capacity to meet the construction and operation needs of the Project, construction and operation of the LNG Terminal would not affect the availability of water for municipal and other uses in the service area for the Brownsville Public Utilities Board.

Firewater System

During operation of the LNG Terminal, the firewater system would be used in the event of a fire emergency to control and/or extinguish a fire at the site. The maximum firewater supply would be 4,315 gpm. Water would be supplied by 2 sources: a freshwater storage tank with a capacity of 519,098 gallons, and 2 seawater pumps that would bring water from the BSC via a short water intake channel if the freshwater storage tank capacity were depleted or unavailable. To minimize the potential for entrainment of aquatic organisms, intakes for the seawater firewater pumps would be screened. Impacts on aquatic resources are discussed in section 4.6.2. Following use, firewater would be treated in an oil-water separator prior to discharging to the BSC. Because of the infrequent use of the firewater system, we conclude that the firewater system would have negligible impacts on water quality within the BSC.

Hydrostatic Testing

Before placing each component of the LNG Terminal into service, LNG tanks, non-cryogenic piping, and freshwater storage tanks would be hydrostatically tested. A detailed description of the hydrostatic testing process is provided in section 2.5.2.1. LNG tanks would be tested using about 30 million gallons of seawater each, which would be withdrawn from the

BSC. As water would not be reused between tanks, hydrostatic testing of all four tanks would require a total of 120 million gallons. Test water would be withdrawn from the BSC and treated via filtration or use of a corrosion inhibitor, if needed, before use. Following each hydrostatic test, water would be transferred to the proposed permanent stormwater ponds and tested for contamination prior to release in accordance with applicable discharge permits.

Water would be withdrawn from the BSC using back-up firewater supply pumps with screened intakes to minimize the potential for entrainment of aquatic organisms and in accordance with water withdrawal permits, including the TCEQ's temporary water use permit. RG LNG developed a Draft LNG Tank Hydrostatic Test Plan[18] for the use of water from the BSC for hydrostatic testing, which would be finalized during detailed engineering and design. RG LNG is also consulting with NMFS and TPWD regarding water withdrawal to identify requirements and mitigation measures for withdrawal.

Because the LNG Tank Hydrostatic Test Plan is not final, **we recommend that:**

- **<u>Prior to construction of the LNG Terminal</u>, RG LNG should file with the Secretary, for review and written approval by the Director of OEP, its final LNG Tank Hydrostatic Test Plan.**

RG LNG would minimize the amount of water required for hydrostatic testing by reusing water at multiple test locations, as practicable. In addition, where possible water would be reused for dust suppression or other onsite uses. Following completion of the hydrostatic tests, municipal water would be tested for contamination prior to release per the requirements of the TCEQ and RRC permits.

The discharge of hydrostatic test water would be conducted in accordance with the RRC hydrostatic discharge permit requirements. If water treatment were required, it would be conducted in accordance with the TCEQ and RRC permits to minimize potential impacts on water quality. Therefore, we conclude that impacts from hydrostatic testing on surface waters would be temporary and minor.

Spills

During construction and operation, hazardous materials resulting from spills or leaks could adversely impact water quality if contamination enters waterbodies adjacent to the LNG Terminal site via a direct spill or as stormwater runoff. RG LNG would implement its site-specific SPCC Plan during construction, which would include spill prevention measures, mitigation measures, and cleanup methods to reduce potential impacts should a spill occur. The SPCC Plan would also address storage and transportation of hazardous materials. Where stormwater could be contaminated by spills or leaks of hazardous materials, such as near the LNG trains and truck loading areas, it would be directed through an oil water separator prior to discharge to the BSC. Given the impact minimization and mitigation measures described above,

---

18 RG LNG's Draft LNG Tank Hydrostatic Test Plan is available on the FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20160901-5281.

we conclude that impacts on surface waters due to spills or leaks during construction and operation of the LNG Terminal would be temporary and minor.

Pipeline Facilities

Pipeline System and Additional Temporary Workspace

Header System and Pipeline 1

One intermittent waterbody would be crossed by the Header System via open cut. The centerline of Pipeline 1 would cross 62 waterbodies, including 21 perennial streams, 19 intermittent streams, 9 ephemeral streams, and 13 ponds and reservoirs (see appendix G). Of those, 13 waterbodies are classified by FERC as minor (less than 10 feet wide), 33 are classified as intermediate (10 to 100 feet wide), and 16 are classified as major (greater than 100 feet wide). RB Pipeline would cross 26 waterbodies via trenchless construction methods, including 5 by conventional bore and 21 by HDD. An additional four waterbodies would be within the construction workspace but would not be crossed by the Pipeline 1 centerline, and three would be located within ATWS. One impaired waterbody, the Arroyo Colorado, would be crossed by HDD. Of the waterbodies crossed, four are navigable, including Los Olmos Creek (MP 19.1), Arroyo Colorado (MP 100.1), the Channel to San Martin Lake (MP 133.5), and the Channel to Bahia Grande (MP 135.2). Each of these waterbodies would be crossed by HDD. No active surface water intakes for public water supply are within 3 miles downstream of the Pipeline System.

Following construction of Pipeline 1, waterbody contours would be restored to pre-construction conditions, and riparian areas would be revegetated using native grasses, legumes, and woody species. However, riparian areas are not expected to return to pre-construction conditions in the relatively short period between construction of Pipeline 1 and Pipeline 2.

Pipeline 2

Construction of Pipeline 2 would commence about 18 months after Pipeline 1 was placed in service. Construction of Pipeline 2 would cross 60 of the waterbodies crossed by Pipeline 1 using the same methods. Two waterbodies would be crossed using different methods: farm pond HY-T05-002 at MP 114.07 would be in the construction workspace for Pipeline 2 (rather than crossed directly, as by Pipeline 1); conversely, ephemeral stream SS-T09-004 at MP 130.0 would be crossed by the centerline of Pipeline 2 (but is only within the construction workspace for Pipeline 1). Also, the centerline of Pipeline 2 would cross the Channel to San Martin Lake twice via HDD at MP 135.2, while the centerline of Pipeline 1 would cross that waterbody once. Following construction of Pipeline 2, waterbody contours would be restored to pre-construction conditions, and riparian areas would be revegetated native grasses, legumes, and woody species, and allowed to return to pre-construction conditions.

General Impacts of the Pipeline System

Activities associated with construction of the Pipeline System include clearing and grading, in-stream trenching, trench dewatering, and backfilling. Clearing and grading of streambanks could expose soil to erosional forces and would reduce riparian vegetation along the cleared section of the waterbody. The use of heavy equipment for construction could compact near-surface soils, resulting in increased runoff into surface waters that could increase turbidity.

Construction through waterbodies would result in increased downstream sedimentation, the extent of which would depend on sediment loads, stream velocity, turbidity, bank composition, and sediment particle size. In-stream construction could also dislodge and transport channel bed sediments and alter stream contours. Changes in stream contours could alter stream dynamics and increase downstream erosion or deposition. Turbidity resulting from resuspension of sediments from in-stream construction and erosion of cleared areas could reduce light penetration and photosynthetic oxygen production. In-stream disturbance could also introduce chemical and nutrient pollutants from sediments.

Resuspension of deposited organic material and inorganic sediments could cause an increase in biological and chemical use of oxygen, potentially resulting in a decrease of dissolved oxygen concentrations in the affected area. Lower dissolved oxygen concentrations could cause temporary displacement of mobile organisms, such as fish, and may kill non-mobile organisms within the affected area. Disturbances to stream channels and streambanks could also increase the likelihood of scour after construction. RB Pipeline does not anticipate blasting for construction of the Pipeline System; therefore, impacts on water resources associated with blasting are not anticipated.

RB Pipeline would use open-cut and trenchless waterbody crossing methods as described in section 2.5.2.1; the use of dam-and-pump or flume crossing methods is not currently proposed. The typical pipeline construction right-of-way width for the Project, as described in section 2.2.2, would be 125 feet; however, RB Pipeline has proposed to reduce or, in the case of trenchless crossings, eliminate the construction right-of-way width at all waterbodies anticipated to be wet at the time of construction (34 and 35 crossings for Pipelines 1 and 2, respectively). Of these waterbodies, HDD crossing methods would be used for 21 or 22 waterbodies crossed by Pipeline 1 and Pipeline 2, respectively, and 4 would be crossed using a conventional bore within a 75-foot-wide construction right-of-way. RB Pipeline would cross the remaining nine flowing waterbodies via open-cut crossing methods, using a construction right-of-way width of 75 or 100 feet, depending on site-specific conditions (see appendix G).

The 28 waterbodies that are not anticipated to be flowing at the time of crossing may be crossed using conventional upland construction techniques. However, if flow becomes discernable, RB pipeline would cross the waterbody in accordance with its Procedures. Further, RB Pipeline would limit the construction right-of-way width to 100 feet or less at all waterbodies with perceptible flow at the time of construction, or would provide site-specific justification in requesting a variance for a greater right-of-way width at the time of construction.

RB Pipeline would obtain all necessary waterbody crossing permits prior to construction. RB Pipeline would minimize impacts on waterbodies during construction by implementing the measures contained in its Procedures, which include:

- constructing the crossing as close to perpendicular to the waterbody as site conditions allow;

- maintaining adequate flow rates throughout construction to protect aquatic life and prevent the interruption of downstream uses;

- requiring temporary erosion and sediment control measures to be installed across the entire width of the construction right-of-way after clearing and before ground disturbance;

- requiring maintenance of temporary erosion and sediment control measures throughout construction until streambanks and adjacent upland areas are stabilized; and

- requiring bank stabilization and reestablishment of bed and bank contours and riparian vegetation after construction.

RB Pipeline would cross most waterbodies via open-cut methods in accordance with its Procedures. Where waterbodies would be crossed via wet open cut, potential impacts of sedimentation would be greatest. In addition to those measures listed above, RB Pipeline would minimize impacts on open-cut waterbodies by stabilizing waterbody banks, installing temporary sediment barriers, and completing in-stream construction within 24 hours for minor waterbodies and 48 hours for intermediate waterbodies. RB Pipeline proposes to cross nine major, intermittent waterbodies using open-cut methods, of which it anticipates four would be dry at the time of crossing. One major waterbody, farm pond HY-T05-002 at MP 114.1, is completely within the construction right-of-way. None of the major waterbodies proposed for open-cut construction are anticipated to be flowing during the time of construction, although high water levels could be present in the farm ponds and reservoirs. In the event that a high level of water was present at the time of construction and an alternative (dry-ditch or trenchless) crossing method is warranted, RB Pipeline would coordinate with the FERC and the COE to modify the waterbody crossing method; the FERC and COE would consider the originally proposed crossing method, as well as the waterbodies flow regime prior to approving an alternative crossing method.

Impacts on waterbodies that would be crossed by trenchless construction methods (conventional bore and HDD) would generally be avoided since the waterbody and its banks would not be disturbed by clearing or trenching, rather, the waterbody would be installed below the feature. However, if an inadvertent release of HDD drilling fluid occurs within a waterbody, the resulting turbidity could affect water quality. RB Pipeline would implement its HDD Contingency Plan,[19] which addresses the general methods for implementing an alternative crossing in the event of a failed HDD attempt, as well as methods for detecting and responding to inadvertent returns. RB Pipeline would complete geotechnical bores to verify the feasibility of HDD construction at proposed locations, and would submit those surveys prior to construction, as recommended in section 4.1.1.2. One or more waterbodies that would be crossed via HDD may be regulated by the International Boundaries and Water Commission (IBWC); RB Pipeline would consult with the IBCW to identify any regulated waterbodies and to determine whether the proposed crossing methods are sufficient to minimize impacts. Because RB Pipeline has not

---

[19] RG Developers' HDD Contingency Plan is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20160829-5283.

completed consultation with the IBWC to identify any regulated waterbodies, **we recommend that**:

- **<u>Prior to the end of the draft EIS comment period</u>, RB Pipeline should file with the Secretary, records of consultation with the IBWC that identifies any regulated waterbodies and appropriate crossing methods, as well as any necessary mitigation, developed in coordination with the IBWC.**

In addition, the pull-string for one HDD crossing would encroach on intermittent stream SS-TDS-003 at MP 101.7. RB Pipeline would install a temporary bridge to allow for the pull-string to be placed on rollers across the bridge, thus minimizing impacts on the waterbody.

During construction, the open trench may accumulate water, either from the seepage of groundwater or from precipitation. Where necessary, RB Pipeline would dewater the trench in a manner that would not result in silt-laden water entering waterbodies or wetlands and would not cause erosion, as described in its Procedures. Where waterbodies are within construction workspaces but not crossed by the pipeline, RB Pipeline would install erosion controls, matting, and/or temporary equipment bridges where needed in accordance with its Procedures.

RB Pipeline generally would not establish ATWS within 50 feet of waterbodies, in accordance with its Procedures (section V.B.2.a). In locations where site-specific constraints require ATWS within 50 feet of, or within, waterbodies, RB Pipeline has provided site-specific justification and measures to minimize impacts on the waterbody (see appendix F). We have reviewed the locations where RB Pipeline has requested ATWS within ephemeral waterbodies that would be graded to provide a level workspace, and have determined that workspace within these waterbodies is not adequately justified. Since RB Pipeline has provided unacceptable justifications for these work areas within waterbodies, **we recommend that**:

- **<u>Prior to the end of the draft EIS comment period</u>, RB Pipeline should file with the Secretary updated information on the waterbody areas in appendix F of the draft EIS identified as unacceptable. The information should include all appropriate details in a consistent manner for each area, updated site-specific justifications for alternative measures to the Commission's Procedures, and revised alignment sheets, as necessary.**

Seasonal and flash flooding hazards are a potential concern where the pipeline would cross flood hazard areas. Additional discussion regarding flooding and flash floods is provided in section 4.1.3.3. Although flooding itself does not generally present a risk to pipeline facilities, bank erosion and/or scour could expose the pipeline or cause sections of pipe to become unsupported. All pipeline facilities are required to be designed and constructed in accordance with DOT's regulations in 49 CFR 192. These regulations include specifications for installing the pipeline at a sufficient depth to avoid possible scour at waterbody crossings.

In navigable waters, the pipeline would be installed via HDD with a minimum of 40 feet of cover. In addition, RB Pipeline would implement measures in its Procedures, including installing and maintaining erosion and sediment controls, restoring floodplain contours and waterbody banks to their pre-construction conditions, and ensuring successful revegetation to minimize potential impacts of flooding.

Long-term impacts associated with pipeline operations and maintenance would be relatively minor. All waterbody banks would be restored to pre-construction contours, and disturbed riparian areas would be revegetated with native species of grasses, legumes, and woody species. Post-construction maintenance would be limited so that a 25-foot-wide riparian strip along each waterbody bank would be allowed to revegetate with native flora to stabilize banks, reduce erosion impacts, and provide shade and cover for fisheries resources. Clearing within the riparian strip would be limited to a 10-foot-wide area centered on the pipeline to facilitate operational surveys.

Refueling of vehicles and storage of fuel, oil, or other hazardous materials near surface waters could result in accidental spills that could contaminate surface waters. RB Pipeline would implement its site-specific SPCC Plan during construction, which would include spill prevention measures and cleanup methods to reduce potential impacts should a spill occur. In addition, refueling and storage of hazardous materials would be restricted within 100 feet of a wetland or waterbody.

The pipeline facilities must be hydrostatically tested prior to being placed into service to ensure structural integrity in accordance with DOT standards set forth in 49 CFR 192. A detailed description of the hydrostatic testing process is provided in section 2.5.2.1. Table 4.3.2-3 identifies RB Pipeline's proposed sources of hydrostatic test water and the volume of water required for testing. One sensitive (impaired) waterbody, the Arroyo Colorado, is proposed for use as a source for hydrostatic test water. The Arroyo Colorado is impaired for recreational and aquatic life uses. RB Pipeline would develop a specific hydrostatic test plan for our review and approval in the event that brackish water is required for use.

In addition, where the pipeline would be installed via HDD, RB Pipeline would obtain water from the waterbody to be crossed where possible in accordance with water withdrawal permits; water for the remaining locations would be transported from permitted locations. Withdrawal of water from a waterbody would be conducted using mobile equipment, and any clearing required for equipment passage would be limited to the hand-clearing of small diameter vegetation (see section 4.5).

Surface water may also be required for dust control during construction of the pipeline facilities. RB Pipeline estimates that about 45 million gallons of water would be required for dust control during construction of the pipeline facilities, based on the proposed construction schedule and assuming that watering is conducted every third day. Water would be sourced from the same locations identified in table 4.3.2-3 for hydrostatic testing.

Table 4.3.2-3
Proposed Sources of Water for Hydrostatic Testing for the Pipeline System

Water Source[a]	Test Section	Begin MP	End MP	Length (miles)	Water Fill Volume (gallons)	Notes[b]	Approximate Discharge Location (MP)[c]
Header System							
Los Olmos Creek (MP 19.2, SS-T05-001)	HS	0.0	2.4	3.2[d]	1,168,528	Water transferred (via truck or pipe) from Test Section 1	0.0 (Compressor Station 1)
Pipelines 1 and 2							
Los Olmos Creek (MP 19.2, SS-T05-001)	1	0.0	19.1	19.1	7,011,166	Test Section 1 using water from Los Olmos Creek	N/A
	2	19.1	35.1	16.0	5,879,155	Water transferred from Test Section 1 and 36,477 gallons from Los Olmos Creek	35.1 (MLV 2; 146,066 gallons)
	3	35.1	51.0	15.9	5,733,089	Water transferred from Test Section 2	51.0 (219,099 gallons)
	4	51.0	58.7	8.7	5,513,990	Water transferred from Test Section 3	58.7 (Compressor Station 2)
Arroyo Colorado (MP 99.8, SS-T09-007)	5	58.7	81.5	22.8	6,171,287	Water transferred from Test Section 6	58.7 (Compressor Station 2)
	6	81.5	100.5	19.0	7,084,199	Test Section 6 using water from Arroyo Colorado River	100.5 (MLV 5, 912,912 gallons)
Resaca De Los Cuates (MP 118.7, SS-T04-009)	7	100.5	119.5	19.0	6,938,133	Test Section 7 using water from Resaca De Los Cuates	119.5 (MLV 6, 1,132,011 gallons)
	8	119.5	135.5	16.0	5,806,122	Water transferred from Test Section 7	135.5 (Compressor Station 3)

[a] Proposed water sources have been identified along the pipeline route. Final water source selection would be determined by permit acquisition.
[b] RB Pipeline plans to transfer water between test sections.
[c] Where water would be transferred between test sections, some water may be discharged if the volume used at one segment exceeds the volume required for testing the subsequent segment. Estimated discharge volumes for these locations are provided.
[d] This length represents the total length of the Header System to be hydrostatically tested, inclusive of one 42-inch-diameter pipeline approximately 2.4 miles in length and a second 42-inch-diameter pipeline approximately 0.8 mile long.

The withdrawal of large volumes of water from surface water sources could temporarily affect the recreational and biological uses of the resource if the diversions constitute a large percentage of the source's total flow or volume. Water withdrawals could also result in temporary loss of habitat, change in water temperature and dissolved oxygen levels, and entrainment or impingement of fish or other aquatic organisms. Where practicable, as shown in table 4.3.2-3, RB Pipeline would minimize surface water withdrawals for hydrostatic testing by transferring test water between pipeline segments. RB Pipeline would minimize the potential effects of water withdrawals from surface water sources by adhering to the measures in its Procedures, including:

- maintaining waterbody flows during all withdrawals;
- screening intake hoses with 4-millimeter mesh and regulating the rate of withdrawal of water to prevent entrainment of aquatic organisms; and
- discharging test water via energy dissipating devices and in accordance with hydrostatic test discharge permits.

Additionally, RB Pipeline would acquire the necessary permits and approvals from state and federal agencies, which would include requirements for the protection of sensitive surface waters. Therefore, we conclude that impacts on surface waters from withdrawal of test, HDD, and dust control water would be minimized and not significant. Section 4.6.2 further discusses the potential impacts from water withdrawal on aquatic species.

Aboveground Facilities

RB Pipeline would construct three compressor stations, eight metering sites, and additional appurtenant facilities as part of the proposed Project; impacts from Compressor Station 3 are discussed above, as it would be within the boundaries of the LNG Terminal. No waterbodies are within the construction or operational areas associated with the aboveground facilities and RB Pipeline would install erosion and sediment controls to prevent migration of sediment outside of construction workspace; therefore, no direct or indirect impacts on waterbodies would be associated with aboveground facilities. RB Pipeline would implement its Plan and Procedures, which require the use of temporary and permanent erosion control measures, to minimize the potential for sedimentation of nearby waterbodies from ground disturbed for construction. All disturbed areas would be routinely monitored in accordance with the Project-specific Plan and Procedures until restoration and revegetation are successful.

Contractor/Pipe Yards

Three contractor/pipe yards would be used during construction of the pipeline facilities. No waterbodies are within the contractor/pipe yards, and RB Pipeline would install erosion and sediment controls to prevent migration of sediment outside of the contractor/pipe yards; therefore, no direct or indirect impacts on waterbodies from the use of contractor/pipe yards would occur.

Access Roads

Existing roads that would be used for temporary access to the pipeline facilities for construction would require five waterbody crossings. One waterbody would be crossed by permanent access road HS-001, which is associated with the Header System. Waterbodies would be crossed by installation of a new culvert, using existing culverts, or installation of equipment mats, where appropriate (see appendix G).

RB Pipeline would minimize potential impacts on waterbodies by installing and maintaining erosion and sediment controls per its Plan and Procedures. Temporary access roads would not require modification, other than the modifications described for wetland (see section 4.4.2.2) and waterbody crossings. RB Pipeline would remove any materials installed to support access roads in waterbodies during the 18-month period between placing Pipeline 1 into service and beginning construction of Pipeline 2. If RB Pipeline determines that maintenance of access road materials in waterbodies is necessary during the period between construction of Pipelines 1 and 2, site-specific justification would be provided to the FERC and COE for review and approval. Temporary access roads would be restored to their pre-construction conditions following the construction of Pipeline 2 and in accordance with applicable permit conditions. Where RB Pipeline has proposed to use access roads that cross major and intermediate waterbodies with equipment mats, erosion controls would be installed to minimize impacts on the waterbody.

Construction of the Rio Grande LNG Project would result in minor impacts on water quality due to dredging, hydrostatic testing, and installation of the pipelines at waterbody crossings. In addition, spills of hazardous materials could affect water quality during construction and operations; however, implementation of mitigation measures in RG Developers' SPCC Plans and Plan and Procedures would minimize potential impacts. During operations, the Project would have minor impacts on water quality due to maintenance dredging and vessel discharges of ballast and cooling water. Permanent impacts on surface water would occur where open water would be converted to industrial/commercial land within the LNG Terminal site and where dredging would permanently modify the profile of the BSC, and would convert existing mudflats to open water; however, impacts would not be significant.

4.4 WETLANDS

Wetlands are areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation (COE 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. In the Rio Grande LNG Project area, wetlands are protected under Section 404 of the CWA. Under Section 404, the COE is authorized to issue permits for activities that would result in the discharge of dredged or fill material, or the dredging of, waters of the United States such as wetlands. Under Section 401 of the CWA, states are required to certify that proposed dredging or filling of waters of the United States meets state water quality standards. In Texas, the TCEQ and RRC share responsibilities for water quality certification. The RRC has jurisdiction over Section 401 as it pertains to installation and operations of the Project facilities; the TCEQ has jurisdiction as it pertains to return water for dredged material placement areas, as described in section 4.3.2.2. In addition, the LNG Terminal site and portions of the pipeline facilities are within the coastal zone of Texas and must receive a Coastal Zone Consistency Determination from the RRC.

4.4.1 Existing Wetland Resources

Estuarine and palustrine wetlands occur within the Rio Grande LNG Project area. Estuarine systems include tidal habitats with variable salinity; palustrine features include non-tidal wetlands dominated by trees, shrubs, and emergent vegetation with less than 0.5 percent salinity (Cowardin et al. 1979). Mudflats at the LNG Terminal site do not meet the definitions of wetlands since they are unvegetated; however, they are regulated as special aquatic sites under Section 404 of the CWA and are therefore addressed in this section. Special aquatic sites are those geographic areas possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important easily disrupted ecological habitats, including wetlands, mud flats, vegetated shallows, and coral reefs as further defined in the CWA. RG LNG also delineated a shallow (less than 6 feet deep) open water lagoon located on the LNG Terminal site as part of a wetland system; impacts on the lagoon (termed “Aquatic Resource 1”) are discussed in section 4.4.2. Wetland delineations were conducted in accordance with COE-approved methods, and RG Developers submitted the results of wetland delineations to the COE for approval in January 2016 (LNG Terminal site) and November 2016 (pipeline facilities). When land access is obtained, RB Pipeline will conduct additional field surveys to delineate wetlands along rerouted portions of the proposed pipeline right-of-way. Table 4.4.1-1 describes the wetland types in the Project area.

4.4.1.1 LNG Terminal

RG LNG identified surface water resources at the LNG Terminal site during field surveys completed in March, April, and November 2015; these surveys identified five wetland/special aquatic sites. Wetland delineations were performed in accordance with the COE’s Wetlands Delineation Manual and the Atlantic and Gulf Coastal Plain regional supplement, and wetland boundaries were refined as a result of site visits with the COE (COE 1987, COE 2010a). Further, RG LNG conducted surveys of temporary offsite storage/parking areas and the temporary haul road, in June, July, and November 2016. Wetlands at the LNG Terminal site are depicted in figure 4.4.1-1, and table 4.4.1-2 identifies the acreage and classification of each wetland and special aquatic site at the LNG Terminal site.

4.4.1.2 Pipeline Facilities

RB Pipeline identified wetlands along the Pipeline System during field surveys conducted in 2015 and 2016, where survey access was available. When further land access is obtained, RB Pipeline will conduct the remaining surveys and for any route modifications. Field surveys were conducted in a 300-foot-wide survey corridor centered on the permanent right-of-way for the Pipeline System, a 75-foot-wide corridor centered on each access road, and the footprint of aboveground facility sites. Wetland delineations were performed in accordance with the COE’s Wetlands Delineation Manual and the Atlantic and Gulf Coastal Plain and Great Plains regional supplements (COE 1987, COE 2010a, COE 2010b).

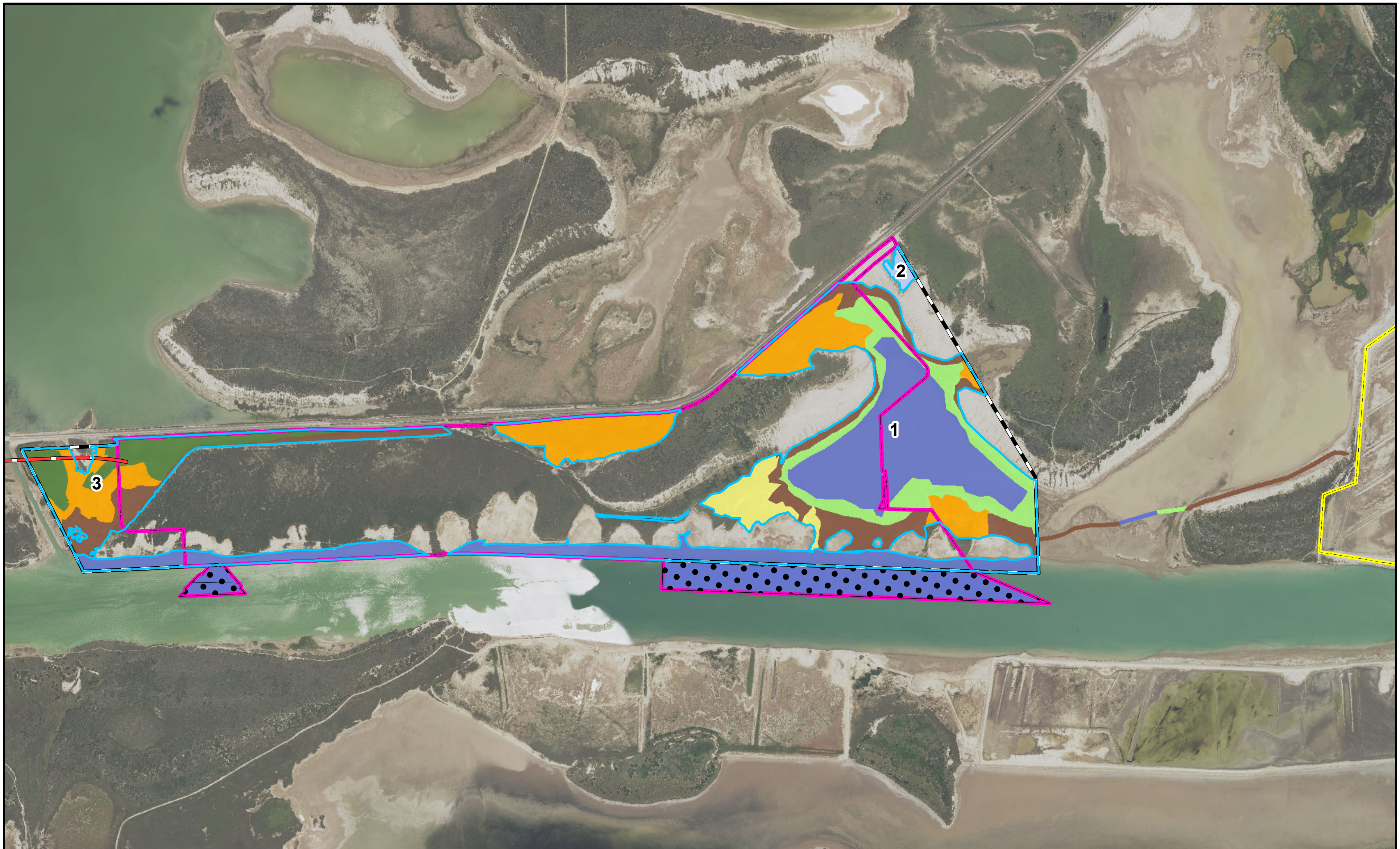
Table 4.4.1-1
Wetland and Special Aquatic Site Types in the Rio Grande LNG Project Area

Cowardin Classification	Wetland Characteristics	Location in the Project Area
Palustrine Wetlands		
Palustrine emergent (PEM)	Freshwater wetlands characterized by erect, rooted, herbaceous plants suited to growing in wet conditions. Dominant species include gulf cordgrass (*Spartina spartinae*), *Cyperus spp.*, and *Eleocharis spp*. In areas where the pipeline crosses saline soils, herbaceous species include sea ox-eye daisy (*Borrichia frutescens*), and sea blite (*Suaeda spp.*).	Along the northern extent of the Pipeline System from the Header System to about MP 125.0
Palustrine scrub-shrub (PSS)	Freshwater wetlands dominated by shrubs and saplings less than 20 feet tall. PSS wetlands in the Project area were dominated by Puerto Rico sensitive briar (*Mimosa asperata*) and retama (*Parkinsonia aculeate*).	
Palustrine forested (PFO)	Freshwater wetlands dominated by trees and shrubs at least 20 feet tall with a tolerance to a seasonally high water table. PFO wetlands have not been field-delineated in the Project area, but likely include tree species such as bald cypress (*Taxodium distichium*), black willow (*Salix nigra*), and willow oak (*Quercus phellos*).	
Estuarine Wetlands		
Estuarine emergent marsh (EEM)	Estuarine wetlands characterized by erect, rooted, herbaceous plants, including marshes, salt flats, and man-made features. Dominant vegetation includes shoregrass (*Monanthachlor littoralis)*, sea ox-eye daisy, sea blite, glassworts (*Salicornia spp.*), and saltwort (*Batis maritima*).	Along the southern extent of the Pipeline System from MP 125.0 to its terminus and at the LNG Terminal site.
Estuarine scrub-scrub (ESS)	Estuarine wetlands dominated by shrubs and saplings less than 20 feet tall. ESS wetlands in the Project area are dominated by black mangrove (*Avicennia germinans).*	Along the southern extent of the Pipeline System from MP 134.8 to the terminus and at the LNG Terminal site.
Estuarine unconsolidated shore (EUS)	Tidally influenced shoreline characterized by the lack of large stable surfaces for plant and animal attachment with vegetation cover less than 30 percent. Mudflats where the substrate is predominantly silt and clay occur in the Project area.	Mudflats at the LNG Terminal site and along the southern extent of the Pipeline System beginning near MP 130.8.
Source: Schafer et al. 2002, Cowardin et al. 1979.		

Table 4.4.1-2
Wetlands and Special Aquatic Sites within the Rio Grande LNG Terminal Site

Aquatic Resource	Habitat Type	Cowardin Classification	Size (acres)
Aquatic Resource 1	Marsh	EEM	78.6
	Salt flat	EEM	40.6
	Mud flat	EUS	44.6
Aquatic Resource 2	Man-made pond	EEM	3.8
Aquatic Resource 3	Mangrove wetland	ESS	33.5
	Salt flat	EEM	20.5
	Mudflat	EUS	27.8
Aquatic Resource 4	Salt flat	EEM	35.5
Aquatic Resource 5	Man-made ditch	EEM	1.2
Total			**285.9**[a]

[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.



Legend

- LNG Terminal Site
- Proposed Rio Bravo Pipeline
- 1 Aquatic Resources
- Proposed LNG Terminal Boundary
- BSC Dredge Areas
- Port Isabel Dredge Pile
- Ditch (EEM)
- High Marsh (EEM)
- Low Marsh (EEM)
- Mangrove (EES)
- Mudflat (EUS
- Salt Flats (EEM)
- Pond (EEM)
- Water

AERIAL IMAGERY: NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP) 2014 - http://datagateway.nrcs.usda.gov/.

N

0 0.25 0.5
Miles

Scale: 1:27,000

Rio Grande LNG Project

Aquatic Resources within the LNG Terminal Site

Figure 4.4.1-1

Where field survey access was not available, environmental information was obtained from aerial imagery, field delineation data from adjacent parcels, and other available Geographic Information System--based information including hydrography, hydric soils, and wetland data. Surveys conducted through 2016 cover about 56 percent of the Pipeline System (including the pipeline route, access roads, aboveground facilities, and contractor/pipe yards). Surveys for the remaining areas would be conducted once access is available.

Appendix J identifies the wetlands that would be potentially affected by the pipeline facilities, including the wetland identification, location, type, crossing width (where applicable), and impact acreage. The pipeline facilities would cross freshwater and estuarine wetlands as described in table 4.4.1-1.

4.4.2 Wetland Impacts and Mitigation

As summarized in table 4.4.2-1, a total of 334.7 acres of wetlands would be within the construction footprint of the Rio Grande LNG Terminal and pipeline facilities.

Impacts would include 9.6 acres of palustrine forested (PFO) wetlands, 23.0 acres of palustrine scrub-shrub (PSS) and estuarine scrub-shrub (ESS) wetlands, and 248.0 acres of palustrine emergent (PEM) and estuarine emergent marsh (EEM) wetlands. In addition, the Project would impact 54.0 acres of mudflats (estuarine unconsolidated shore [EUS]) during construction. A total of 287.2 acres would be within the operational footprint of the Project, of which 182.4 would be permanently converted to industrial/commercial land or open water at the LNG Terminal site (including 19.8 acres of ESS wetland, 114.9 acres of EEM wetlands, and 47.7 acres of mudflats) and 104.8 would be maintained as PEM/PSS within the pipeline right-of-way in accordance with the Project-specific Procedures (including 7.4 acres of PFO wetlands, 3.2 acres of PSS wetlands, and 94.2 acres of emergent [PEM and EEM] wetlands and mudflats).

4.4.2.1 LNG Terminal

Public scoping comments expressed concern regarding wetland impacts and loss, including impacts on mangroves, due to construction and operation of the LNG Terminal. Public comments also express concern over loss of wetlands that provide important habitat for aquatic resources, which are addressed in section 4.6.2. Construction of the LNG Terminal would result in the permanent loss of 182.4 acres of wetlands and special aquatic sites, including 114.9 acres of EEM, 19.8 acres of ESS (mangroves), and 47.7 acres of EUS/mudflats (see table 4.4.2-1).

Impacts for the LNG Terminal site include those acreages associated with RG LNG's Compressor Station 3, which would be constructed at the western end of the LNG Terminal site. A total of 168.1 acres of wetlands would be converted to upland industrial land and open land within the site. This includes modification of the wetlands along the BSC and the perimeter of the turning basin for shoreline stabilization. Shoreline stabilization is further discussed in section 4.3.2.2. The remaining 14.3 acres would be converted to open water to support marine facilities including the marine berths, turning basin, and firewater canal. Impacts related to dredging and modification of open water at the LNG Terminal site are addressed in section 4.3.2.2. All direct impacts on wetlands at the LNG Terminal site would occur during initial construction, since site clearing and preparation would be conducted at that time.

Table 4.4.2-1
Wetlands Affected by the Rio Grande LNG Project[a]

Facilities	PEM Wetland		PSS Wetland		PFO Wetland		EEM Wetland		ESS Wetland		EUS		Total	
	Con[b]	Op[b]	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op
LNG TERMINAL														
LNG Terminal[c,d]	0.0	0.0	0.0	0.0	0.0	0.0	114.9	114.9	19.8	19.8	47.7	47.7	182.4	182.4
Temporary haul road[d]	0.0	0.0	0.0	0.0	0.0	0.0	9.4	0.0	0.0	0.0	0.0	0.0	9.4	0.0
Offsite storage / parking	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
Port Isabel dredge pile[e]	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bulk water loading area	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
LNG Terminal Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**124.3**	**114.9**	**19.8**	**19.8**	**47.7**	**47.7**	**191.8**	**182.4**
PIPELINE Facilities														
Header System and Pipeline 1														
Header System	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipeline 1														
Pipeline ROW	40.0	36.2	3.2	3.2	9.5	7.4	70.7	53.9	0.0	0.0	5.6	4.1	129.1	104.8
Access roads[f]	0.2	0.0	0.0	0.0	<0.1	0.0	7.9	0.0	0.0	0.0	0.2	0.0	8.3	0.0
Contractor / pipe yards	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ATWS	0.0	0.0	0.0	0.0	0.1	0.0	4.9	0.0	0.0	0.0	0.6	0.0	5.6	0.0
Aboveground facilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal	***40.2***	***36.2***	***3.2***	***3.2***	***9.6***	***7.4***	***83.5***	***53.9***	***0.0***	***0.0***	***6.3***	***4.1***	***142.9***	***104.8***
Pipeline 2[g]														
Pipeline ROW	52.8	46.8	0.0	0.0	0.0	0.0	70.7	53.9	0.0	0.0	5.6	4.1	129.1	104.8
Access roads[f]	0.2	0.0	0.0	0.0	<0.1	0.0	7.9	0.0	0.0	0.0	0.2	0.0	8.3	0.0
Contractor / pipe yards	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ATWS	0.1	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.0	0.0	0.6	0.0	5.6	0.0
Aboveground facilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal	***53.1***	***46.8***	***0.0***	***0.0***	***0.0***	***0.0***	***83.5***	***53.9***	***0.0***	***0.0***	***6.3***	***4.1***	***142.9***	***104.8***
Pipeline Facilities Total[h]	**40.2**	**36.2**	**3.2**	**3.2**	**9.6**	**7.4**	**83.5**	**53.9**	**0.0**	**0.0**	**6.3**	**4.1**	**142.9**	**104.8**
Rio Grande LNG Project Total[h]	**40.2**	**36.2**	**3.2**	**3.2**	**9.6**	**7.4**	**207.8**	**168.8**	**19.8**	**19.8**	**54.0**	**51.8**	**334.7**	**287.2**

[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] Con = Construction; Op = Operation.
[c] Acreages for the LNG Terminal site include those acreages associated with RG LNG's Compressor Station 3 and the marine facilities.
[d] Placement of these facilities are a deviation to the FERC Procedures (see section 4.4.2.1); section 3 includes alternatives discussions for these Project components
[e] Wetland delineation surveys are not planned at the Port Isabel dredge pile due to the deposition of and use of that site for dredged material management.
[f] Modification of access roads in wetlands would not be required, other than the placement of temporary equipment mats to prevent soil impacts.
[g] Forested and scrub-shrub wetlands restored following construction of Pipeline 1 would revegetate to emergent vegetation conditions prior to construction of Pipeline 2, rather than the pre-construction vegetation cover. Therefore, construction of Pipeline 2 would have a greater impact on PEM and EEM wetlands than Pipeline 1.
[h] This total includes the footprint of the entire Pipeline System, rather than the sum of its individual components, as the affected acreage for Pipeline 2 overlaps with the affected acreage proposed for Pipeline 1.

To avoid and minimize impacts on wetlands, the LNG Terminal facilities were sited in a manner that would avoid impacts on wetlands at the eastern and western edges of the terminal site. However, construction of the LNG Terminal within wetlands would be an alternative measure to the FERC Procedures and is discussed in section 4.4.2.3. As described in section 3.3, alternative LNG Terminal sites were analyzed to determine whether wetland impacts could be further avoided and/or minimized while meeting the Project's stated purpose and safety requirements; no suitable alternative sites were identified and no alternative configurations resulted in significantly fewer impacts on wetlands and met the Project's stated purpose. RG LNG would be required to obtain the applicable COE permits for permanent loss of wetland habitat and implement any mitigation measures required by the COE for that loss, as discussed in section 4.4.2.4. RG Developers submitted an updated Section 10/404 application to the COE for the LNG Terminal on March 30, 2018.[20]

About 1.7 acres of wetlands were initially identified at the Port of Brownsville Temporary Storage/Parking area during field surveys; however, RG LNG has since modified its proposed workspace boundary to avoid all wetlands at that location. No wetlands are present in the Port Isabel Temporary Storage Area or the bulk water loading area.

RG LNG proposes to use a temporary haul road during construction for dump trucks to access the Port Isabel dredge pile, which would affect 9.4 acres of wetlands and mud flats outside the boundary of the LNG Terminal site, including 1.9 acres within the eastern natural buffer area described below. The temporary haul road would also impact 1.0 acre of open water, as discussed in section 4.3.2.2. In addition to temporary, direct impacts on wetlands and open water within the footprint of the temporary haul road, its use could cut off tidal exchange between the BSC and adjacent habitat, and could increase sedimentation of adjacent wetlands and mud flats. To maintain tidal flow, RG LNG proposes to install culverts along the temporary haul road. To minimize potential erosion and sedimentation of adjacent wetlands from road use, RG LNG proposes to install an earthen safety berm on each side of the road. Following its use, the temporary haul road would be restored to pre-construction conditions, and vegetated areas would be allowed to revegetate naturally. RG LNG is also evaluating the feasibility of planting estuarine marsh vegetation along the temporary haul road to ensure successful revegetation and for erosion control as additional mitigation.

As discussed in section 4.4.2.4, RG Developers are consulting with the COE to develop a Project-specific Wetland Mitigation Plan. However, construction of the haul road would be a deviation from the FERC Procedures (section VI.B.1.d) and we believe it prudent to explore options that would avoid the impacts associated with the haul road, if possible. Thus, we have recommended in section 3.4 that RG LNG further assess the feasibility of using SH-48 for transit of the dump trucks, or using barges to transport material down the BSC. Based on currently available information, these alternative options would appear to be environmentally preferable to construction and use of a new haul road. We will make our final recommendation regarding construction and use of this road in the final EIS.

---

[20] RG Developers' Section 10/404 application to the COE for the LNG Terminal is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20180419-5210.

About 233.8 acres of land, including 103.5 acres of wetlands and mudflats, are present within the parcel leased by RG Developers, but would be outside of the LNG Terminal facility boundary. Of that area, about 10.5 acres would be dredged for a planned expansion of the Bahia Grande Channel for wetland restoration that is not related to the Rio Grande LNG Project, as discussed in section 4.3.2.2. The remaining areas would not be directly affected by Project construction, but would be retained as natural buffer.

Wetlands adjacent to the LNG Terminal site could be impacted by sedimentation from construction activities or could become contaminated due to spills and leaks of hazardous materials during construction and operation. RG LNG would minimize construction-related impacts on the adjacent wetlands by implementing its Procedures. Construction of the levee during Stage 1 of construction would further protect adjacent wetlands from sedimentation and potential contamination. RG LNG would implement measures contained in its SPCC Plan during construction, which include spill prevention measures, mitigation measures, and cleanup methods to reduce potential impacts should a spill occur. The SPCC Plan also addresses storage of hazardous materials. Per our recommendation in section 4.2.2.1, a final construction SPCC Plan as well as copies of RG LNG's operational SPCC Plan would be filed with the Secretary prior to construction.

During operation, vessel traffic along the BSC, within the turning basin, and at the marine berths could result in increased shoreline erosion, potentially impacting wetlands and other aquatic sites along the shore of the marine facilities. As described in section 4.3.2.2, RG LNG would modify the slope of the shoreline and stabilize the shoreline of marine facilities to minimize impacts. In addition to providing scour protection, the rip-rap would prevent erosion of the adjacent unprotected shoreline by wave activity from maneuvering vessels. Because the BSC is an established shipping corridor and RG LNG would stabilize the shoreline of its marine facilities, we have determined the increase in vessel traffic within the BSC would not result in a significant increase in shoreline erosion or significant impact on wetlands.

4.4.2.2 Pipeline Facilities

Pipeline System and Additional Temporary Workspace

<u>Header System and Pipeline 1</u>

The Header System would not cross any wetlands. Construction workspace for Pipeline 1 would impact a total of 134.7 acres of wetlands, including 9.6 acres of PFO wetlands, 3.2 acres of PSS wetlands, and 115.6 acres of emergent (PEM and EEM) wetlands. In addition, construction of Pipeline 1 would affect 6.2 acres of mudflats (EUS). Following construction of Pipeline 1, wetlands would be restored to pre-construction conditions and would be allowed to revegetate naturally or using seed mixes in accordance with NRCS recommendations (see section 4.2.2.2). Of the 104.8 acres of wetlands within the permanent footprint of the pipeline facilities, 7.4 acres would be PFO and 3.2 acres would be PSS wetland.

Pipeline 2

Construction of Pipeline 2 would commence approximately 18 months after the installation and restoration of Pipeline 1. Wetlands affected by construction of Pipeline 1 would be expected to revegetate to emergent cover in the period between construction of Pipeline 1 and Pipeline 2; however, PFO and PSS wetlands would likely be in early successional stages and would not return to a community of mature woody vegetation during that time. Construction workspace for Pipeline 2 would be identical to construction workspace for Pipeline 1, as described above, and would impact a total of 134.7 acres of wetlands, including 128.5 acres of emergent (PEM and EEM) wetlands and 6.2 acres of mudflats (EUS). Following construction of Pipeline 2, wetlands would be allowed to revegetate, either naturally or using seed mixes in accordance with NRCS recommendations; however, wetland vegetation would be maintained as discussed below and specified in the Project-specific Procedures.

General Impacts of the Pipeline System

Construction would be conducted in accordance with the Project-specific Procedures and as described in section 2.5.2.1. RB Pipeline has proposed a 75-foot-wide construction right-of-way for the majority of wetland crossings less than 1,000 feet in length. The 75 feet used for construction would be 100 percent collocated with the 75-foot-wide permanent right-of-way. Figure 2.2.2-2 depicts the typical 75-foot-wide right-of-way configuration in wetlands. For wetlands with crossing lengths greater than 1,000 feet (including the PFO wetlands near the origin of the pipeline), RB Pipeline has proposed a construction right-of-way width of 100 feet. Appendix F lists all areas where RB Pipeline proposes a right-of-way width greater than 75 feet through wetlands; we have reviewed these requested deviations to the FERC Procedures and have found them acceptable.

The reduction in construction right-of-way widths to minimize impacts on wetlands has resulted in irregularly shaped workspace at some locations along the construction right-of-way, including locations where wetlands are surrounded by, but excluded from, temporary workspace. RB Pipeline would protect wetlands located outside the construction workspace in accordance with its Procedures (e.g., by use of silt fences and/or straw bales, and other measures), thereby minimizing impacts. At one location (wetland WW-T04-015 near MP 36.5), temporary workspace is proposed adjacent to wetlands, but does not appear to be accessible via access roads or the construction right-of-way. We do not find the isolated temporary workspace at this location to be acceptable, thus **we recommend that:**

- **Prior to construction of the Rio Bravo Pipeline through wetland WW-T04-015, RB Pipeline should file with the Secretary, for review and written approval by the Director of OEP, revised construction right-of-way configurations that either exclude inaccessible temporary workspace at the wetland crossing, or reconfigure the workspace so that it complies with section 6.1.3 of RG Developers' Procedures.**

RB Pipeline would determine the method of pipeline construction within each wetland by soil stability and saturation at the time of construction. Where soils are stable and not saturated at the time of crossing, the pipeline would be installed using methods similar to those in upland areas. Additional protection methods in these wetlands include limiting the use of equipment operating in wetlands and segregating topsoil. RB Pipeline would use equipment mats in wetlands where rutting could occur.

Where wetland soils are saturated or not stable enough to support construction equipment at the time of crossing, RB Pipeline would string and weld the pipe in an upland staging area, except where the pipeline segment would be too large to safely weld and move into place from an upland location (see appendix J). Vegetation and stump removal would be limited to the trench line, and topsoil would not be segregated if soils are saturated or inundated. In addition, equipment would be limited to one pass through these wetlands to avoid rutting.

The impacts of RB Pipeline's construction on wetland vegetation could include temporary changes in hydrology and water quality during construction. Ground-disturbing activities, including clearing and grading of temporary work areas and excavation activities could temporarily affect the rate and direction of water movement within wetlands. If contours and elevations are not properly restored, these effects could adversely impact wetland hydrology and revegetation by creating soil conditions that may not support wetland communities and hydrophytic vegetation at pre-construction levels. Temporary removal of wetland vegetation during construction could alter the capacity of wetlands to function as habitat, or as flood and erosion control buffers. Mixing of topsoil with subsoil could alter nutrient availability and soil chemistry, thereby inhibiting recruitment of native wetland vegetation. Heavy equipment operating during construction could result in soil compaction or rutting that would alter natural hydrologic and soil conditions, potentially inhibiting germination of native seeds and the ability of plants to establish healthy root systems. Heavy equipment could also introduce non-native and invasive species to the disturbed soil (see section 4.5.3). Additionally, stormwater discharges and discharges from dewatering structures or hydrostatic testing could transport sediments and pollutants into wetlands, affecting water quality.

The majority of the impacts on wetlands from the pipeline facilities would be temporary. RB Pipeline would restore all wetlands to pre-Project contours and hydrology. Herbaceous wetland vegetation would regenerate quickly, typically within 1 to 3 years. Impacts on PFO and PSS wetlands within the construction workspaces (but outside of the permanent right-of-way) would be long-term, because woody vegetation would take several years to regenerate. In accordance with its Procedures, RB Pipeline would monitor the success of wetland revegetation annually until wetland revegetation is successful. Wetland revegetation would be considered successful when the vegetation cover is at least 80 percent of the vegetation in adjacent undisturbed wetland areas or as compared to documented, pre-Project conditions. In accordance with its Procedures, if revegetation is not successful 3 years from the conclusion of construction, RB Pipeline would develop and implement (in consultation with a professional wetland ecologist) a plan to actively revegetate applicable wetlands with native wetland plant species. Further, RB Pipeline would consult with the COE to develop a Project-specific wetland restoration plan, which would include measures for revegetation; these consultations are ongoing.

RB Pipeline would avoid impacts on 11 wetlands by use of HDD, which would eliminate the need for trenching and operation of heavy construction equipment within the wetland. Along the northern extent of the Project route, wetlands avoided by HDD construction are associated with major, perennial waterbody crossings; along the southern extent where the Pipeline System would cross large estuarine wetlands, HDD construction would avoid impacts on mangrove (ESS wetland) habitat. RB Pipeline would limit activities between the HDD entry and exit points to the hand-clearing of a 2-foot-wide path to place guide wires for the drill alignment.

Where surface water is proposed for use to support HDD construction, mobile equipment would be used to withdraw water from the waterbody; however, any clearing required for equipment passage would be limited to the hand-clearing of small diameter vegetation (see section 2.5.2). If an inadvertent release of HDD drilling fluid occurred within a wetland, the resulting sedimentation could affect water quality. RB Pipeline would implement its HDD Contingency Plan,[21] which includes methods for detecting and responding to inadvertent returns.

During operation and in compliance with its Procedures, RB Pipeline would limit routine vegetation maintenance to the mowing of a 10-foot-wide corridor centered on the pipeline in wetlands. Additionally, RB Pipeline would selectively clear trees within 15 feet of the centerline in PFO and PSS wetlands that could damage the pipeline during operation. As the remainder of the permanent right-of-way would not be maintained, wetlands would be allowed to return to pre-Project vegetation conditions outside of the 10-foot-wide (for emergent wetlands) or 30-foot-wide (for PFO or PSS) corridors, as applicable. RB Pipeline would minimize wetland impacts by implementing its Procedures. Further, due to the longer disturbance of wetlands within the same corridor due to proposed sequential installation of Pipelines 1 and 2, and the potential for conversion of wetland cover types within the permanent right-of-way, compensatory mitigation could be required as part of the CWA Section 404 permit for the Pipeline System. RB Pipeline would be required to implement the conditions of its CWA Section 404 and 401 permits to mitigate for wetland impacts. RG Developers submitted the Section 10/404 application to the COE for the pipeline facilities on February 14, 2017,[22] and plans to submit a revised Section 404/10 application to the COE in when additional surveys have been completed. Specific measures RB Pipeline would implement include:

- limiting equipment within wetlands to that necessary for the installation of each pipeline;
- restricting non-essential equipment to upland access roads or, where access roads are unavailable, to one pass through wetlands that cannot be stabilized to avoid rutting;
- locating ATWS at least 50 feet from wetland boundaries, except where site-specific conditions warrant otherwise, and as approved by the FERC (see section 4.4.2.3);

---

21 RG Developers' HDD Contingency Plan is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20160829-5283.

22 RG Developers' Section 10/404 application to the COE for the pipeline facilities is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20170221-5224.

- cutting vegetation just above ground level, leaving existing root systems in place, and limiting the pulling of stumps and grading activities to directly over the trenchline except where the Chief Inspector and EI determine that these activities are required for safety reasons;
- using low ground weight equipment or operating equipment on timber mats in saturated soils to prevent rutting;
- segregating the top 12 inches of topsoil from the trenchline, except in areas where standing water is present or soils are saturated; and
- installing trench plugs as necessary and restoring pre-construction contours to maintain the original wetland hydrology.

Aboveground Facilities

The pipeline facilities would include three compressor stations, two booster stations, eight metering sites, and additional appurtenant facilities; impacts from Compressor Station 3 are discussed above, as this station would be within the boundaries of the Rio Grande LNG Terminal site. No wetlands would be within the construction or operational areas associated with the aboveground facilities for the Pipeline System. While the initial configuration of Compressor Station 1 included impacts on PFO wetlands, RB Pipeline modified the facility footprint to avoid these impacts. RB Pipeline would implement its Plan and Procedures, which require the use of temporary and permanent erosion control measures, to minimize the potential for sedimentation of nearby wetlands from ground disturbed for construction. All disturbed areas would be routinely monitored in accordance with RB Pipeline's Plan and Procedures until restoration and revegetation are successful.

Contractor/Pipe Yards

Three contractor/pipe yards would be used during construction of the pipeline facilities. No wetlands are located within the contractor/pipe yards, and RB Pipeline would install erosion and sediment controls to prevent migration of sediment outside of the contractor/pipe yards. Therefore, no direct or indirect impacts on wetlands from the use of contractor/pipe yards are anticipated.

Access Roads

RB Pipeline proposes to use 10 access roads within wetlands during construction, all of which are existing roads. The existing roads proposed for use comprise about 8.3 acres of wetlands crossed. RB Pipeline would not use fill in wetlands crossed by access roads, and would place mats over saturated soils in crossed wetlands to reduce impacts from rutting and compaction. Because modification of existing access roads in wetlands would not be required, PFO wetland vegetation would not be cleared where crossed by an existing access road. RB Pipeline would remove any materials installed to support access roads in wetlands during the 18-month period between placing Pipeline 1 into service and beginning construction of Pipeline 2. If RB Pipeline determines that maintenance of access road materials in wetlands is necessary during the period between construction of Pipelines 1 and 2, site-specific justification would be provided to the FERC for review and approval. No permanent access roads would be located in wetlands. RB Pipeline would minimize potential impacts on wetlands by installing and maintaining erosion and sediment controls per its Plan and Procedures.

4.4.2.3 Alternative Measures to the FERC Procedures

LNG Terminal

Sections VI.A.6 and VI.B.1.d of the FERC Procedures specify that aboveground facilities and access roads, respectively, should generally be located outside of wetlands. Although RG LNG proposes to locate the LNG Terminal site (including Compressor Station 3) in wetlands, we have determined that the proposed location is the most environmentally preferable and practical alternative that meets the Project’s stated purposed (see section 3.3). RG LNG also proposes to construct the new temporary haul road in wetlands (see section 4.4.2.1); however, in section 3.4 we have recommended that RG LNG assess potential alternatives to the haul road.

Pipeline Facilities

The FERC Procedures specify that the construction right-of-way width in wetlands should be limited to 75 feet. RB Pipeline has requested a 75-foot-wide construction right-of-way in most wetlands, and a construction right-of-way width of 100 feet in wetlands greater than 1,000 feet long, as listed in appendix F. Generally, the justifications provided by RB Pipeline indicate that certain soil types affect slope stability; therefore, adequate space is needed to store spoil piles and separate subsoil from topsoil. Most 1,000-foot-long wetland crossings are along the southern extent of the Pipeline System beginning near MP 125.0 where the Pipeline System would cross large estuarine wetlands and mudflats. RB Pipeline initially proposed construction right-of-way widths of 100 and 125 feet for each pipeline in wetlands; however, in response to our comments on the Application, RB Pipeline reduced the proposed typical right-of-way widths in wetlands to 75 and 100 feet as described above. Further, RB Pipeline would avoid impacts on 11 wetlands using HDD construction. Site-specific justification for each location where a 100-foot-wide construction right-of-way is proposed is included in appendix F.

The FERC Procedures specify that extra workspace should not be within 50 feet of wetlands except where an alternative measure has been requested by RB Pipeline and approved by the FERC (Section VI.B.1). Areas where RB Pipeline has requested ATWS within wetlands (such as for spoil storage and at conventional bore and HDD construction locations) are identified in appendix F. We have reviewed these locations and have determined that some of the justifications are insufficient. Therefore, **we recommend that:**

- **<u>Prior to the end of the draft EIS comment period</u>, RG Developers should file with the Secretary updated information on the impacted wetland areas in appendix F of the draft EIS identified as unacceptable. The information should include all appropriate details in a consistent manner for each area, updated site-specific justifications for alternative measures to the Commission’s Procedures, and revised alignment sheets, as necessary.**

The FERC Procedures state that the only access roads that can be used in wetlands are those existing roads that require no modifications or improvements and that would not impact the wetland. RB Pipeline has requested the use of 10 existing, temporary access roads within wetlands, as identified in appendix F. RB Pipeline does not propose to use fill in wetlands, and would use matting where soils are saturated to reduce impacts due to rutting and compaction. We find this to be consistent with the FERC Procedures.

4.4.2.4 Compensatory Mitigation

The COE has a goal of "no net loss" of wetlands in the United States. This means that unavoidable wetland impacts must be offset by the creation, restoration, enhancement, or preservation of at least an equal amount of wetlands, which is referred to as compensatory mitigation. In order to offset the wetland impacts that would occur as a result of the Project, RG LNG developed a Conceptual Mitigation Plan[23] as part of its initial permit application to the COE, and provided a detailed Mitigation Alternatives Analysis[24] in October 2017 that describes the proposed mitigation. The detailed Mitigation Alternatives Analysis was provided to the COE on March 30, 2018, with the updated Section 10/404 permit application. Consultation with the COE and other applicable agencies (including the EPA, FWS, and NMFS) to finalize the plan is ongoing. RG LNG is proposing to use permittee-responsible mitigation via offsite wetland preservation at a site about 1 mile south of the LNG Terminal on the south side of the BSC (the Loma Ecological Preserve).

Public scoping comments expressed concern regarding the availability of wetland mitigation for the scope of Project-related wetland impacts. RG LNG proposes to preserve wetlands within the Loma Ecological Preserve, a 4,600-acre area owned by the BND and managed by the Lower Rio Grande Valley NWR until 2023, when its lease expires. Wetland habitats and special aquatic sites within the Loma Ecological Preserve include ESS wetlands, mudflats, and EEM wetlands. RG LNG is proposing to acquire and preserve a portion of the Loma Ecological Preserve in perpetuity to offset impacts on wetland and open water habitat; the preservation area would be permanently transferred to a land manager such as the FWS. RG LNG anticipates determination of the total acres and location within the Loma Ecological Preserve that would be designated for preservation in coordination with the COE. Per RG LNG's Conceptual Mitigation Plan, which is pending revision, long-term management and maintenance of the preservation area within the Loma Ecological Preserve would be the responsibility of the land managing entity. The COE has not approved RG LNG's Conceptual Mitigation Plan and is working with RG Developers, in conjunction with the FWS, NMFS, EPA, and TPWD to revise the proposed mitigation measures as appropriate. Construction of the LNG Terminal would not commence prior to finalization of the wetland mitigation plans and issuance of the COE's CWA Section 404/Section 10 permit.

---

[23] RG LNG's Conceptual Mitigation Plan, which would be updated pending coordination with applicable regulatory agencies, is available on the FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20161006-5114.

[24] RG LNG's Mitigation Alternative Analysis is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20171117-5156.

As discussed above, construction of the Project would result in the permanent loss of 182.4 acres of wetlands and mudflats within the LNG Terminal site. In addition, 7.4 acres of PFO wetlands would be within the permanent right-of-way for the Pipeline System, of which a 30-foot-wide area centered on each pipeline would be maintained as PEM/PSS wetlands in accordance with the Project-specific Procedures. Compensatory mitigation for these wetland impacts could be required as part of the CWA Section 404 permit for the Pipeline System. With adherence to measures contained in the Project-specific Procedures, COE permits, and our recommendations, impacts on wetlands would be reduced, but permanent, with the majority of adverse impacts occurring at the LNG Terminal site. We anticipate that, if the COE issues a Section 404/Section 10 permit for the Project, it would be conditioned upon Project-related adverse impacts on waters of the United States being effectively offset by wetland mitigation, such that impacts would be reduced to less than significant levels.

4.5 VEGETATION

4.5.1 Existing Vegetation Resources

The Rio Grande LNG Project is within the Western Gulf Coastal Plain Level III ecoregion, which spans the entire coast of Texas. With little topographical relief, the ecoregion is generally favorable to grassland and cropland (EPA 2007). The TPWD has further defined vegetation communities based on the plant species, soils, and land characteristics present; 13 vegetation communities were identified within the Project footprint (see table 4.5-1). Each of these vegetation communities can generally be classified as one of five broad cover types, including agricultural land, upland herbaceous land, shrub/forest upland, shrub/forested wetlands, and emergent wetlands. Table 4.5-1 identifies the TPWD-classified vegetation communities that would be crossed by the Project, including representative plant species and general cover type. The Project would also cross barren/dredge spoil areas and industrial/commercial land; however, as these land types are generally unvegetated or provide little habitat value, they are discussed in section 4.8 (Land Use).

4.5.1.1 LNG Terminal

RG LNG has leased a 984.2-acre property from the BND for placement of the Rio Grande LNG Terminal. The property is generally low-lying (elevations of less than 10 feet), with higher-elevation features (up to 25 feet high) including lomas (coastal clay dunes) and dredge spoil piles (see figure 4.5.1-1). The site itself is dominated by a lagoon, tidal flats, and marshes on the east; a mud/salt flat complex and mangroves on the west; and a terraced area that was used as historic dredge spoil placement in the center and along the banks of the BSC. The property is bordered by SH-48 to the north, the BSC to the south, and the Bahia Grande Channel to the west. The property immediately to the east of the LNG Terminal site is similar in vegetation cover, but is currently proposed for industrial development (see section 4.13). Vegetated land within the construction and operational footprint of the proposed LNG Terminal includes upland herbaceous (34.0 percent), upland shrub/forest (33.6 percent), emergent wetlands (28.9 percent), and shrub/forested wetlands (3.5 percent) (see table 4.5.1-1 and figures 4.4.1-1 and 4.5.1-1). Additional impacts on non-vegetated lands (i.e., barren, industrial/commercial land, and open water) are discussed in section 4.8.

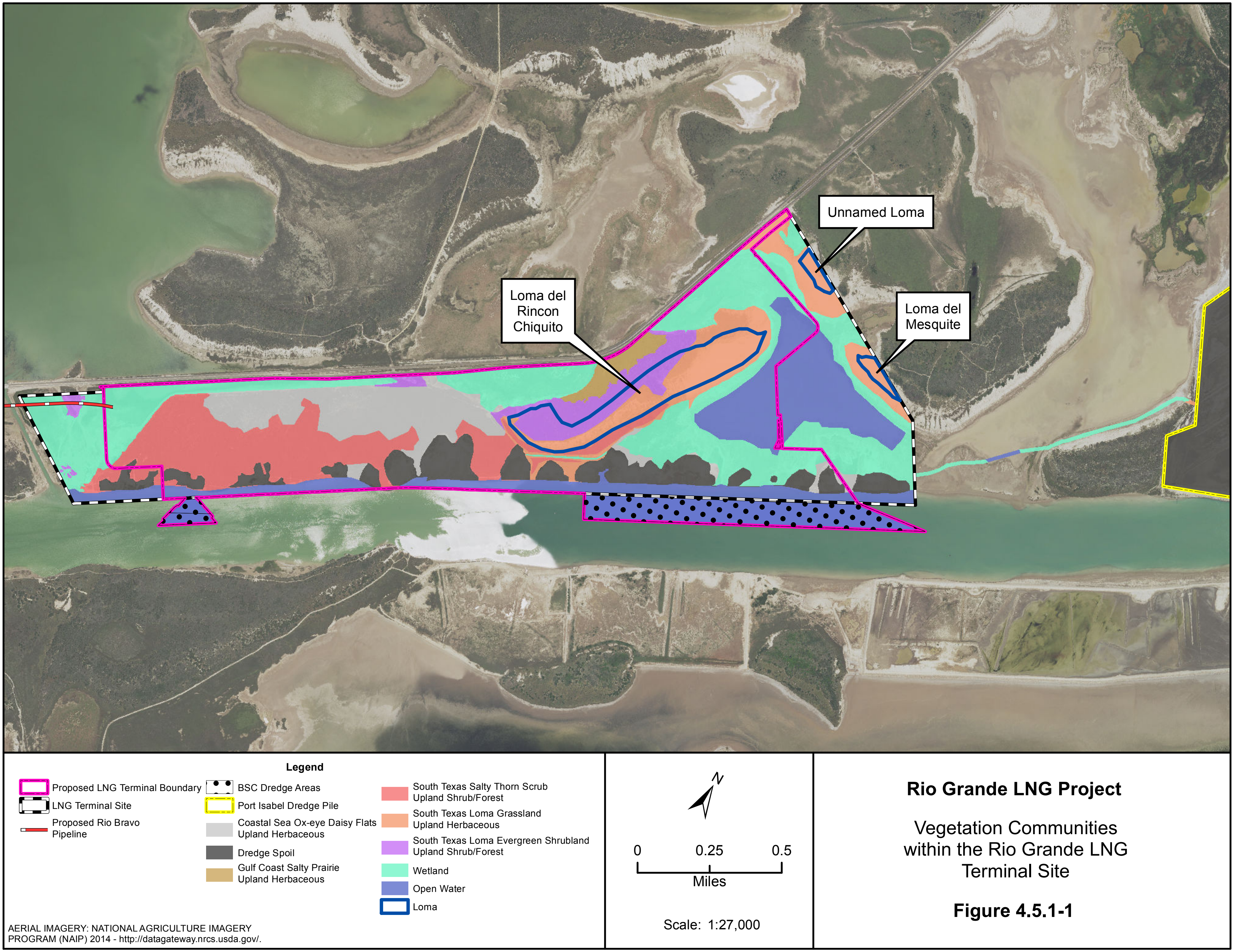
Table 4.5-1 Vegetation Communities Crossed by the Proposed Rio Grande LNG Project			
Vegetation Community	**Habitat Description and Typical Vegetation**	**Present at LNG Terminal Site**	**Present along Pipeline System**
Upland Herbaceous (Open) Land			
South Texas Loma Grassland	Grassland occurs in slightly saline and non-saline soils at low elevations around the base of lomas. Dominant herbaceous species include gulf cordgrass (*Spartina spartinae*), shoregrass (*Monanthochloe littoralis*), and saltwort (*Batis maritima*). Evergreen shrubs such as mesquite (*Prosopis glandulosa*), Spanish dagger (*Yucca gloriosa*), pricklypear (*Opuntia* spp.), and huisachillo (*Acacia schaffneri*) comprise a smaller component of these communities.	x	x
South Texas Disturbance Grassland	Habitat includes a variety of heavily grazed grassland including managed exotic pastures. Dominant herbaceous species include buffelgrass (*Cenchrus ciliaris*), King Ranch bluestem (*Bothriochloa ischaemum*), Kleberg bluestem (*Dichanthium annulatum*), pappusgrasses (*Pappophorum spp*.), and guineagrass (*Megathyrsus maximus*). Small shrubs and trees such as mesquite, huisache (*Acacia farnesiana*), lotebush (*Zizyphus obtusifolia*), and granjeno (*Celtis pallida*) are also common components of these communities.	x	x
South Texas Sandy Mesquite Savanna Grassland	Grassland with scattered mesquite. Dominant herbaceous species include King Ranch bluestem, buffelgrass, Kleberg bluestem, Bermuda grass (*Cynodon dactylon*), and little bluestem (*Schizachyrium scoparium*). Additional common shrubs include pricklypear, huisache, colima (*Zanthoxylum fagara*), and granjeno.	--	x
Gulf Coast Salty Prairie	Community is dominated by gulf cordgrass, which forms mosaics with marsh hay cordgrass (*Spartina patens*) and saltgrass. Other common species include shoregrass, switchgrass (*Panicum virgatum*), baccharis (*Baccharis halimifolia*), and mesquite.	x	x
Coastal Sea Ox-eye Daisy Flats	Community consists of sparse, low shrubland dominated by salt-tolerant species such as sea ox-eye daisy (*Borrichia frutescens*), saltwort, saltgrass (*Distichlis spicata*), glasswort (*Salicornia* spp.), and cordgrasses (*Spartina* spp.). Some areas of higher elevation, especially lomas, are mapped as this type and may have scattered mesquite and tornillo (*Prosopis pubescens*).	x	x
Upland Shrub / Forest Land			
South Texas Loma Evergreen Shrubland	Low, dense shrubland occurs on slightly saline and non-saline soils atop lomas and support a dense shrub and tree community. The vegetation community is dominated by species such as mesquite, pricklypear, Spanish dagger, Texas ebony (*Ebenopsis ebano*), and huisachillo, as well as grasses such as gulf cordgrass.	x	x
South Texas Salty Thorn Scrub	Occurs over salty soils and is dominated by a mesquite overstory with whitebrush (*Aloysia gratissima*), blackbrush (*Coleogyne ramosissima*), granjeno (*Celtis pallida*), lotebush (*Zizyphus obtusifolia*), brasil (*Condalia hookeri*), and pricklypear. Common herbaceous understory includes buffelgrass (*Cenchrus ciliaris*), Kleberg bluestem (*Dichanthium annulatum*), and whorled dropseed (*Sporobolus pyramidatus*).	x	--
South Texas Sandy Mesquite Woodland and Shrubland	Community is characterized by mesquite woodlands with pricklypear, granjeno, huisache, and lotebush also commonly occurring.	--	x
South Texas Sandy Mesquite Dense Shrubland	Community consists of dense mesquite shrubland with a diverse assemblage of shrubs and trees such as granjeno, Texas persimmon (*Diospyros texana*), sugar hackberry (*Celtis laevigata*), Texas ebony (*Ebenopsis ebano*), and huisache.	--	x

Table 4.5-1 (continued) **Vegetation Communities Crossed by the Proposed Rio Grande LNG Project**			
Vegetation Community	**Habitat Description and Typical Vegetation**	**Present at LNG Terminal Site**	**Present along Pipeline System**
Coastal and Sandsheet Deep Sand Live Oak Forest and Woodland	Community is comprised of dense, low stands of live oak (*Quercus virginiana*). The interior of these habitats is generally low in species diversity; however, American beautyberry (*Callicarpa americana*), granjeno, red bay (*Persea borbonia*), yaupon (*Ilex vomitoria*), and wax myrtle (*Myrica cerifera*) may be present in the understory or around edges.	--	x
South Texas Sandy Mesquite / Evergreen Woodland	Community is dominated by mesquite and huisache with granjeno, colima, and lotebush common in southern occurrences of this habitat.	--	x
Emergent Wetlands	Wetland habitats dominated by herbaceous species, including EEM and PEM wetlands. Species identified during field surveys are listed in section 4.4.	x	x
Shrub-Forested Wetlands	Wetland habitats dominated by woody vegetation, including ESS (including mangroves), PSS, and PFO wetlands. Species identified during field surveys are listed in section 4.4.	x	x
Agricultural Land	Habitat includes all cropland where fields are fallow for some portion of the year; fields may rotate in and out of cultivation.	--	x
Source: Ludeke et al. 2010.			

The wetlands across the LNG Terminal site are estuarine emergent and scrub-shrub (mangrove) wetlands. Estuarine wetlands provide important ecological functions including water purification, shoreline stabilization, and flood protection. They also support essential habitat for various life stages of many fish and wildlife species. No palustrine (freshwater) wetlands occur within the LNG Terminal site. Typical species of these wetland communities are described in section 4.4.1.

Two NWRs, including the Laguna Atascosa NWR and the Lower Rio Grande Valley NWR, are within 0.25 mile of the LNG Terminal site. The Laguna Atascosa NWR is an 89,845-acre coastal marsh refuge that provides habitat for wintering waterfowl and other migratory birds (FWS 2013a, 2015a). The Lower Rio Grande Valley NWR is a 97,908-acre coastal marsh refuge that was established to protect local biodiversity (FWS 2010b, 2015b). The Laguna Atascosa NWR would not be directly affected by construction; however, three proposed ATWS currently extend into the Lower Rio Grande Valley NWR (see section 4.6.1).

Offsite facilities proposed for use during construction and/or operation of the Rio Grande LNG Terminal include a storage/parking area in Brownsville, a storage area in Port Isabel, a bulk water loading area, the Port Isabel dredge pile, and a temporary haul road between the LNG Terminal site and the Port Isabel dredge pile. Although the Port Isabel storage area and dredge pile are largely disturbed and unvegetated, the Brownsville storage area and bulk water loading area include upland herbaceous vegetation and the temporary haul road is mainly composed of wetland habitat.



AERIAL IMAGERY: NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP) 2014 - http://datagateway.nrcs.usda.gov/.

Rio Grande LNG Project

Vegetation Communities within the Rio Grande LNG Terminal Site

Figure 4.5.1-1

Table 4.5.1-1
Vegetation Types Affected by Construction and Operation of the Rio Grande LNG Project (in acres)

Facilities	Upland Herbaceous		Upland Shrub / Forest		Emergent Wetlands		Shrub / Forested Wetlands		Agricultural Land		Total	
	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op
LNG TERMINAL												
LNG Terminal[a]	191.5	191.5	189.1	189.1	162.5	162.5	19.8	19.8	0.0	0.0	**562.9**	**562.9**
MOF and berthing / turning basin dredge area	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**
Temporary haul road[b]	0.3	0.0	0.0	0.0	9.4	0.0	0.0	0.0	0.0	0.0	**9.7**	**0.0**
Port of Brownsville temporary storage area	18.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**18.9**	**0.0**
Port Isabel temporary storage area	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**
Port Isabel dredge pile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**
Bulk water loading area	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**
LNG Terminal Total	***210.7***	***191.5***	***189.1***	***189.1***	***171.9***	***162.5***	***19.8***	***19.8***	***0.0***	***0.0***	***591.5***	***562.9***
PIPELINE FACILITIES												
Pipeline System and ATWS												
Header System and Pipeline 1												
Header System ROW	8.8	4.9	21.9	11.9	0.0	0.0	0.0	0.0	0.0	0.0	**30.7**	**16.8**
Header System ATWS	0.8	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**2.0**	**0.0**
Pipeline 1 ROW	822.2	495.4	444.2	273.2	116.4	94.2	12.7	10.6	514.5	321.2	**1910.0**	**1194.6**
Pipeline 1 ATWS	9.4	0.0	13.7	0.0	5.5	0.0	0.1	0.0	19.4	0.0	**48.1**	**0.0**
Subtotal	***841.3***	***500.3***	***480.8***	***285.1***	***121.9***	***94.2***	***12.8***	***10.6***	***533.9***	***321.2***	***1990.7***	***1211.4***

Table 4.5.1-1 (continued)
Vegetation Types Affected by Construction and Operation of the Rio Grande LNG Project (in acres)

Facilities	Upland Herbaceous		Upland Shrub / Forest		Emergent Wetlands		Shrub / Forested Wetlands		Agricultural Land		Total	
	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op
Pipeline 2												
Pipeline 2 ROW	1,266.5	768.6	0.0	0.0	129.1	104.8	0.0	0.0	514.5	321.2	**1,910.1**	**1,194.6**
Pipeline 2 ATWS	23.2	0.0	0.0	0.0	5.6	0.0	0.0	0.0	19.4	0.0	**48.2**	**0.0**
Subtotal	***1,289.7***	***768.6***	***0.0***	***0.0***	***134.6***	***104.8***	***0.0***	***0.0***	***533.9***	***321.2***	***1,958.2***	***1,194.6***
Access Roads												
Header System Access Roads	0.7	0.6	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	**0.9**	**0.8**
Pipelines 1 and 2 Access Roads	73.7	4.8	1.8	0.6	8.3	0.0	<0.1	0.0	0.5	0.0	**84.3**	**5.4**
Subtotal	***74.4***	***5.4***	***2.0***	***0.8***	***8.3***	***0.0***	***<0.1***	***0.0***	***0.5***	***0.0***	***85.2***	***6.2***
Contractor / Pipe Yards												
Contractor / Pipe Yard 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	135.6	0.0	**135.6**	**0.0**
Contractor / Pipe Yard 2	16.4	0.0	9.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**25.5**	**0.0**
Contractor / Pipe Yard 3	136.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**136.1**	**0.0**
Subtotal	***152.5***	***0.0***	***9.1***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***135.6***	***0.0***	***297.2***	***0.0***
Aboveground Facilities												
Header System												
Metering Site HS-1	0.2	0.2	1.9	1.9	0.0	0.0	0.0	0.0	0.0	0.0	**2.1**	**2.1**
Metering Site HS-2	0.2	0.2	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	**1.4**	**1.4**
Metering Site HS-3	0.9	0.9	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	**2.0**	**2.0**
Metering Site HS-4	<0.1	<0.1	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	**1.3**	**1.3**
Subtotal	***1.3***	***1.3***	***5.6***	***5.6***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***6.9***	***6.9***
Pipelines 1 and 2[c]												
Compressor Station 1	0.0	0.0	37.2	37.2	0.0	0.0	0.0	0.0	0.0	0.0	**37.2**	**37.2**

Table 4.5.1-1 (continued)
Vegetation Types Affected by Construction and Operation of the Rio Grande LNG Project (in acres)

Facilities	Upland Herbaceous		Upland Shrub / Forest		Emergent Wetlands		Shrub / Forested Wetlands		Agricultural Land		Total	
	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op
Compressor Station 2	28.6	28.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**28.6**	**28.6**
Interconnect Booster Station 1	2.5	2.5	7.1	7.1	0.0	0.0	0.0	0.0	0.0	0.0	**9.7**	**9.7**
Interconnect Booster Station 2	9.7	9.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**9.7**	**9.7**
MLVs	0.1	0.1	0.3	0.3	0.0	0.0	0.0	0.0	0.4	0.4	**0.8**	**0.8**
Subtotal	***41.0***	***41.0***	***44.6***	***44.6***	***0.0***	***0.0***	***0.0***	***0.0***	***0.4***	***0.4***	**86.0**	**86.0**
Aboveground Facilities Subtotal	***42.3***	***42.3***	***50.2***	***50.2***	***0.0***	***0.0***	***0.0***	***0.0***	***0.4***	***0.4***	**92.9**	**92.9**
Header System and Pipeline 1 Total[d]	**1,110.4**	**548.0**	**542.3**	**336.1**	**130.1**	**94.2**	**12.8**	**10.6**	**670.4**	**321.6**	**2,466.0**	**1,310.5**
Pipeline 2 Total[e]	**1,612.2**	**859.5**	**0.0**	**0.0**	**142.9**	**104.8**	**0.0**	**0.0**	**670.4**	**321.6**	**2,425.5**	**1,285.9**
Pipelines 1 and 2[f]	**1,098.8**	**541.1**	**513.4**	**318.4**	**130.1**	**94.2**	**12.8**	**10.6**	**670.4**	**321.6**	**2,425.5**	**1,285.9**
Pipeline System Total[g]	**1,110.4**	**548.0**	**542.3**	**336.1**	**130.1**	**94.2**	**12.8**	**10.6**	**670.4**	**321.6**	**2,466.0**	**1,310.5**
Rio Grande LNG Project Total[g]	**1,321.2**	**739.5**	**731.3**	**525.1**	**302.0**	**256.7**	**32.6**	**30.4**	**670.4**	**321.6**	**3,057.5**	**1,873.3**

[a] Acreages for the LNG Terminal include those acreages associated with Compressor Station 3 and the marine facilities.

[b] Placement of this access road is a deviation to the FERC Procedures and, as such, is discussed in sections 3.3.2 and 4.4.2.1.

[c] These facilities would be disturbed during the construction of Pipeline 1. Although use and modification of these facilities would occur during the construction of Pipeline 2, no additional operational footprint would be required.

[d] All impacts associated with construction of the Header System and Pipeline 1, including right-of-way, ATWS, contractor/pipe yards, and aboveground facilities.

[e] All impacts associated with construction of Pipeline 2, including right-of-way, ATWS, contractor/pipe yards, and aboveground facilities, which were previously disturbed during construction of Pipeline 1. Shrub/forest land restored following construction of Pipeline 1 would revegetate to open land and emergent wetland conditions prior to construction of Pipeline 2, rather than the pre-construction vegetation cover. Therefore, construction of Pipeline 2 would have a greater impact on open land and emergent wetlands than Pipeline 1.

[f] This total includes the footprint of Pipelines 1 and 2, rather than the sum of its individual components. Since Pipeline 2 would be constructed in the same footprint as Pipeline 1, the entire construction footprint for Pipeline 2 overlaps with the affected acreage proposed for Pipeline 1.

[g] This total includes the footprint of the entire Pipeline System, rather than the sum of its individual components. Since Pipeline 2 would be constructed in the same footprint as Pipeline 1, the entire construction footprint for Pipeline 2 overlaps with the affected acreage proposed for Pipeline 1

4.5.1.2 Pipeline Facilities

The Pipeline System, including the 2.4-mile-long Header System and 135.5 miles of dual, 42-inch-diameter pipelines, would cross through a variety of vegetation communities, as listed in table 4.5.1-1. The northern portion of the pipeline route through Jim Wells, Kleberg, and Kenedy Counties is characterized by large tracts of land used for ranch and cattle operations; King Ranch, an 825,000-acre ranch, makes up the majority of the land crossed. As the pipeline route moves south into Willacy and Cameron Counties, the land is predominately grassland and cropland. Based on RB Pipeline's field investigations, the primary crops currently in production in the Project area include cotton, sorghum, and corn. The southernmost portion of the pipeline route crosses extensive mosaics of wetland habitat as it approaches the LNG Terminal site. Although land classified as forested would be crossed by the Pipeline System, these areas are generally small pockets of trees, areas of where trees are not densely present, and/or areas where the pipeline is collocated with U.S. Highway 77.

As discussed in section 2.2.2.1, portions of the pipeline right-of-way would be collocated with existing pipelines, power lines, roads, railroads, and canals to minimize fragmentation of vegetation communities. Vegetation impacted during construction of the pipeline facilities would include upland herbaceous land (45.0 percent), agricultural land (27.2 percent), upland shrub/forest land (22.0 percent), emergent wetlands (5.3 percent), and shrub/forested wetlands (0.5 percent). Additional impacts on non-vegetated land (i.e., barren, industrial/commercial land, and open water) are discussed in section 4.8.

4.5.2 Vegetation Impacts and Mitigation

As summarized in table 4.5.1-1, a total of 3,057.5 acres of vegetation would be within the construction footprint of the LNG Terminal site and pipeline facilities. Following construction, approximately 1,184.2 acres would be restored to pre-construction conditions. A total of 1,873.3 acres would be within the operational footprint of the Project, of which 662.0 acres would be permanently converted to developed land and 1,211.4 acres would generally be maintained as herbaceous or scrub-shrub land.

Construction impacts on vegetation resources are classified based on the duration and significance of impacts. Temporary impacts generally occur during construction, with vegetation returning to pre-construction conditions almost immediately after construction, whereas short-term impacts are those which require up to 3 years to return to pre-construction conditions once construction has been completed. Long-term impacts require more than 3 years to revegetate, but conditions would return to pre-construction state during the life of the Project. Permanent impacts are those that modify vegetation resources to the extent that they would not return to pre-construction conditions during the life of the Project.

4.5.2.1 LNG Terminal

A total of 750.4 acres of land would be cleared during construction at the LNG Terminal site, including 562.9 acres of vegetated land that would be permanently converted to industrial use associated with operation of the facility, although the levee and small areas within the LNG Terminal fenceline would be revegetated with ornamental grasses and shrubs. This permanent conversion would result in the loss of 191.5 acres of upland herbaceous land, 189.1 acres of upland shrub/forest land, 162.5 acres of emergent wetlands, and 19.8 acres of shrub/forested wetlands.

About 233.8 acres of land, including 103.5 acres of wetland habitat, occurs outside the boundary of the proposed facilities but within the larger parcel leased by RG LNG. Of the 233.8 acres, about 10.5 acres of wetlands would be dredged for a planned expansion of the Bahia Grande Channel that is not related to the Rio Grande LNG Project (see section 4.3.2.2). Of the remaining 223.3 acres, about 46.5 acres would be vegetated (36.5 acres of upland herbaceous and 10.0 acres of upland shrub/forest land) and the remainder would be open water or barren land (see section 4.8). These land types would not be directly affected by Project construction.

In addition to the facilities proposed for the LNG Terminal site, RG LNG would also construct a temporary haul road to the Port Isabel dredge pile to obtain fill materials, and would use two offsite storage/parking areas to support construction activities. The temporary haul road would be about 1.8 miles long and would temporarily impact about 9.7 acres of vegetated habitat composed predominately of emergent wetlands (but see our discussions in sections 3.3.2 and 4.4.2.1).

The 20.8-acre storage area proposed in Brownsville is predominately upland herbaceous land (18.9 acres), with small amounts of unvegetated land. The bulk water storage area would impact less than 0.1 acre of upland herbaceous land. No vegetated habitat is present within the Port Isabel storage area or dredge pile. Following construction, each of the approved offsite facilities would be restored to pre-construction conditions, unless requested otherwise by the landowner and in accordance with federal and state regulations.

Construction of the marine facilities for the LNG Terminal would require dredging and/or excavation of areas within and immediately adjacent to the BSC. Vegetated land excavated for the marine facilities is included in the impacts discussion above. No additional upland, wetland, or aquatic vegetation would be impacted by dredging at the LNG Terminal site or at the existing dredged material placement areas that are being considered for use. Impacts from dredging are further discussed in sections 2.2.1 and 4.3.

Vegetation adjacent to the LNG Terminal site could be impacted by sedimentation from construction activities or could become contaminated due to spills and leaks of hazardous materials during construction and operation. RG LNG would minimize construction-related impacts on the adjacent vegetated land by implementing its Plan and Procedures. Construction of the levee during Stage 1 of construction would further protect adjacent habitats from sedimentation and potential contamination. As discussed in section 4.3.2.2, RG LNG would implement its SPCC Plan during construction, which would include spill prevention measures, mitigation measures, and cleanup methods to reduce potential impacts should a spill occur. The SPCC Plan would also address storage and transportation of hazardous materials.

RG LNG would implement its Plan, Procedures, and SPCC Plan so that impacts on vegetation adjacent to the LNG Terminal site boundaries would be avoided or adequately minimized. Impacts on vegetation within the footprint of the Rio Grande LNG Terminal site would be permanent, resulting in a locally significant impact on vegetation cover at that location. However, given the extent of habitat adjacent to the proposed location, including protected land to the north and south of the LNG Terminal site, we have determined that impacts on upland vegetation, though permanent, would be minor.

As discussed in section 4.4, the conversion of 191.7 acres of wetlands (19.8 acres of shrub/forested wetlands and 162.5 acres of emergent wetlands) within the footprint of the LNG Terminal would be considered a moderate impact; however, if the COE issues a Section 404 permit for the Project, it would be conditional upon effective wetland mitigation, such that impacts on wetlands would be reduced to less than significant levels.

4.5.2.2 Pipeline Facilities

Pipeline System and Additional Temporary Workspace

Header System and Pipeline 1

RB Pipeline would construct the Header System within a 100- to 125-foot-wide construction right-of-way and Pipeline 1 within a 125-foot-wide construction right-of-way. Construction of these pipelines, including ATWS, would affect 1,990.7 acres of vegetation, including 841.3 acres of upland herbaceous land, 533.9 acres of agricultural land, 480.8 acres of upland shrub/forest land, 121.9 acres of emergent wetlands, and 12.8 acres of shrub/forested wetlands. Following construction, 500.3 acres of upland herbaceous land, 321.2 acres of agricultural land, 285.1 acres of upland shrub/forest land, 94.2 acres of emergent wetlands, and 10.6 acres of shrub/forested wetlands within the permanent easement would be restored to pre-construction conditions, but would be subject to routine maintenance. Forested land within maintained portions of the permanent right-of-way would be permanently converted to herbaceous or early successional-stage scrub-shrub land. Specific mitigation for impacts on wetlands is discussed in section 4.4.

Pipeline 2

Pipeline 2 would be installed within the same 125-foot-wide construction right-of-way affected by Pipeline 1. As such, all land disturbed by the construction of Pipeline 2 would have been previously disturbed during the construction of Pipeline 1. Similarly, land associated with ATWS, access roads, contractor/pipe yards, and aboveground facilities would have been previously disturbed. Following construction, land affected by Pipeline 2 would be restored to pre-construction conditions.

General Impacts of the Pipeline System

The primary impacts on vegetation from construction of the pipelines would be the cutting, clearing, and/or removal of existing vegetation within the construction workspace to facilitate pipeline installation and allow for safe operation of equipment. The duration and magnitude of impacts would depend on the type and amount of vegetation affected, the rate at which vegetation regenerates after construction, and the frequency of vegetation maintenance conducted on the permanent easement during pipeline operation. In addition, revegetation would depend on factors such as the local climate, soil types, and land use.

Impacts on agricultural land would be temporary to short-term, as these areas are disturbed annually to produce crops and would typically return to their previous condition shortly following construction, cleanup, and restoration. RB Pipeline would maintain topsoil segregation throughout all construction activities in agricultural land in order to mitigate impacts on subsequent crop production and maintain a minimum cover depth of 36 inches. Upland herbaceous land and emergent wetlands would typically revegetate within 1 to 3 years, depending on a number of factors.

Cleared shrub/forest lands (upland or wetland) would likely require 3 to 5 years to regain their woody composition. Where trees are present but not in the permanently maintained right-of-way, impacts would be long term, as reestablishment of trees may require 10 to 30 years or more, depending on the species. Trees would not be allowed to reestablish within the permanent right-of-way, representing a permanent impact.

Clearing would not be conducted over the path of an HDD, with the exception of a 2-foot-wide path that would be hand-cleared for the HDD guide wire. RB Pipeline proposes to use crossed streams as the source of water for HDD operations at some locations (see section 2.5.2-1). Withdrawal of water to support HDD construction would be conducted using mobile equipment in accordance with applicable waterbody withdrawal permits. Clearing at these locations would be restricted to the hand-clearing of small-diameter shrub and herbaceous vegetation.

Impacts associated with disturbances to vegetation could include increased soil compaction and erosion, increased potential for the introduction and establishment of non-native and invasive species (see section 4.5.3), and a local reduction in available wildlife habitat (see section 4.6.1). To minimize impacts on vegetation, RB Pipeline has collocated 66.4 percent of Pipeline 1 with existing disturbance. In addition, RB Pipeline would implement its Plan and Procedures, which require the use of temporary and permanent erosion control measures, topsoil segregation in select areas, and testing and mitigation for soil compaction. Following the construction of each pipeline, RB Pipeline would seed all of the previously vegetated areas disturbed by construction in accordance with its Plan and Procedures, which requires disturbed areas to be reseeded with seed mixes developed in consultation with the local soil conservation agency and/or the landowner. RB Pipeline is consulting with the local offices of the NRCS to determine the most appropriate seed mixes for use in south Texas, but has currently proposed the use of predominantly native grasses, interspersed with two introduced species (*Sorghum almum* and Wilman lovegrass [*Eragrostis superba*]), which are fast-growing species that can act as erosion control. As discussed in section 4.6.1.4, native grasses can also provide habitat for pollinator species.

Disturbed areas would be routinely monitored until restoration and revegetation were successful in accordance with the Project-specific Plan and Procedures. During operation, RB Pipeline would mow up to a 75-foot-wide permanent right-of-way no more than once every 3 years; however, a 10-foot-wide corridor centered on each pipeline may be mowed more frequently to facilitate routine patrols and emergency access. Within wetlands, RB Pipeline would permanently maintain only a 10-foot-wide corridor and selectively remove trees within 15 feet of the pipeline. These maintenance activities would permanently convert shrub/forested wetlands to an emergent or scrub-shrub state.

Aboveground Facilities

The Pipeline System would require three compressor stations, eight metering sites, and additional appurtenant facilities; impacts from Compressor Station 3 are discussed above, as it would be within the boundaries of the LNG Terminal site. Construction of the aboveground facilities would affect a total of 92.9 acres of vegetation, including 50.2 acres of upland shrub/forest land, 42.3 acres of upland herbaceous land, and 0.4 acre of agricultural land. MLVs would impact a total of 0.8 acre, including 0.3 acre of upland shrub/forest land; however, these facilities would be located within the permanent right-of-way for the Pipeline System. Following construction, land within construction workspaces but outside of the aboveground facility footprints would be allowed to revert to pre-construction conditions in accordance with the RG Developers' Plan and Procedures, NRCS seeding recommendations, other agency requirements and permit conditions, and landowner requests. Specific mitigation for impacts on wetlands is discussed in section 4.4. Each aboveground facility would be fenced to ensure safety and security of the site. As discussed in section 4.8, the fenced area of the compressor and interconnect booster station sites would be maintained while the area outside of the fence lines would not.

The compressor stations, booster stations, metering sites, and appurtenant facilities constructed for Pipeline 1 would also be used for Pipeline 2. Although some modifications to these facilities would be required to accommodate a second pipeline, all work would be conducted within areas disturbed during the original construction of those facilities and no additional vegetation would be disturbed.

<u>Contractor/Pipe Yards</u>

RB Pipeline has proposed to use three contractor/pipe yards during construction the Pipeline System (see appendix B), resulting in impacts on 152.5 acres of upland herbaceous land, 135.6 acres of agricultural land, and 9.1 acres of upland shrub/forest land. The contractor/pipe yards would be used for construction of the entire Pipeline System and would be restored after Pipeline 2 construction were completed, unless otherwise requested by the landowner. Therefore, use of the yards would be a temporary, minor impact on vegetation.

<u>Access Roads</u>

RB Pipeline has proposed the use of 64 access roads, most of which are existing roads that would not require improvements; however, 2 existing roads would be expanded, and 5 access roads would be newly constructed. Use of these access roads would result in impacts on 74.4 acres of upland herbaceous land, 8.3 acres of emergent wetlands, 2.0 acres of upland shrub/forest land, 0.5 acre of agricultural land, and less than 0.1 acre of shrub/forested wetlands. Construction impacts on vegetation would be comparable to those described for the proposed pipelines, including the potential for soil compaction and erosion, and establishment of invasive species. During construction of Pipeline 2, RB Pipeline would use only those access roads that were previously disturbed or developed during the construction of Pipeline 1; therefore, there would be no new ground disturbance associated with access roads for Pipeline 2. Of the 64 access roads proposed for use during construction, 12 would be retained for use during operation. These permanent roads would result in the conversion of 5.4 acres of upland herbaceous land, 0.8 acres of upland shrub/forest land.

With the implementation of the mitigation measures described above, we conclude that construction and operation of the Pipeline System and aboveground facilities would have a permanent, but minor impact on vegetation communities.

4.5.3 Exotic or Invasive Plant Communities and Noxious Weeds

Exotic plant communities, invasive species, and noxious weeds can out-compete and displace native plant species, thereby negatively altering the appearance, composition, and habitat value of affected areas. In accordance with the Plant Protection Act of 2000 (7 USC 7701), 19 plants have been federally designated as noxious weeds that could occur in Texas (NRCS 2016). A total of 26 noxious or invasive weeds are state listed in Texas as having serious potential to cause economic or ecological harm to the state (4 TAC Part 19.300[a]).

RG Developers conducted surveys of the LNG Terminal site and accessible portions of the Pipeline System between July and November 2015, and additional accessible areas in the summer of 2016, with the intent of identifying individuals or infestations of species listed at 4 TAC Part 19.300(a). No state listed noxious or invasive weeds were identified during surveys of the LNG Terminal site and, as areas within the LNG Terminal fence line would be permanently converted to industrial use with minimal vegetated areas, noxious or invasive plants would be unlikely to establish. Upon obtaining land access, RB Pipeline will conduct additional surveys to account for rerouted portions of the proposed pipelines. Similarly, no noxious or invasive species were identified within the surveyed workspaces for the pipeline facilities or offsite facilities for the LNG Terminal. RB Pipeline will complete surveys as access is obtained. Given that RB Pipeline does not propose to begin construction of the pipelines until Year 4, the presence of noxious weeds would be re-assessed during pre-construction clearance surveys to ensure that noxious weeds had not become established.

RB Pipeline's removal of existing vegetation and disturbance of soils during construction of the pipeline facilities could create conditions conducive to the establishment of invasive weeds, particularly where new corridors are established. To minimize the potential spread of invasive species, RB Pipeline has developed a Noxious and Invasive Plant Management Plan[25] to minimize the potential for noxious and invasive weeds to become established within construction workspaces. RB Pipeline's Noxious and Invasive Plant Management Plan includes the following measures:

---

[25] RB Pipeline's Noxious and Invasive Plant Management Plan is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20160505-5179.

- all vehicles, equipment, and materials would be inspected and cleaned of soil and vegetation before entering construction workspaces;
- all vehicles or equipment working in areas of identified infestations, if applicable, would be cleaned following completion of work in the infested area;
- all imported fill material and straw bales used for erosion control would be certified weed free;
- removal of identified weeds would be by herbicide, mechanical, or manual means, as appropriate depending on the location of the infestation (e.g., in wetlands); and
- restoration of disturbed areas would be in accordance with written recommendations for seed mixes, rates, and dates obtained from landowners and appropriate agencies.

RB Pipeline would further minimize the potential spread of noxious and invasive weeds through implementation of its Plan, which requires that post-construction surveys be conducted until revegetation is deemed successful. Revegetation in non-agricultural areas would be deemed successful when visual surveys indicate that the density and cover of non-nuisance vegetation are similar to that in adjacent, undisturbed land. Based on lack of noxious and invasive weed infestations identified during field surveys of accessible properties, implementation of RB Pipeline's Noxious and Invasive Plant Management Plan and Project-specific Plan, and RB Pipeline's commitment to complete surveys of inaccessible parcels prior to construction, we conclude that the potential spread of noxious or invasive weeds would be effectively minimized or mitigated.

4.5.4 Vegetation Communities of Special Concern

Vegetation communities of special concern may include ecologically important natural communities or other rare or imperiled plants sensitive to disturbance or in need of special protection. Federally or state listed plants with the potential to occur in the vicinity of the Project are discussed in section 4.7. Two vegetation communities of special concern have been identified within 1 mile of the Project, including Texas ebony-snake-eyes shrubland series and seacoast bluestem-gulfdune *Paspalum* series. Four additional vegetation communities were identified by the FWS as being of concern, including areas of oak wilt, lomas, thorn-scrub habitat, and Pine Tree Conservation land; no active oak wilt has been identified in Project counties (Texas A&M University 2017).

Texas ebony-snake-eyes shrubland series is an imperiled community that is vulnerable to extirpation in Texas, due mainly to the conversion of land to agricultural and developed uses. The series consists of evergreen shrubland dominated by tall thorny shrubs over clayey soils. Individual species include Texas ebony (*Ebanopsis ebano*), snake-eyes (*Phaulothamnus spinescens*), mesquite (*Prosopis glandulosa*), granjeno (*Celtis pallida*), coyotillo (*Karwinskia humboldtiana*), and other thorny shrub species (NatureServe 2016). Two identified locations for this series occur within 1 mile of the proposed LNG Terminal site; however, they are within the Lower Rio Grande Valley NWR, south of the BSC, and would not be affected by proposed Project (TXNDD 2017).

The seacoast bluestem-gulfdune *Paspalum* series is considered vulnerable and includes seacoast bluestem (*Andropogon littoralis*), gulfdune paspalum (*Paspalum monostachyum*), as well as tanglehead (*Heteropogon contortus*) and brownseed paspalum (*Paspalum plicatulum*). This community has been recorded within 1 mile east of the proposed Pipeline System from MP 26.2 to 29.0 (TXNDD 2017).

During Project planning, the FWS also indicated concern for the lomas within the boundaries of the proposed LNG Terminal site. Although lomas are not protected habitats, the FWS is concerned based on this community's habitat value to the federally endangered ocelot and northern aplomado falcon. Three lomas have been identified within the LNG Terminal site (see figure 4.5.1-1). Two (an unnamed loma and Loma del Mesquite) are located outside of the proposed footprint of the LNG Terminal; they would not be impacted by construction or operation of the Project. The third, a 63.9-acre loma (Loma del Rincon Chiquito) composed mainly of south Texas loma grassland and loma evergreen shrubland, would be converted to industrial land during construction. Two additional named lomas would be affected by the proposed Project outside of the LNG Terminal boundaries, including Loma de la Draga, which would be adjacent to proposed temporary haul road, and Loma de las Yeguas, which would be crossed by the Pipeline System near MP 132.5. As ocelots and Northern aplomado falcons are federally listed species, they are discussed in section 4.7; however, use of the lomas at the LNG Terminal site by ocelots has not been specifically studied or documented. Northern aplomado falcons may nest and hunt from yuccas on lomas; however, regularly conducted area surveys have not indicated the presence of nesting falcons at the Rio Grande LNG site. As no special vegetation communities have been noted as occurring on these lomas, and, since all but one would be restored after construction, the loss of this habitat would be considered a permanent, but minor impact.

Similar to lomas, south Texas salty thornscrub is not a protected habitat, but is a vegetation community of concern to the FWS because of widespread conversion of the habitat and its importance as habitat to ocelots (see section 4.7.1). Construction and operation of the LNG Terminal would result in the conversion of 138.4 acres of south Texas salty thornscrub habitat to developed land. No land classified as South Texas salty thornscrub was identified within the footprint of the pipeline facilities. About 149,173 acres of south Texas salty thornscrub habitat has been identified along the Texas gulf coast, and more inland areas, conversion of 138.4 acres would represent a moderate and permanent impact on this vegetation community (Ludeke et al. 2010). As this habitat is particularly important to the federally listed ocelot, we have recommended in section 4.7.1.4 that RG LNG consult with the FWS to develop appropriate mitigation for habitat loss.

The Pine Tree Conservation Society owns two parcels of land that would be crossed by the pipeline between MPs 110.7 and 113.0. The land is largely undisturbed sandy mesquite woodland and shrubland (shrub/forest upland areas). At the request of both FWS and FERC, RB Pipeline reached out to the Society multiple times to determine if the parcels had any conservation goals or restoration requirements that should be adhered to; no response has yet been provided. Further, the Society has not provided comments regarding the proposed pipeline crossing its land. As no response or comments have been filed with the Commission, construction and restoration of this property would be conducted in compliance with the Project-specific Plan and Procedures.

Overall, the Project would result in temporary to permanent impacts on vegetation. The Impacts of the pipeline facilities would generally be temporary or short-term impacts, although vegetated habitat would be converted to industrial/commercial land within the footprint of the aboveground facilities, and would be maintained as herbaceous or early successional scrub-shrub habitat within the permanent right-of-way. Construction and operation of the LNG Terminal would result in permanent impacts on vegetation within the footprint of the facility, although impacts on wetland vegetation would be mitigated as required by the COE under Section 404 of the CWA.

4.6 WILDIFE AND AQUATIC RESOURCES

4.6.1 Terrestrial Wildlife Resources

Wildlife species occurring in the vicinity of the Project vary by the type of habitat present in a given area. Section 4.5.1 provides a detailed description of the vegetation communities present in the vicinity of the Project. Habitat types were identified based on aerial photography, NWI maps, region-specific TPWD habitat classifications, and field surveys. Aquatic resources and federally or state listed wildlife species are discussed in sections 4.6.2 and 4.7, respectively.

4.6.1.1 Existing Wildlife Habitats

The wildlife habitat types present in the vicinity of the Project include agricultural land, open (herbaceous) land, upland shrub/forest land, open water, and wetlands (shrub/forested and emergent). Each of these habitat types includes a unique plant species composition, which is described in detail in section 4.5.1. Although the proposed Project would affect additional land types, such as barren/dredge spoil, residential, and industrial/commercial land, these land types do not typically provide quality habitat for wildlife, and wildlife in the Project area would likely use these areas only transiently while moving between areas of suitable habitat; one exception is the use of barren land at the LNG Terminal site as foraging habitat for special status shorebirds, which is discussed in section 4.6.1.3. As such, barren/dredge spoil and industrial/commercial land are discussed in section 4.8 (Land Use). Typical wildlife occurring within each of the primary habitat types are described in detail below.

Agricultural land includes active and rotated cropland. Due to low diversity and frequent disturbance, agricultural land does not provide high quality habitat for cover or nesting, but does provide foraging opportunities for several species. Irrigation ditches, ponds, and shallow open water areas may provide habitat for shorebirds, wading birds, and waterfowl. Many wildlife species capable of inhabiting herbaceous land or shrub/forest uplands such as the opossum (*Didelphis virginiana)*, common raccoon (*Procyon lotor)*, and eastern gray squirrel (*Sciurus carolinensis)* also utilize agricultural land. Avian species commonly found in agricultural habitats include the American robin (*Turdus migratorius)*, cattle egret (*Bubulcus ibis)*, eastern meadowlark (*Sturnella magna)*, and mourning dove (*Zenaida macroura)*. Amphibians and reptiles likely to occur in agricultural land include species such as the Great Plains rat snake (*Elaphe guttata emoryi)* and Texas toad (*Anazyrus speciosus)*.

Herbaceous uplands (uplands dominated by grasses and forbs) along the northern portion of the proposed Pipeline System are often used for cattle grazing/ranching, which may be used by various wildlife species for foraging. Areas more dominated by low-lying shrubs or undisturbed cover types provide foraging and nesting habitat. Species inhabiting herbaceous uplands include the white-tailed deer (*Odocoileus virginiannus),* common raccoon, and eastern cottontail rabbit (*Sylvilagus floridanus)*. In addition, avian species found within upland herbaceous land include Northern aplomado falcon (*Falco femoralis septentrionalis*), American robin, cattle egret, red-tailed hawk (*Buteo jamaicensis),* and mourning dove. Amphibians and reptiles that likely occur in upland herbaceous uplands include the Texas brown snake (*Storeria dekayi texana)* and six-lined racerunner lizard (*Aspidoscelis sexlineata)*.

Shrub/forest habitat associated with the Project includes multiple community types ranging from low shrubland to areas of dense, low trees. Tree and shrub layers provide shelter and foraging habitat for various bird species and larger mammals. Organic material on forest floor provides habitat for invertebrates, reptiles, smaller mammals, and amphibians. Mammals typically associated with shrub/forest habitat in the vicinity of the Project include the white-tailed deer, feral hog (*Sus scrofa*), and common raccoon. Typical bird species include the red-shouldered hawk (*Buteo lineaus*), wood thrush (*Hylocichla mustelina*), and loggerhead shrike (*Lanius ludovicianus*). Amphibians and reptiles include the six-lined racerunner lizard, Texas brown snake, and Texas toad. Many common species in the area, such as white-tailed deer and feral hogs have recreational value for hunters; however, no commercially important wildlife species occur in the Project area.

Open water habitat in the Project area consists of larger waterbodies, such as the BSC and a shallow water lagoon at the proposed LNG Terminal site, as well as ponds, streams, and irrigation canals associated with the Pipeline System. Wildlife typically associated with open water and linear aquatic habitat includes wading birds, waterfowl, and other species dependent upon an aquatic environment.

Wetland habitat in the Project area, includes emergent and scrub-shrub estuarine wetlands and emergent, scrub-shrub, and forested palustrine (freshwater) wetlands, as well as sparsely vegetated mudflats (see section 4.4). Wetlands typically support a diverse ecosystem that provide nutrients, cover, shelter, and water for a variety of terrestrial and aquatic wildlife species including waterfowl, wading birds, raptors, mammals, reptiles, and amphibians. Typical wildlife associated with palustrine wetlands include white-tailed deer, common raccoon, feral hog, mottled duck (*Anas fulvigula),* blue heron (*Ardea herodias*), red-winged blackbird (*Agelaius phoeniceus*), Texas toad, six-lined racerunner lizard, and diamondback water snake (*Nerodia rhombifer rhombifer*).

4.6.1.2 Impacts and Mitigation

Construction and operation of the Project would result in various short- and long-term impacts on wildlife. Impacts would vary based on specific habitat requirements of a species and the level and duration of Project impacts on each habitat type. A total of about 3,241.3 acres of wildlife habitat would be within the footprint of the LNG Terminal and pipeline facilities (including the 68.7-acre area of open water within the BSC that would be dredged for the marine facilities). Following construction, approximately 1,186.8 acres would be restored to pre-construction conditions. A total of 2,054.5 acres would be within the operational footprint of the Project, of which 737.8 acres would be permanently converted to developed land (including 75.8 acres of open water at the LNG Terminal site; the remaining areas of open water affected by LNG Terminal construction would remain open water habitat during operations). A total of 1,211.4 acres would be maintained as herbaceous or scrub-shrub land within the pipeline rights-of-way.

LNG Terminal

General Impacts

Construction of the LNG Terminal site, including Compressor Station 3, would affect 669.0 acres of wildlife habitat consisting of 191.5 acres of upland herbaceous land, 189.1 acres of upland shrub/forest land, 162.5 acres of emergent wetland habitat, 106.1 acres of open water, and 19.8 acres of scrub-shrub (mangrove) wetlands (see table 4.5.1-1 and section 4.3.2). In addition, about 68.7 acres of open water would be dredged outside the boundaries of the LNG Terminal site. Following construction, all disturbed habitat would be permanently converted to industrial land. Wetland impacts would be permitted through the COE and would be mitigated through implementation of RG Developers' Wetland Mitigation Plan, once approved.

About 233.8 acres of land, including 103.5 acres of wetlands, is present outside the boundary of the proposed LNG Terminal site, but within the larger parcel leased by RG LNG. Of that area, about 10.5 acres would be dredged for a planned expansion of the Bahia Grande Channel that is not related to the Rio Grande LNG Project (see section 4.3.2.2). The remaining areas would not be directly affected by Project construction, but would be retained as natural buffer.

Offsite facilities proposed for use during construction and/or operation of the Rio Grande LNG Terminal include a storage/parking area in Brownsville, a storage area in Port Isabel, the Port Isabel dredge pile, and a 1.8-mile-long temporary haul road between the LNG Terminal site and the Port Isabel dredge pile. Although the Port Isabel storage area and dredge pile are largely disturbed and unvegetated, the Brownsville storage area is composed mainly of herbaceous upland (18.9 acres) and the temporary haul road is mainly composed of wetland habitat (9.4 acres). With the possible exception of the temporary haul road, which we are still evaluating and which may or may not be used, these areas would be restored to pre-construction conditions following construction. Impacts on wildlife associated with construction of the LNG Terminal and offsite facilities would include displacement, stress, and direct mortality of some individuals. Clearing of vegetation would reduce suitable cover, nesting, and foraging habitat for some wildlife species. Mobile wildlife species, such as birds and terrestrial mammals, may relocate to similar habitats nearby when construction activities commence. However, smaller, less mobile wildlife (such as some reptiles and amphibians) could be inadvertently injured or killed by construction equipment. The permanent reduction in available habitat within the LNG Terminal fenceline, as well as the influx of individuals to other nearby areas, may increase local population densities, resulting in increased inter- and intra-specific competition and reduced reproductive success of individuals. As fencing would be installed around the LNG Terminal site during Stage 1 of construction (750.4 acres), wildlife would be deterred from entering the construction areas after grading began.

Based on a request from the FWS and TPWD, RG LNG assessed the potential to include wildlife passages in the terminal fencing to minimize entrapment of wildlife. However, as such a design would not meet security needs at the facility, RG LNG has agreed to conduct pre-construction surveys and hazing at the LNG Terminal property to flush wildlife from the site prior to completing the fencing. Although some wildlife mortality would still occur, we find that surveys and hazing prior to completing the fence would minimize mortality to animals trapped within the fence, to the extent practicable.

Construction of the LNG Terminal would take about 7 years, and the number of construction personnel would peak at 5,225 workers. An increased number of people in the area could lead to increased direct and indirect effects on wildlife, such as food or trash attracting predators, and vehicular/wildlife interactions. RG LNG would collect, contain, and dispose of excess construction material and debris, including garbage, throughout the construction process in accordance with its Plan, which would minimize the potential to attract predators. Workers commuting to the LNG Terminal site would increase the potential for vehicular/wildlife interactions; however, construction-related traffic would not result in an exceedance of the planned capacity of SH-48.

Construction-related noise could affect animal behavior, foraging, or breeding patterns, and cause wildlife species to move away from the noise or relocate in order to avoid the disturbance. Although the timing of construction would depend on receipt of all required permits, RG LNG originally anticipated that construction activities at the LNG Terminal site would be staggered, occurring over the course of 7 years, predominantly during daylight hours. RG LNG estimates that the noise produced during facility grading and construction would result in maximum composite noise levels of 61.1 decibels (dB) on the A-weighted scale (dBA) at nearby critical habitat for the piping plover, and 51.7 dBA at the Laguna Atascosa NWR, which is considered moderate (see tables 4.11.2-1 and 4.7.1-3). Sound would attenuate with increased distance from construction activity.

Although construction noise levels could deter wildlife in the area, especially in close proximity to the LNG Terminal, most wildlife would be separated from the LNG Terminal by SH-48 on the north and the BSC on the south, which see regular vehicle or marine vessel traffic, respectively. Noise produced by high-speed vehicles on highways (70 to 80 dBA at 50 feet) and recreational marine vessels (generally around 86 dBA) would be comparable to those produced by activity related to construction of the LNG Terminal, indicating that local wildlife may be accustomed to regular increases in noise (FHWA 2003, Coast Guard 2003). Therefore, although the increased sound levels throughout construction may deter some wildlife from the areas adjacent to the proposed LNG Terminal site, the increase in noise during construction is not anticipated to result in significant changes in wildlife behaviors. Noise from construction of the LNG Terminal is discussed in detail in section 4.11.2; noise-related impacts on sensitive wildlife habitat is addressed in section 4.7.1; underwater noise is discussed further in section 4.6.2.

Operation of the LNG Terminal would result in increased human activity, lighting, and noise that could disturb nearby wildlife. The increase in human presence would increase the potential for vehicular/wildlife interactions; however, as the operational staff would include only about 270 people, this impact would be minimal. The overall increase in nighttime lighting during construction and operation of the Project would result in a permanent, but minor impact on wildlife. RG LNG has developed mitigation measures to minimize the impacts of nighttime lighting at the LNG Terminal site, including limiting the amount of outdoor lighting installed, dimming, or turning off non-essential lights at night, choosing lighting colors in consideration of wildlife, and directing light downward. RG LNG has developed nighttime LNG Terminal renderings that depict the extent of nighttime lighting (see appendix N and section 4.8.2.1); these renderings indicate that impacts from ground-level receptors (e.g., terrestrial wildlife) would not be significant. Night-time renderings of the LNG Terminal from an aerial view, however, indicate that avian receptors may be attracted to the lighted area; impacts on birds from nighttime lighting at the facility are discussed in section 4.6.1.3.

Operational noise would result in an increase in the ambient sound levels in the immediate vicinity of the Project. At the boundary of the LNG Terminal site, operational sound levels would be about 75 dBA, which is considered moderate to loud. Within about 1 mile, construction noise would drop to about 60 dBA, which is audible, but likely not a nuisance, and at a distance of about 2 miles, noise would drop to about 50 dBA, which is considered quiet (see figure 4.11.2-1). While the immediate vicinity of the LNG Terminal site is not developed, wildlife in the area is currently exposed to noise from traffic along SH-48 and in the BSC, as well as industrial sources at the Port of Brownsville. Therefore, moderate impacts on general wildlife species may occur in areas immediately adjacent to the LNG Terminal boundaries resulting in potential increases in avoidance of the area. However, operational noise would quickly attenuate such that impacts outside of the immediate vicinity would not be anticipated to result in significant effects on local wildlife behaviors. Since conducting the noise impact analysis, RG LNG has adopted certain mitigation measures (see section 4.11.2.3); however, these modifications did not result in significant changes in the estimated noise attenuation identified above.

RG LNG would implement its Plan and Procedures to minimize impacts on adjacent habitat and open water during construction; however, wildlife would be directly displaced from the 750.4-acre facility footprint during construction and operation of the LNG Terminal, and some wildlife may be indirectly displaced within a larger area due to the increase in noise and lighting during construction and operation of the LNG Terminal. The direct loss of habitat and the indirect effects associated with displacement indicate that the construction and operation of the proposed LNG Terminal would result in a minor to moderate, permanent impact on local wildlife. With the implementation of pre-construction surveys and wildlife hazing prior to enclosing the LNG Terminal site, direct loss of wildlife at the LNG Terminal site would be further minimized.

Pipeline Facilities

<u>Pipeline System and Additional Temporary Workspace</u>

Header System and Pipeline 1

RB Pipeline would construct the Header System within a 100- to 125-foot-wide construction right-of-way and Pipeline 1 within a 125-foot-wide construction right-of-way. Construction of these pipelines, including ATWS, would affect 1,998.6 acres of wildlife habitat, including 841.3 acres of upland herbaceous land, 533.9 acres of agricultural land, 480.8 acres of upland shrub/forest land, 121.9 acres of emergent wetlands, and 12.8 acres of shrub/forested wetlands, and 7.9 acres of open water. Following construction, 500.3 acres of upland herbaceous land, 321.2 acres of agricultural land, 285.1 acres of upland shrub/forest land, 94.2 acres of emergent wetlands, 10.6 acres of shrub/forested wetlands within the permanent easement would be restored to pre-construction conditions but would be subject to routine maintenance; 6.4 acres of water within the permanent right-of-way would not be subjected to routine maintenance. Shrub/forest land within maintained portions of the permanent right-of-way would be permanently converted to herbaceous or early successional-stage scrub-shrub land.

Pipeline 2

Pipeline 2 would be installed within the same 125-foot-wide construction right-of-way affected by Pipeline 1. As such, all land disturbed by the construction of Pipeline 2 would have been previously disturbed during the construction of Pipeline 1. Similarly, land associated with ATWS, access roads, contractor/pipe yards, and aboveground facilities would have been previously disturbed. Following construction, land affected by Pipeline 2 would be restored to pre-construction conditions.

General Impacts of the Pipeline System

Wildlife would be impacted by clearing of vegetation, alteration of the landscape from grading activities and soil disturbance, displacement and increased predation, activities associated with trenching, and increased human and vehicle presence. During construction, more mobile species would be temporarily displaced from the construction right-of-way to similar habitats nearby due to human presence and increases in noise. Noise impacts would generally be temporary and intermittent as pipeline construction typically occurs in a manner similar to a moving assembly line, except at HDD locations where construction activity would generate elevated noise levels and could occur up to 24 hours a day, 7 days a week, for up to 10 weeks at each site.

Less mobile species, such as small mammals, reptiles, amphibians, and nesting birds may experience direct mortality or permanent displacement. Displacement of species could lead to increased competition for some resources. Some wildlife displaced from the right-of-way would return to the newly disturbed area and adjacent, undisturbed habitats after completion of construction. Soil-dwelling invertebrates would be impacted directly through movement of soil from one place to another, resulting in some mortality and displacement. This could reduce the forage potential for insectivores and other small predators that inhabit the area. The overall impact of these effects, however, would be minor due to the temporary nature of the effects and limited area affected by construction. In addition, clearing of vegetation and subsequent increases in visibility could result in increased predation during construction and operation of the Pipeline System. While individual mortality rates could increase, the Project would not likely result in any population-level impacts.

The clearing of vegetation on the construction right-of-way and within ATWS would reduce cover, foraging, breeding, and nesting habitat for some wildlife. The degree of impact would depend upon the type of habitat affected, the timing of clearing and construction activities, and the rate at which the area recovers after disturbance from construction. Seasonal habitat use for migratory birds is discussed in section 4.6.1.3. The effects on species that rely on upland herbaceous habitats would be short-term as RB Pipeline would reseed these areas, which would likely recover 1 to 3 years following construction.

Cleared shrub/forest vegetation would likely require several years to return to its woody composition. The effect of workspace clearing on shrub/forest-dwelling wildlife species would be greater than open habitat wildlife as shrub/forest land could take decades to return to pre-construction conditions, particularly if stands of trees are present. In addition, trees would be prevented from re-establishing along the permanent right-of-way. RB Pipeline would minimize the potential for these effects by collocating 66.4 percent of the workspace.

Wildlife could be impeded by, or fall into, areas of open trench, resulting in injury, mortality, or delay of local migration. To minimize the potential for this impact RB Pipeline would plan construction to limit the amount and duration of open trench. In addition, RB Pipeline would employ a qualified biologist to inspect open trenches each morning and remove trapped wildlife.

Construction of the Pipeline System would take about 4 years; however, construction activity along the pipeline route would generally be restricted a 12-month period for the construction of the Header System and Pipeline 1 and, after an 18-month delay, a second 12-month period for the construction of Pipeline 2. The peak number of construction personnel during this time would be 900 workers. An increased number of people in the area could lead to increased direct and indirect effects on wildlife, such as food or trash attracting predators and vehicular/wildlife interactions. RB Pipeline would collect, contain, and dispose of excess construction material and debris, including garbage, throughout the construction process in accordance with its Plan, which would minimize the potential to attract predators. Workers commuting along the pipeline route would increase the potential for vehicular/wildlife interactions; however, as the 900 workers would be spread across 137.9 miles of pipeline, these impacts would be minor. Operational staff would be limited to between 10 and 20 people for the entire Pipeline System and aboveground facilities; therefore, impacts from operational staff would be negligible.

A spill of hazardous materials during construction, such as fuel or oil, or the excavation and exposure of contaminated soil and/or groundwater could impact wildlife. RG Developers would implement procedures outlined in their Project-specific Plans, SWPPP, and SPCC Plans to minimize impacts associated with construction-related spills. In addition, in the event that contaminated groundwater and/or soils are encountered during construction, RG Developers would implement measures in their *Unanticipated Contaminated Sediment and Soils Discovery Plan*, as discussed in section 4.2.

Following construction of each pipeline, RB Pipeline would seed all of the previously vegetated areas disturbed by construction in accordance with recommendations from the local soil conservation agency and/or the landowner. RB Pipeline is consulting with the local offices of the NRCS to determine the most appropriate seed mixes for use in south Texas (see section 4.6.1.4). Disturbed areas would be routinely monitored until restoration and revegetation were successful in accordance with the Project-specific Plan and Procedures. During operation, RB Pipeline would mow up to a 75-foot-wide permanent right-of-way no more than once every 3 years; however, a 10-foot-wide corridor centered on each pipeline may be mowed more frequently to facilitate routine patrols and emergency access. Within wetlands, RB Pipeline would permanently maintain only a 10-foot-wide corridor and selectively remove trees within 15 feet of the pipeline. These maintenance activities would permanently convert scrub-shrub and forested wetlands to an emergent state.

Aboveground Facilities

RB Pipeline would construct three compressor stations, eight metering sites, and additional appurtenant facilities. Proposed Compressor Station 3 is within the LNG Terminal site; therefore, impacts associated with Compressor Station 3 have been included above. Construction of the remaining aboveground facilities would affect 92.9 acres of wildlife habitat comprised of upland herbaceous, upland shrub/forest, and agricultural land. No open water or wetland habitats would be affected by construction or operation of the aboveground facilities. The impacts associated with the construction of the aboveground facilities would be similar to those described in the general pipeline impacts.

Contractor/Pipe Yards

Contractor/pipe yards associated with the Project would temporarily impact 152.5 acres of upland herbaceous land, 135.6 acres of agricultural land, and 9.1 acres of upland shrub/forest land. RB Pipeline would utilize the same contractor/pipe yards for both Pipeline 1 and 2; therefore, no additional habitat would be impacted during the construction of Pipeline 2. Following completion of construction, the yards would be converted back to their current use. The impacts associated with the contractor/pipe yards would be similar to those described in the general pipeline impacts.

Access Roads

RB Pipeline proposes to use 52 temporary access roads during construction and 12 permanent access roads during construction and operation of the Project. Of the 64 roads, 57 are existing access roads that would not require improvements, 2 are existing roads that would be expanded, and 5 would be newly constructed. Construction or modification of access roads would impact 74.4 acres of upland herbaceous land, 8.3 acres of emergent wetlands, 0.5 acre of agricultural land, 0.1 acre of open water, and less than 0.1 acre of shrub/forested wetland. Construction impacts on these habitats would be the same as those described for the pipeline facilities and include soil compaction and erosion and the potential establishment of invasive species. RB Pipeline would restore and seed any previously vegetated areas affected by construction in accordance with its Plan following construction. Operational use of the 12 permanent roads would result in the permanent conversion of 5.4 acres of upland herbaceous land, 0.8 acre of upland shrub/forest land, and less than 0.1 acre of open water. A full list of access roads is provided in appendix C.

With the implementation of the Project-specific Plan and Procedures, SPCC Plan, and Noxious and Invasive Plant Management Plan, as well as additional minimization and mitigation measures discussed above, we find that construction of the proposed pipeline facilities would have a minor and temporary impact on local wildlife. Similarly, ongoing operation of the pipeline facilities would have a permanent, but minor impact on local wildlife, that would generally be limited to ongoing vegetation maintenance along the Pipeline System and the loss of land associated with the aboveground facilities.

4.6.1.3 Migratory Birds

Migratory bird species nest in the United States and Canada during the summer months and then migrate south to the tropical regions of Mexico, Central and South America, and the Caribbean for the non-breeding season. Some species migrate from breeding areas in the north to the Gulf Coast for the non-breeding season. Migratory birds are protected under the MBTA, which prohibits the intentional take or killing of individual migratory birds, their eggs and chicks, and active nests. The MBTA provides that it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg of any such bird. Executive Order 13186 (January 2001) directs federal agencies to consider the effects of agency actions on migratory birds and determine where unintentional take is likely to have a measurable negative effect on migratory bird populations, and to avoid or minimize adverse impacts on migratory birds through enhanced collaboration with the FWS. Executive Order 13186 states that emphasis should be placed on species of concern, priority habitats, and key risk factors, and that particular focus should be given to addressing population-level impacts.

On March 30, 2011, the FWS and the Commission entered into a Memorandum of Understanding (MOU) that focuses on avoiding or minimizing adverse impacts on migratory birds and strengthening migratory bird conservation through enhanced collaboration between the two agencies. This voluntary MOU does not waive legal requirements under the MBTA, BGEPA, ESA, Federal Power Act, NGA, or any other statute and does not authorize the take of migratory birds.

We received many comments regarding the importance of the Project area to migratory birds. The Project is within the Central Flyway, which generally covers the central portion of North America and into Central America. South Texas acts as a funnel for migratory birds as they try to avoid flying too far east (into open Gulf waters) or west (into desert habitat). In addition, south Texas is the northern extent of migration for certain species (FWS 2016a, b). The Laguna Atascosa and Lower Rio Grande Valley NWRs, located near the southern terminus of the Project area, both act as major stopover locations during these migrations, as suitable habitat is protected from development and degradation within these areas. At peak use, about 250,000 ducks stopover in the Laguna Atascosa NWR, with thousands more stopping in adjacent habitats; this is in addition to the hundreds of other migratory bird species that stopover in the region. These areas are also subject to "fallout" for migratory songbirds, where, during years with strong winds and cold weather, these birds will stop at the refuges to regain strength until they can continue their migration (FWS 2016a). Bird-watching and other nature-based activities are a large source of tourism for south Texas; impacts on eco-tourism are discussed in section 4.9.

Birds of Conservation Concern (BCC) are a subset of protected birds under the MBTA and include all species, subspecies, and populations of migratory nongame birds that are likely to become candidates for listing under the ESA without additional conservation actions. In order to accurately identify these sensitive bird species and stimulate action by federal/state agencies and private parties, the FWS Migratory Bird Office issued a report describing the Birds of Conservation Concern (FWS 2008a). The report identifies priority bird species at the national, regional, and Bird Conservation Region (BCR) levels. The Project is predominantly within BCR 37 (Gulf Coastal Prairie); however, the Header System and Pipeline System, through MP 14, fall within BCR 36 (Tamaulipan Brushland) (FWS 2008a). As provided in appendix K, RG Developers have compiled a list of BCCs that occur in the Project area based on review of FWS' Information for Planning and Consultation (IPaC) tool, including bird conservation status, preferred habitat, likelihood of occurrence within the LNG Terminal site or along the pipeline route, and occurrence of known breeding in the Project area. Based on this review, a total of 16 BCCs were identified as having the potential to occur on the LNG Terminal site due to suitable habitat being present; 10 of these species were further identified as having the potential to nest on the LNG Terminal site. Similarly, 43 BCCs were identified as potentially occurring along the pipeline route, 19 of which are known to breed in the Project counties.

Colonial waterbirds, a subset of migratory birds, include a large variety of bird species that share two common characteristics: 1) they tend to gather in large assemblies, called colonies or rookeries, during the nesting season, and 2) they obtain all or most of their food from the water (FWS 2002).[26] Consultation with the TPWD has identified two rookery areas between 1.4 and 2 miles east of the LNG Terminal site, along the BSC. At that distance, noise from the LNG Terminal operation would be between 50 and 55 dBA which, while potentially audible, is unlikely to be considered a nuisance. The TPWD has indicated concern with the potential for increased erosion at these rookery areas due to the wake from transiting LNG carriers during operations; however, use of the BSC by marine vessels associated with the LNG Terminal during construction and operation would be consistent with the planned purpose of the BSC and is not expected to cause significant impacts on shoreline stability (see section 4.3.2.2). Although FERC does not have jurisdiction over the transit of LNG carriers through the BSC, final permitting for the Brazos Harbor Channel Improvement Project should account for the impacts of these larger vessels on the stability of the shoreline and related impacts on the identified rookery.

At the request of the FWS, RG LNG conducted spring bird surveys of the LNG Terminal site over three days between April 26 and May 25, 2017, which coincided with the spring migratory period and the beginning of the local breeding season. Each survey day included 6 locations that were each surveyed for a 1-hour period. Over the course of the spring surveys, 1,926 birds from 79 different species were identified; however, this number may be low as the nearby Laguna Atascosa NWR has documented 417 species of birds (FWS 2016a, 2018). The majority of the birds were observed flying over the site, while a smaller percentage (24.2 percent [467 birds]) were observed using habitat at the LNG Terminal site. The number of birds observed decreased throughout the survey period, with 814 birds observed on April 26, 614 on

---

26 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.

May 11, and 480 on May 25. A list of birds observed, the date and number of observations, and the resident or migrant status of each species is presented in appendix K-3.

Two state listed species (the reddish egret and the white-tailed hawk) were observed flying over the LNG Terminal site during surveys; state listed threatened and endangered species are discussed in section 4.7.2. In addition, 15 BCCs were observed during the surveys, including 7 of the species that were identified as potentially nesting at the LNG Terminal site (the reddish egret, the white-tailed hawk, Wilson's and snowy plovers, American oystercatcher, sandwich tern, and gull-billed tern). At the request of the FWS, RG LNG also planned to survey the Port Isabel dredge pile in the spring of 2018 to determine its use by nesting birds; as the results of this survey have not yet been provided, we have recommended below that the survey results be provided to the Secretary and to the FWS for review.

The vegetation communities associated with the Project provide potential habitat for migratory bird species, including songbirds, waterbirds, and raptors. Impacts on migratory birds and their habitat due to construction and operation of the Project would typically be similar to impacts on general wildlife (see section 4.6.1.2). Potential impacts specific to migratory birds would include disorientation due to artificial illumination and potential strike of elevated Project components. In addition, the loss of habitat associated with the LNG Terminal site would be considered a permanent and moderate impact on migratory birds. Loss of habitat due to the pipeline facilities would result in temporary (during construction) and permanent (during operation) impacts on migratory birds; however, those habitats would largely be available to migratory birds after construction had been completed, with the exception of land within the footprint of aboveground facilities or those habitats that are permanently converted from shrub/forest to emergent or early successional vegetation.

RB Pipeline plans to avoid vegetation clearing and maintenance between March 1 and August 31, in accordance with FWS recommendations, if practicable at the time of construction. However, RG LNG has indicated that clearing only outside of the migratory bird window may not be possible at the LNG Terminal site, and has developed a Migratory Bird Conservation Plan (MBCP)[27] to identify measures to account for potential conflicts in the construction schedule. As noted in its MBCP, RG LNG proposes multiple potential mitigation methods to avoid or minimize direct impacts on migratory birds during clearing and grading activities at the LNG Terminal site. RB Pipeline would also implement the procedures in RG LNG's MBCP, if clearing associated with the pipeline facilities were not able to occur during the recommended clearing period. Per the MBCP, RG LNG would implement one or more of the measures below, to the extent practicable, during construction:

- clear and grade outside of the FWS-recommended window for migratory bird nesting (March 1 through August 31); or
- selectively clear areas deemed most valuable to migratory bird nesting (shrubland and grassland loma habitat) outside of the FWS-recommended window; or

---

[27] RG LNG's MBCP is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20161229-5149.

- conduct pre-construction clearance of stick nests, which may be used repeatedly by raptors and ravens, in accordance with FWS guidelines; or

- remove existing stick nests, in accordance with FWS guidelines, prior to construction and outside of the nesting season in order to deter future nesting; or

- conduct pre-construction surveys (within 7 days of construction) to identify active nests and evaluate the potential to establish a no-activity buffer until the young have fledged. The necessary buffers would be determined by consulting FWS prior to construction, but is anticipated to be 30 feet for BCCs; or

- or relocate active nests identified during pre-construction surveys, for which establishment of a protective buffer is not logistically feasible, by an FWS-approved biologist using FWS guidelines; or

- allow the loss of active nests, if no other option is deemed feasible, which would be mitigated in consultation with the FWS.

Although RG Developers have identified their commitment to avoiding impacts on migratory birds to the extent practicable, some birds and nests would likely be lost as a result of construction of the Project. Implementation of any of the above-noted bullets would reduce the potential for the take of migratory birds; however, if RG Developers determine at the time of construction that none of the above measures are feasible (i.e., clearing occurs during the nesting season with no identification or buffering of active nests), incidental take of birds, eggs, and/or nests would occur. Adult birds present onsite during construction would likely leave once construction had commenced due to the increased noise and human presence. Further, the number of active nests present onsite during construction would be constrained by the available breeding habitat at the LNG Terminal site and the size of the breeding territories required by the species that nest there. Due to the size of the LNG Terminal site, the ability of many birds to have more than one brood per year, and the amount of available nesting habitat remaining in the Project vicinity, we find that loss of any nests/eggs onsite during construction would not result in significant impacts on the avian population. However, as BCCs require additional conservation measures, and multiple BCCs are known to occur in the area and have the potential to nest at the LNG Terminal site, we agree that the measures in RG LNG's MBCP, as finalized in accordance with our recommendation below, are appropriate for use and would adequately protect BCCs as well as non-BCC migratory birds.

Many birds use natural light from the sun, moon, and stars for navigation. Artificial lighting can hide natural light sources, having unknown effects on birds at the population level. Fatalities to avian species due to artificial light have been well documented. Avian fatalities are associated with attraction to light sources, especially in low light, fog, and where there is a low cloud ceiling (Orr et al. 2013). Construction of the Project would require adequate lighting for operations and safety; however, nighttime construction is not proposed and therefore nighttime lighting would be limited, and would be shielded and downward facing to facilitate safe operations at night or during inclement weather. RG LNG also conducted visual simulations depicting anticipated nighttime lighting conditions at the LNG Terminal site (see section 4.8.2). Based on our review of the visual simulations for the LNG Terminal, and the proposed mitigation measures that would be implemented to minimize light and all aboveground facilities, we have determined that the overall increase in nighttime lighting during construction and operation of the proposed Project would result in permanent, but minor impacts on resident or migratory birds. However, if a mortality event were observed at the LNG Terminal related to lighting, RG LNG would consult with the FWS to determine possible adaptive management measures that would minimize the risk of additional mortalities.

During construction and operation of the LNG Terminal, birds would be at risk of colliding with elevated facilities, including the LNG storage tanks (175 feet high) and vent stack (100 feet high). Birds may also experience an increased risk of vehicular collision during construction due to the increased traffic; however, incidence of collision is anticipated to be limited given that birds will generally fly at higher elevations. The risk of collision with LNG Terminal components is expected to be low given the visibility of the facilities, but could increase during storms, dense fog, at night, or at other times with reduced visibility.

As previously discussed, lighting at the LNG Terminal site would be minimized to the extent practicable. Birds have also been known to be drawn to, and fly into, flares at LNG terminals; however, RG LNG has designed its LNG Terminal to include ground flares, which would be significantly lower than other facility components, as well as significantly lower than elevated flare stacks used at many other LNG terminals. Although the elevated vent stack may be used for flaring as well, its use as a flare would be limited to periods of emergencies. Therefore, we conclude that although some bird strikes at the LNG Terminal site are possible, the overall impact on bird populations would be negligible.

Overall, construction of the proposed Project would result in permanent, minor to moderate impacts on birds due to potential incidental take of birds, eggs, or nests during construction, as well as the loss of habitat in an area heavily used by birds during the migration period. The impact of habitat loss may be mitigated for certain birds (those that use wetland habitat) through preservation of habitat in the nearby Loma Ecological Preserve, which is being proposed as mitigation for wetland impacts (see section 4.4); however, the proposed preservation activities at this location have not been approved by the COE for wetland mitigation. In addition, we believe that RG Developers would be able to appropriately minimize impacts on sensitive bird species along all, or a majority of, the pipeline route through use of the FWS-recommended clearing window. Although we realize that use of the clearing window may not be fully practicable for the LNG Terminal site, we believe that the loss of bird nests will be limited with the implementation of applicable measures in the MBCP. However, as the FWS has not yet reviewed the measures identified in RG LNG’s MBCP to minimize impacts on nesting and migrating birds during Project construction, **we recommend that:**

- **<u>Prior to construction of the Project</u>, RG Developers should consult with the FWS to develop a final MBCP, which should include outstanding surveys at the Port Isabel dredge pile. RG Developers should file the revised MBCP and evidence of consultation with FWS with the Secretary.**

4.6.1.4 Sensitive or Managed Wildlife Habitats

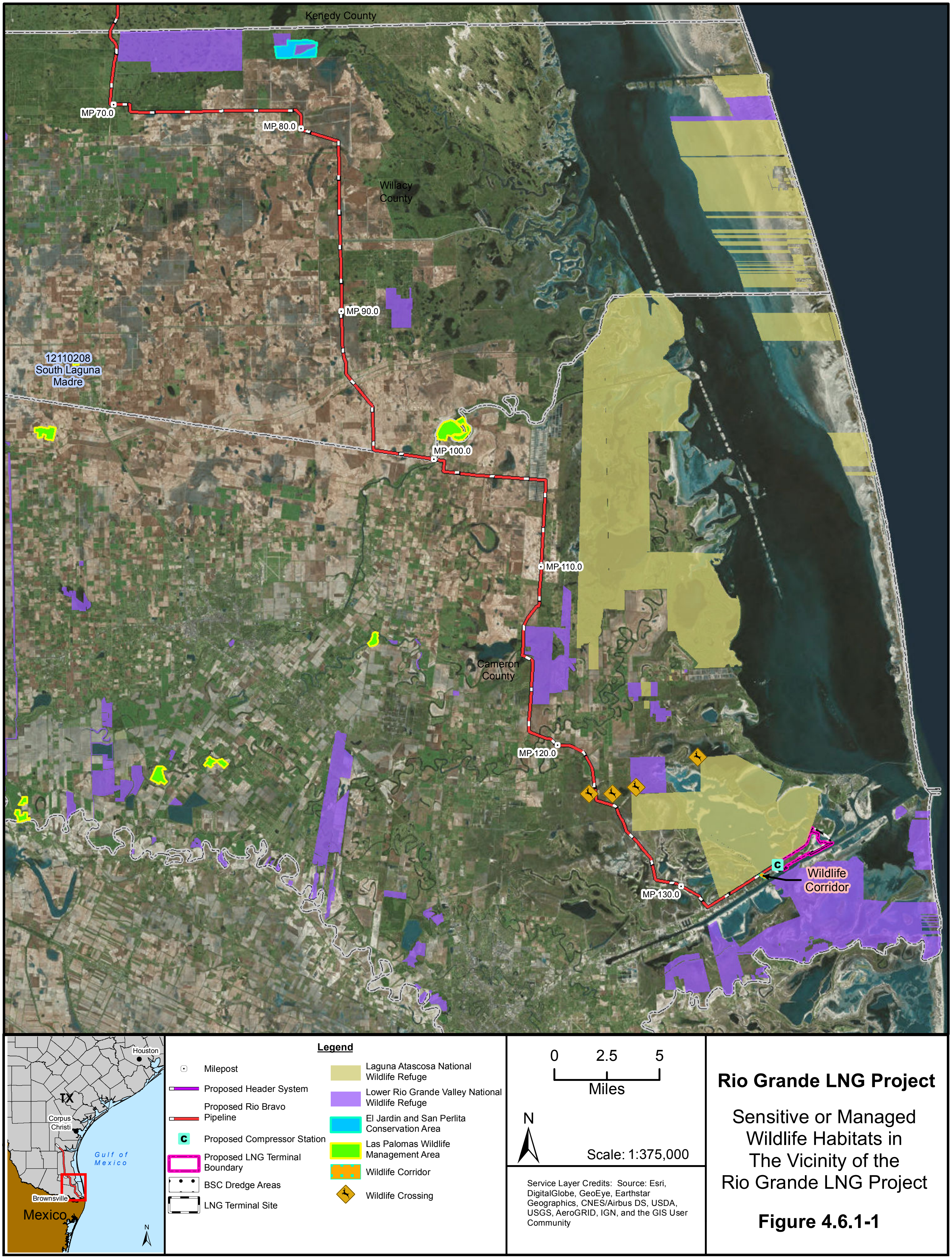
Several sensitive or managed wildlife habitats, or habitats of concern, are located in the vicinity of the proposed Project, including the Laguna Atascosa NWR, the Lower Rio Grande Valley NWR, wildlife corridors, pollinator habitat, and a wildlife quarantine zone. A description associated with impacts to each of these resources is described below. Two additional managed areas, including the Nature Conservancy's El Jardin and San Perlita Conservation Area and TPWD's Las Palomas WMA are more than 1 mile away from workspaces associated with the pipelines; therefore, no direct or indirect impacts would occur on the habitat they provide or the wildlife that utilize them. Sensitive waterbodies are discussed in sections 4.3.2 and 4.6.2; EFH is discussed in section 4.6.3. Critical habitat for federally listed species is discussed in section 4.7.

Laguna Atascosa National Wildlife Refuge

The Laguna Atascosa NWR was established in 1946 to provide habitat for wintering waterfowl and other migratory birds; however, the current emphasis of the refuge includes endangered species and shorebird management. The NWR is made up of several discontinuous parcels in Cameron County covering about 97,000 acres, and provides quality habitat for numerous species of mammals (45), reptiles (44), butterflies (130), and plants (450), in addition to the hundreds of bird species, as discussed in section 4.6.1.3 (FWS 2016a, b). The Bahia Grande, a large waterbody immediately north of the proposed LNG Terminal site, is included as the Bahia Grande Unit of the Laguna Atascosa NWR.

Although the Laguna Atascosa NWR would not be directly affected by any component of the proposed Project, it is within 0.25 mile of Project workspaces at three locations. As shown in figure 4.6.1-1, these locations include the northern boundary of the LNG Terminal site (about 211.2 feet north) and two locations along the pipeline route (52.8 feet southeast of MP 126.0 and within 52.8 feet north of the route between MP 132.3 and 135.5). Therefore, indirect impacts on the Laguna Atascosa NWR may occur during construction and operation of the proposed Project, including disturbance from increased noise and nighttime lighting associated with Project facilities.

Where the Laguna Atascosa NWR is near the northern boundary of the LNG Terminal site, estimated noise levels during LNG Terminal construction would be limited to a 1.2 dBA increase over ambient conditions, which is not anticipated to result in significant changes in wildlife behaviors, given the presence of SH-48. The sound level associated with LNG Terminal operations is estimated to be 71.4 dBA, and would result in an expected increase of about 11.9 dB over ambient levels (see table 4.7.1-4). This increase in noise could result in moderate impacts on wildlife through increased avoidance of areas immediately adjacent to the LNG Terminal site; however, the increase in operational noise is not anticipated to result in significant changes in general wildlife behaviors further within the NWR, as noise begins to attenuate over distance. Noise impacts on sensitive species are discussed in section 4.7.1.



Rio Grande LNG Project

Sensitive or Managed Wildlife Habitats in The Vicinity of the Rio Grande LNG Project

Figure 4.6.1-1

Similarly, facility lighting is not anticipated to result in significant impacts on local wildlife (see section 4.6.1.2). Although construction of the pipelines could also result in indirect impacts on the NWR, the construction crews are mobile spreads, thereby limiting the time spent adjacent to the NWR, and impacts on wildlife utilizing the NWR would be minor and temporary. Where HDD construction would be near the NWR, including the HDD crossing of the Bahia Grande Channel, construction activity would generate elevated noise levels and could occur up to 24 hours a day, 7 days a week, for up to 10 weeks.

In addition to potential indirect effects of land-based construction and operation, the LNG Terminal site is adjacent to the Bahia Grande Channel, which was constructed as part of a pilot program to restore tidal flow to the Bahia Grande, which was cut off from tidal flow during original construction of the BSC. Dredging within the BSC for the proposed LNG Terminal, as discussed in section 4.3.2, would result in negligible changes in average current speeds within the Bahia Grande Channel, and would therefore not significantly increase water flow or sediment transport through the Bahia Grande Channel. The pipeline facilities would avoid direct impacts on the Bahia Grande Channel using HDD construction methods.

Lower Rio Grande Valley NWR

The Lower Rio Grande Valley NWR, another biologically diverse area with over 1,200 documented species, consists of approximately 97,908 acres of coastal marsh refuge in the vicinity of the Project (FWS 2016c). Similar to the Laguna Atascosa NWR, the Lower Rio Grande Valley NWR consists of multiple discontinuous parcels. The largest (main) parcel is south of the BSC, but individual parcels are located as far north as Willacy County. The LNG Terminal site would not be within 0.25 mile of the Lower Rio Grande Valley NWR. The pipelines would cross about 53 feet west of the NWR from MPs 112.9 to 117.1; however, 3 proposed ATWS currently extend into the NWR, including ATWS-334 (MP 115.9), ATWS-336 (MP 116.3), and ATWS-338 (MP 116.6) (see figure 4.6.1-1). In addition, RB Pipeline has proposed HDDs at MP 115.6 and MP 116.4. As discussed above for the Laguna Atascosa NWR, HDD construction near NWR boundaries would generate elevated noise levels for up to 10 weeks within the NWR. Although RB Pipeline has indicated its intent to modify ATWS within the NWR subsequent to civil survey, such that no direct impacts on the NWR would occur, and because RB Pipeline has not yet identified noise surveys and mitigation at the NWR, **we recommend that:**

- **Prior to construction of the Rio Bravo Pipeline between MPs 115.9 and 116.6, RB Pipeline should file with the Secretary, for review and written approval by the Direction of OEP, updated alignment sheets depicting the modification of ATWS within this section to avoid surface impacts within the boundary of the Lower Rio Grande Valley NWR; and**

- **Prior to construction of the Rio Bravo Pipeline HDD crossings at MPs 115.6 and 116.4, RB Pipeline should file with Secretary, for review and written approval by the Director of OEP, estimates of ambient sound levels at the boundary of the Lower Rio Grande Valley NWR near the HDDs, as well as anticipated noise impacts and any necessary mitigation to minimize potential effects on wildlife.**

With adherence to our recommendations, direct impacts would not occur on the habitat or wildlife in the NWR and indirect impacts associated with noise would be minimized. Indirect impacts associated with erosion and runoff of sediments and inadvertent spills may occur; however, RB Pipeline would implement its Plan, Procedures, and SPCC Plan to minimize the potential for such impacts. Therefore, indirect impacts on the Lower Rio Grande Valley NWR would be temporary and minor.

Wildlife Corridors

In addition to the NWRs near the proposed Project, BND land that is subject to an easement managed by FWS as a wildlife corridor to connect habitat for the federally endangered ocelot (*Leopardus pardalis*) on either side of SH-48. Although bobcats, raccoons, and coyotes have been noted to use the underpass, no data on ocelot use of the underpass are currently available (FWS 2014a). The Pipeline System would cross the ocelot corridor between MPs 134.5 and 134.7; however, this wildlife corridor would be crossed by HDD, thereby avoiding impacts on the underpass itself and the immediately adjacent land. The wildlife corridor is about 0.8 mile west of the LNG Terminal site boundary and about 2.4 miles west of the site center; at this distance, noise levels from site preparation, construction, and operation of the LNG Terminal would result in a negligible increase (less than 1 dB) over existing ambient levels. Impacts on ocelots are discussed in section 4.7.

In addition to the wildlife corridor under SH-48, additional wildlife crossings are completed, or planned for installation, under SH-100. The Pipeline System would cross SH-100 at MP 124.8. The two closest wildlife crossings are about 0.3 mile west and 0.8 mile east of the Pipeline System and would not be directly affected by its construction (see figure 4.6.1-1).

Pollinator Habitat

Pollinator species, including bats, bees, hummingbirds, butterflies, wasps, moths, and flies, require the pollen and/or nectar of plants for food. As about 80 percent of plant species need to be pollinated, there is currently no specific management of pollinator habitat (FWS 2016d); however, the decrease in suitable plant cover has led to concern over the state of pollinator species. A total of 30 native pollinators (bees, butterflies, and moths) have been designated by the TPWD as Species of Greatest Conservation Need in Texas; as such, the TPWD has developed the Texas Monarch and Native Pollinator Conservation Plan, which outlines plans to conserve habitat, educate the public, and conduct research on these species (TPWD 2016d).

On June 20, 2014, then-President Obama signed a Presidential Memorandum, “Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators.” According to the memorandum, “there has been a significant loss of pollinators, including honey bees, native bees, birds, bats, and butterflies, from the environment.” The memorandum also states that “given the breadth, severity, and persistence of pollinator losses, it is critical to expand Federal efforts and take new steps to reverse pollinator losses and help restore populations to healthy levels.” In response to the President’s memorandum, the federal Pollinator Health Task Force published a National Strategy to Promote the Health of Honey Bees and Other Pollinators in May 2015. This strategy established a process to increase and improve pollinator habitat.

RG Developers have consulted with the NRCS to develop preliminary seeding mixes for use during restoration that would enhance the habitat for pollinator species, which includes predominantly native grasses. Native bunch grasses, such as switchgrass (*Panicum virgatum*) are non-sod forming grasses that often serve as host plants for butterflies and potential nesting sites for bumble bees (TPWD 2016e). Final seed mixes for full restoration will be developed prior to construction, in coordination with the NRCS. However, native pollinators need a diversity of flowering (nectar-producing) plants and nesting sites to be successful, and RG Developers have not indicated their intent to incorporate native flowering species into their seed mix, which could provide an energy source for local and migrating pollinators. In addition, the FWS has indicated concern with the specific species that would be included in the seed mixes. Therefore, **we recommend that:**

- **<u>Prior to construction of the Project</u>, RG Developers should file with the Secretary the final seed mixes that would be used in applicable areas of the LNG Terminal site and the pipeline right-of-way that incorporate native flowering plants, developed in coordination with the NRCS and FWS. RG Developers should include in the filing records of agency consultation.**

Construction impacts associated with the pipeline facilities would result in a temporary impact on pollinators; however, impacts would be adequately minimized through use of the NRCS-recommended seeding mixes, developed in consideration of our recommendation. Loss of 92.9 acres of vegetated land associated with the aboveground facilities for the Pipeline System would result in a permanent, but minor impact on pollinators. Although operational maintenance of the pipeline right-of-way would result in regular mowing of established pollinator plant species, maintenance of the full right-of-way would occur not more than once every 3 years, and never between April 15 and August 1; therefore, these impacts would be minimal as pollinators would use adjacent land until flowering plants became re-established within the right-of-way. Loss of 591.5 acres of potential pollinator (vegetated) habitat during operation of the proposed LNG Terminal would result in a moderate, but permanent impact on pollinator species; however, adjacent, undisturbed pollinator habitat within the Laguna Atascosa NWR and surrounding areas would still be available for use.

Cattle Tick Fever Quarantine Areas

The Texas Animal Health Commission (TAHC) has established a 500-mile-long quarantine zone, varying in width from 600 feet to 10 miles, along the Rio Grande River to help control the spread of fever ticks from Mexico into the United States. The ticks are a threat to U.S. cattle operations as they can spread parasites and cattle fever. Treatment of cattle is conducted by dipping, injectable treatments, and/or vacating infected pastures for a period of nine months. Although useful for cattle, these methods are not practical for local wildlife hosting fever ticks, such as white-tailed deer, and treatment is limited to medicated feed (TAHC 2015). The official fever tick quarantine zone is within Cameron County along the Rio Grande; however, due to the spread of fever ticks, the TAHC established a temporary quarantine zone in other areas of Cameron County, including the proposed LNG Terminal site and portions of the pipeline route. Within the temporary quarantine zone, exotic nilgai antelope, white-tailed deer, and other free-ranging wildlife and exotic animals capable of supporting fever ticks must be inspected by the TAHC prior to movement into another area (TAHC 2016). To minimize the potential spread of fever ticks, RG Developers would inform all construction personnel of current regulations regarding the quarantine zones during pre-construction training. RG Developers would also prohibit the capture or hunting of wildlife within construction workspaces. Therefore, we find that impacts from construction and operation of the Project would be adequately minimized.

4.6.2 Aquatic Resources

4.6.2.1 Existing Aquatic Resources

The Rio Grande LNG Project area includes freshwater, estuarine, and marine waterbodies that are classified as perennial, intermittent, or ephemeral (see section 4.3.2), as well as freshwater and estuarine wetlands. While perennial waterbodies are typically capable of supporting populations of fish and macroinvertebrates, intermittent and ephemeral waterbodies provide limited habitat value for aquatic resources due to restricted water flow regimes. Estuarine wetlands provide year-round warmwater habitat for aquatic resources, and mudflats provide habitat for a variety of invertebrate species and microfauna. The TCEQ has designated sustainable fisheries as those waterbodies with the potential to have sufficient fish production of fishing activity to create significant long-term human consumption of fish; all designated waterbodies and all bays, estuaries, and tidal rivers are considered to have sustainable fisheries (see table 4.3.2-2 and appendix G). All of the fisheries in the Project area support warmwater species. Table 4.6.2-1 lists representative finfish and crustacean species found in the vicinity of the LNG Terminal site and pipeline facilities, and identifies the salinity regime in which they occur.

Life histories of many Gulf of Mexico fish species can be characterized as estuarine-dependent because they typically spawn in open water, 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 Project area include red drum, gray snapper, blue crab, and penaeid shrimp.

In 2013, the Port of Brownsville and Port Isabel together ranked as the second largest commercial fishing port by value along the Gulf of Mexico (National Ocean Economics Program 2016). Shrimp are the top commercial species in the region, most of which are caught offshore (Fisher 2015). As discussed in section 4.9.4.2, recreational fishing in the Project area is most common in the bays along the coasts of Cameron and Willacy Counties. Speckled seatrout, redfish, southern flounder, and sheepshead are the most commonly caught species in these bays. Offshore fishing in south Texas targets red snapper, king mackerel, Spanish mackerel, gray triggerfish, tuna, and billfish, but comprises only about 5 percent of fishing effort spent in the bays (TPWD 2015a). Additionally, a small number of anglers and fishing guides fish for snook specifically within the BSC, where the species is known to school (Ferguson 2015). The Project would not cross commercial fisheries or significant recreational fisheries in Jim Wells, Kleberg, or Kenedy Counties. Impacts on recreational and commercial fisheries are addressed in section 4.9. No invasive aquatic species have been documented in the waterbodies in the vicinity of the Project (TexasInvasives.org 2016).

Table 4.6.2-1 Representative Fish Species Occurring in Aquatic Habitats in the Rio Grande LNG Project Area		
Common Name	**Scientific Name**	**Salinity Regime**
Crustaceans		
Blue crab	*Callinectes sapidus*	Estuarine and marine
Crayfish	*Procambarus spp.*	Freshwater
Fiddler crab	*Uca spp.*	Estuarine
Grass shrimp	*Palaemonetes spp.*	Estuarine
Marsh periwinkle	*Littoraria irrorata*	Estuarine
Penaeid shrimp	*Farfantepenaeus and Litopenaeus spp.*	Estuarine and marine
Finfish		
Atlantic stingray	*Dasyatis sabina*	Estuarine and marine
Atlantic croaker	*Micropogonias undulatus*	Estuarine and marine
Black drum	*Pogonias cromis*	Estuarine and marine
Channel catfish	*Ictalurus punctatus*	Freshwater and estuarine
Common snook	*Centropomus undecimalis*	Estuarine and marine
Crappie	*Pomoxis spp.*	Freshwater
Gafftopsail catfish	*Bagre marinus*	Estuarine and marine
Gar	*Lepisosteus spp.*	Freshwater and estuarine
Gray snapper	*Lutjanus griseus*	Estuarine and marine
Gulf menhaden	*Brevoortia patronus*	Estuarine and marine
Hardhead catfish	*Arius felis*	Estuarine and marine
Largemouth bass	*Micropterus salmoides*	Freshwater and estuarine
Mosquitofish	*Gambusia affinis*	Freshwater and estuarine
Pinfish	*Lagodon rhomboides*	Estuarine and marine
Red drum	*Sciaenops ocellatus*	Estuarine and marine
Rough silverside	*Membras martinica*	Estuarine and marine
Sheepshead minnow	*Cyprinodon variegatus*	Estuarine and marine
Southern flounder	*Paralichthys lethostigma*	Estuarine and marine
Speckled seatrout	*Cynoscion nebulosus*	Estuarine and marine
Striped mullet	*Mugil cephalus*	Estuarine and marine
Sunfish	*Lepomis spp.*	Freshwater
Tarpon	*Megalops atlanticus*	Estuarine and marine
Source: TPWD 2014.		

LNG Terminal

Habitat for aquatic resources includes estuarine emergent wetlands, mudflats, and open water habitat within the LNG Terminal site, along the proposed temporary haul road, and within the BSC. The BSC has been designated as an estuarine surface water that supports exceptional aquatic life (TCEQ 2014). The estuarine wetlands, mudflats, and open water lagoon (Aquatic Resource 1) on the LNG Terminal site have the potential to provide habitat for species identified in table 4.6.2-1; however, the placement of dredged material from the original construction of the BSC during the 1930s isolated the lagoon from tidal exchange and altered the hydrology of wetlands on the site.

The open water lagoon and the BSC substrates are estuarine unconsolidated bottom sediment that provide habitat for benthic (bottom-dwelling) organisms and fish. Substrates within the BSC are subject to frequent disturbance from maintenance dredging and vessel traffic. Wetlands on the LNG Terminal site are described in detail in section 4.4; open water is described in section 4.3.2.

Waterbodies in the vicinity of the LNG Terminal site, including LNG carrier transit areas, include the Bahia Grande Channel, Bahia Grande, Laguna Madre, and South Bay (see section 4.3.2). Each of these waterbodies supports marine and estuarine aquatic resources. Public scoping comments identified the waterbodies in the Project vicinity as habitat for aquatic organisms. The Bahia Grande was historically a large and productive wetland and open water system connected to the Laguna Madre; however, construction of the BSC and SH-48 during the 1930s obstructed tidal flow to the Bahia Grande, which degraded habitat suitability for estuarine species and resulted in fish kills. The Bahia Grande and its channel are part of an ongoing coastal wetland restoration project (FWS 2015a).

The Laguna Madre is a long, narrow lagoon between the Texas mainland and South Padre Island, extending from Corpus Christi Bay into Mexico; South Bay forms the southernmost bay in the Laguna Madre System. The Lower Laguna Madre and South Bay are designated as supporting exceptional aquatic life; however, the Lower Laguna Madre is impaired for bacteria affecting oyster waters (TCEQ 2014). The Laguna Madre and South Bay both support oyster reefs and areas of submerged aquatic vegetation (or seagrass) (TPWD 2016e, USGS 2006b). Oyster reefs provide habitat for marine organisms, including juvenile crabs and fish, reduce turbidity by filtering the water column, and may provide protection from waves and currents (NMFS 2016a). Similar to estuarine wetlands, seagrass beds provide feeding grounds for adult fish and nursery areas for larval and juvenile fish and invertebrates (TPWD 2016f). Seagrass covers about 67 percent of the substrate of the Lower Laguna Madre and South Bay, and potential impacts on seagrasses and oyster reefs were identified as an issue of concern in public scoping comments (USGS 2006b).

Neither the storage areas nor the Port Isabel dredge pile would affect waterbodies or wetlands. The proposed haul road would temporarily impact open water, wetlands, and mudflats outside the boundaries of the LNG Terminal site; however, we are considering alternatives to the construction and use of this road (see sections 3.3.2 and 4.4.2.1).

Portions of the BSC, Aquatic Resource 1 (which includes open water, marsh, salt flat, and mudflat habitats on the eastern side of the LNG Terminal site), the Bahia Grande Channel, wetlands at the LNG Terminal site, the Laguna Madre, and South Bay have been designated as EFH. Marine and estuarine waterbodies may also contain suitable habitat for state and federally listed species. EFH is discussed in section 4.6.3; impacts on federally listed species are discussed in section 4.7.

Dredged material that is not used as fill at the LNG Terminal site would either be placed at the New Work ODMDS via mechanical means, or at Port of Brownsville Placement Areas 5A and/or 5B via hydraulic means. RG LNG is also considering potential beneficial uses of dredged material (see section 4.3.2.2). The New Work ODMDS is about 4.4 miles off the coast of South Padre Island in water depths of 60 feet or greater. Material from maintenance dredging would be placed in an available upland placement area (PA 4a, 4b, 5a, or 5b), a nearshore beach nourishment site (the Feeder Berm), or the Maintenance ODMDS. The Maintenance ODMDS is about 1.9 miles from shore, and is at a depth of about 44 feet. The Feeder Berm is a nearshore beach nourishment site between 0.4 and 0.9 mile offshore of South Padre Island (see section 4.2.3). It is designed such that material is transported toward and along South Padre Island beaches via nearshore currents (COE 2014).

Pipeline System

The waterbodies that would be crossed or affected by the pipeline facilities, as well as the proposed crossing method and fishery and water quality classification for each feature, are included in appendix G. The Arroyo Colorado, a tidally influenced waterbody crossed at MP 100.1, is designated as an estuarine surface water that supports exceptional aquatic life; however, it is impaired due to low levels of dissolved oxygen (TCEQ 2014). Los Olmos Creek, crossed at MP 19.1, is an estuarine tributary to Baffin Bay, which is designated as supporting high aquatic life use (TCEQ 2012, 2014). As shown in appendix G, East Main Drain (MP 82.4), Resaca de los Cuates (MP 118.9), and several unnamed freshwater intermittent and perennial waterbodies are designated as low quality for supporting aquatic life.

The remaining freshwater waterbodies, which are not classified by the TCEQ, are predominately farm ponds and reservoirs, drainage canals, and streams that may support warmwater, freshwater fisheries. Tidal channels, flats, and estuarine wetlands from MP 125.0 to the terminus of the route that receive tidal exchange with the BSC or lower Laguna Madre are not designated by the TCEQ but support warmwater estuarine fisheries.

The channel to San Martin Lake (MP 133.5) and Bahia Grande Channel (MP 135.2), as well as estuarine emergent and scrub-shrub wetlands and mudflats from MP 131.6 to the pipeline terminus, have the potential to provide EFH for estuarine-dependent species. In addition, The Arroyo Colorado (MP 100.1) and Los Olmos Creek (MP 19.1) both provide EFH about 0.25 mile downstream of the pipeline crossings. Waterbodies that provide EFH may also contain suitable habitat for state and federally listed species. EFH is discussed in section 4.6.3; impacts on federally listed species are discussed in section 4.7.

4.6.2.2 Impacts and Mitigation

LNG Terminal

Potential impacts on aquatic resources during construction and operation of the LNG Terminal include those associated with dredging and dredged material placement; construction of LNG Terminal facilities, including the marine berths and turning basin; vessel traffic; site modification and stormwater runoff; water use, including hydrostatic testing and operation of the firewater system; facility lighting; and spills or leaks of hazardous materials. Several public scoping comments expressed concern over impacts on aquatic resources from Project construction and operation, including those impacts identified above.

Dredging

RG LNG proposes to dredge 94.3 acres of open water (including about 68.7 acres within the BSC outside of the LNG Terminal site boundary), and 14.3 acres of wetlands and mudflats to create the marine facilities. As discussed in section 4.3.2.2, additional open water areas within the BSC may be affected by dredging. The MOF would be dredged to a depth of -10 feet MLLW (plus -2 feet of overdredge allowance) and would generate about 39,000 yd^3 of dredged material. During construction of the marine berths and the turning basin, about 6.5 mcy of material would be dredged and about 0.6 mcy of material would be removed by land-based excavation. The marine berths and turning basin would be dredged to a depth of about -43 feet MLLW (plus -2 feet of overdredge allowance). In addition, 0.4 acre of open water would be within the firewater intake canal. RG LNG proposes to conduct all dredging and excavation during Stage 1 of Project construction as part of site preparation. Dredging for the MOF would require about 2 weeks; dredging of the remaining marine facilities would occur over a period of 14 months. Dredging would permanently modify the profile of the BSC, and would convert existing wetlands and mudflats to open water.

Potential impacts on aquatic resources resulting from dredging activities include direct take and habitat modification as well as temporary increases in noise, turbidity, and suspended solid levels. Most fish species are highly mobile and would likely leave the area during dredging activities. During dredging, the benthic community would be reduced in species richness, species abundance, and biomass through direct mortality. This would reduce the amount of prey available for fish species in the Project area; however, marine worms such as polychaetes and oligochaetes, as well as other benthic species would quickly recolonize disturbed areas following dredging. Through natural processes and rapid population growth, these species take advantage of unoccupied space in newly exposed sediments (Minerals Management Service 2004). Therefore, we anticipate that dredging would result in a negligible, temporary impact on the benthic community. Following construction activities, aquatic resources would return to the recessed berthing area, which would be similar to the existing habitat within the BSC, but would contain an additional 30.2 acres of open water habitat and have an increased water depth within the marine facilities.

Dredging would result in the conversion of 3.7 acres of estuarine emergent marsh and 10.6 acres of mudflats to open water habitat. Because wetlands at the LNG Terminal site were isolated by construction of the BSC and SH-48, they have restricted tidal exchange and reduced function as habitat for aquatic species. The permanent reduction in wetland and mudflat habitat within the Project area is not expected to result in significant displacement of aquatic species.

Dredging activities would temporarily increase noise, turbidity, and suspended solid levels within the water column, which could reduce light penetration and the corresponding primary production 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 suitability of spawning habitat. Sediments in the water column could be deposited on nearby substrates, burying aquatic macroinvertebrates. Impacts on aquatic resources due to increased turbidity and suspended solid levels would vary by species; however, the aquatic resources present within the Project area are likely accustomed to regular fluctuations in noise and turbidity levels from regular maintenance dredging within the BSC. Further, conditions would be expected to return to pre-construction conditions within a few hours of the end of dredging (COE 2014). The Laguna Madre and South Bay connect to the BSC more than 2.5 miles from the LNG Terminal site; therefore, impacts of dredging and dredged materials on seagrass beds and oyster beds within these waterbodies are not anticipated.

Invertebrate and finfish species spawn, feed, and migrate in the vicinity of the New Work and Maintenance ODMDS sites and Feeder Berm (see section 4.2.3). Placement of dredged materials at these locations would result in impacts similar to those described for dredging activities, including increased turbidity and sedimentation resulting in reduced light penetration, depleted dissolved oxygen concentrations, decreased foraging success, and burial from settling sediments. These temporary impacts could affect the movement or migration of adult finfish. Early life stage invertebrates and finfish (e.g., larvae and juveniles) could suffer mortality from burial in sediment or stress from adverse environmental conditions (e.g., reduced dissolved oxygen).

All dredging would be conducted using equipment designed to meet the Texas state water quality standards and in accordance with applicable COE permit requirements, which would require that construction activities be performed in a manner to minimize turbidity in the work area and otherwise avoid adverse effects on water quality and aquatic life. RG Developers submitted the CWA Section 10/404 application to the COE for the LNG Terminal on July 27, 2016, and submitted a revised permit application on March 30, 2018. Given the temporary nature of dredging and dredged materials placement operations, and because RG LNG would be required to implement the measures in applicable COE permits and the state water quality requirements for dredging and dredged material management, we conclude that dredging and dredged materials placement for construction and operation of the LNG Terminal would have short-term and minor impacts on fisheries resources.

Pile-driving

Where practicable, RG LNG would construct the marine facilities from the shoreline to minimize potential impacts on aquatic resources; however, construction of the LNG Terminal would require the installation of four in-water piles to support the marine facilities (two at the MOF and two for the fixed aid to navigation), which would take about four days. As discussed in section 2.5.1.3, pile-driving activities would take place up to 10 hours per day, 5 days per week. Marine pile-driving would also be required for sheet piling at the MOF, which is anticipated to occur over 25 days. 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.

In discussing the impacts of sound on aquatic resources, it is important to note the difference in sound intensity in air versus water. Sound in water and sound in air are both waves that move similarly and can be characterized the same way; however, the differences in density and sound speed (the speed at which the sound wave travels through the medium, in this case air or water) result in a different reference pressure in air than in water.

As in-water pile-driving has been proposed, RG LNG has provided preliminary estimates of underwater noise resulting from pile-driving based on literature reviews. Steel pipe piles and concrete piles would be driven with impact hammers. RG LNG has committed to using vibratory hammers to drive the sheet pilings at the MOF, which would result in lower sound levels than impact-driven piles; however, if refusal is met, an impact hammer may be employed. Table 4.6.2-2 summarizes the underwater sound associated with marine pile-driving for the Project.

Table 4.6.2-2
Estimated Sound Levels from Underwater Pile-Driving for the Rio Grande LNG Project and Effects Levels for Fish

Pile-driving Activity or Effect Level	Cumulative Sound Exposure Level (SEL_{cum}) (dB re 1 μPa^{2}s)[a,b]	Root Mean Square Sound Level (dB RMS) (dB re 1 μPa)[c]	Peak Sound Level (dB re 1 μPa)[d]
36- to 48-inch Steel pile (impact hammer)[e]	175 to 185[e]	185 to 195	198 to 210
36- to 48-inch concrete pile (impact hammer)[e]	166[e]	176	188
Sheet pile (vibratory hammer/impact hammer)[f]	--	163/195	--
Behavioral effects	--	150	--
Injury onset (all sizes)	--		206
Injury onset (>2 grams)	187	--	--
Injury onset (<2 grams)	183	--	--

Sources: NMFS 2017, California Department of Transportation 2015, Stadlar and Woodbury 2009, ICF Jones and Stokes 2012.

[a] 1 μPa is a reference pressure of 1 micropascal, used for underwater sound propagation.

[b] SEL_{cum} = cumulative sound exposure level. The cumulative sound exposure level is the energy accumulated over multiple strikes or continuous vibration over a period of time.

[c] The root mean square exposure level is the square root of the average squared pressures over the duration of a pulse and represents the effective pressure and intensity produced by a sound source.

[d] Peak sound pressure level is the largest absolute value of instantaneous sound pressure.

[e] Estimated values include range of underwater sound levels for water-based pile-driving of steel piles between 36 and 60 inches in diameter for land- and marine-based piled-driving, and 24-inch concrete piles (NMFS 2017).

[f] These values are single strike values, which are used to develop the cumulative sound levels during modeling.

Sound is measured in decibels, which are relative units that compare two pressures: the sound pressure and a reference pressure. The reference pressures typically used for air and water are not the same, and a direct comparison of values between in-air and underwater noises is not appropriate. Underwater sounds use a reference pressure of 1 micropascal (μPa) while in air sounds have a reference pressure of 20 μPa. For in-air sound levels, the reference pressure is often not explicitly stated, as is the case in this text; in-air sound level estimates are described in detail in section 4.11.2. The reference pressure of underwater sounds is typically stated, and is presented in this text. This is done to remind readers of the different reference pressures between underwater and in air sound levels, and avoid direct comparison. Therefore, in this text, in air sound levels are presented in decibels while underwater sound levels are presented as "dB referenced to (re) 1 μPa." Underwater sound levels may also include a distance to indicate setback from the sound source. For example, a setback distance of 1 meter would be expressed as "dB (re 1 μPa) at 1 meter." Propagation distances in water are farther than in air because water is denser; however, loudness underwater diminishes quickly with distance from the sound source.

The primary impacts on aquatic resources from pile-driving activities would be avoidance of the area, stress, or injury due to the 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 (Popper and Hastings 2009). NMFS uses 150 decibels at a reference pressure of 1 μPa (dB re 1 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 root mean square (RMS) can cause temporary behavior changes (startle and stress) that could decrease a fish's ability to avoid predators (NMFS 2017). The thresholds for the onset of injury to fish are summarized in table 4.6.2-2. Table 4.6.2-3 includes the distances required for in-water pile-driving noise to attenuate to below the impact levels identified in table 4.6.2-2.

Table 4.6.2-3
Estimated Zones of Impact for Fish from Underwater Pile-Driving Sound

Pile-driving Activity or Effect Level	Installation Method	Distance to Attenuation Below Take Levels (feet)[a]		
		Steel Sheet Pile	Steel Pipe Pile	Concrete Pile
Behavioral (150 dB RMS)	Vibratory	241.3 feet	--	--
	Impact	6.2 miles[b]	1.3 miles	0.3 mile
Injury (206 dB re 1 μPa)	Vibratory	0.0 feet	--	--
	Impact	60.6 feet[b]	9.6 feet	2.1 feet

[a] Where the distance is 0.0 feet, the source level is less than the noted threshold.
[b] RG LNG does not propose to install sheet piling using an impact hammer unless refusal is met with the vibratory hammer.

As RG LNG's estimated sound levels for pile-driving exceed the threshold for behavioral effects and injury to fishes, pile-driving activities could result in the mortality, injury, or disturbance of fishes that are present immediately adjacent to pile-driving activity. However, given RG LNG's commitment to conduct the majority of pile-driving from land to minimize impacts on aquatic resources, and the planned use of a vibratory hammer for the sheet piling at the MOF, which would likely cause behavioral impacts but not injury, we find that overall impacts on fish would be temporary and minor. A discussion of impacts on protected marine species from pile-driving is included in section 4.7.

Vessel Traffic

During construction and operation of the LNG Terminal, barges, support vessels, and LNG carriers would call on the LNG Terminal, thereby increasing ship traffic within the BSC and Gulf of Mexico. Potential impacts on aquatic marine mammals resulting from vessel strikes are discussed in section 4.7.2. Potential impacts on aquatic resources resulting from increased vessel traffic include shoreline erosion and resuspension of sediments, ballast water discharges, cooling water discharges, and increased noise levels. The following sections describe these potential impacts as well as measures proposed by RG LNG to minimize impacts on aquatic resources.

Shoreline Erosion and Resuspension of Sediments

During construction of the LNG Terminal, barges would deliver large equipment and materials to the LNG Terminal site. RG LNG estimates that barges would make 880 marine deliveries to the LNG Terminal site during construction. Marine deliveries to the LNG Terminal site would occur about 15 times per month during the first 5 years of construction; no deliveries are currently anticipated during the remainder of the construction period, though sporadic deliveries could occur as needed. During operation, about 312 LNG carriers would be expected to call on the LNG Terminal per year (see section 4.9.4).

Vessel traffic during construction and operation along the BSC, in the turning basin and berthing areas, could increase shoreline erosion and suspended sediment concentrations due to increased wave action. Turbidity resulting from suspension of sediments could reduce light penetration and photosynthetic oxygen production. Disturbance could also introduce chemical and nutrient pollutants from sediments, if present. The channel embankments and slope of the LNG Terminal site along the BSC, and the marine facilities would be modified during construction and the shoreline would be stabilized using rip-rap to minimize the potential for erosion due to vessel traffic (see section 4.1.3.4). In addition, as described in section 4.3.2.2, current speeds within the BSC near the LNG Terminal site are estimated to be similar to pre-Project conditions, thereby reducing the potential for increased erosion due to stronger currents after construction.

The BSC was specifically created to provide deepwater access for maritime commerce and is maintained by regular dredging. Similarly, LNG carriers transiting the Gulf of Mexico would use established shipping channels. As such, use of the waterways by LNG carriers, barges, and support vessels during construction and operation of the LNG Terminal would be consistent with the planned purpose and use of these active shipping channels, and associated impacts on aquatic resources due to increased shoreline erosion and resuspension of sediments would be negligible.

Ballast Water Discharge and Hull Fouling

The effects of ballast water discharges on four ambient water quality parameters (i.e., temperature, pH, dissolved oxygen, and salinity) are described in section 4.3.2.2. Ballast water is stored below the ship's hull; as a result, the temperature of discharged water is not expected to deviate substantially from ambient water temperature. The pH of ballast water would be similar to seawater, and would therefore be similar to the pH in the BSC, which receives tidal flow from the Gulf of Mexico. Therefore, any changes in salinity levels resulting from ballast water discharges would be negligible.

Dissolved oxygen levels below 4 milligrams per liter (mg/L) are generally considered unhealthy for aquatic life, and levels below 2 mg/L are considered hypoxic and inadequate to support most aquatic life. As discussed in section 4.3.2.2, ballast water would contain low dissolved oxygen levels and could decrease existing dissolved oxygen levels within the immediate vicinity of the discharge point. Depending on the oxygen levels present in both the ballast and ambient water at the time of discharge, aquatic resources present in the vicinity of the discharge point could be exposed to dissolved oxygen levels considered unhealthy for aquatic life. The general adaptability of resident species within the BSC to natural variation in oxygen levels, and the ability to move over a short distance to more suitable conditions, would minimize the adverse impacts associated with ballast water discharges.

Vessels calling on the LNG Terminal would be required to adhere to the EPA and Coast Guard regulations[28] that prevent the introduction of exotic species such as:

- limiting the concentration of living organisms in ballast water;
- washing anchors and anchor chains to remove organisms at their point of origin;
- removing fouling organisms;
- cleaning ballast tanks regularly; and
- disposing of any waste in accordance with regulations.

Given that the amount of ballast water discharged into the BSC during each LNG carrier visit to the LNG Terminal during operations would make up less than 0.1 percent of the approximately 25 billion gallons of water within the BSC, and because vessels would be subject to U.S. regulations to prevent the introduction of exotic species, we have determined that impacts on aquatic resources from ballast water discharges or hull fouling would be negligible.

Cooling Water Discharge

During operation, LNG carriers use water to cool the main engine, other machinery, and for hoteling services as described in section 4.3.2.2. The cooling water would be withdrawn from and then returned to the BSC. The volume of cooling water used per vessel would be negligible compared with the total volume of the BSC. Intake of water can result in the entrainment of aquatic resources. Intakes are screened; screens are typically spaced about 25 millimeters or more apart and would avoid impacts on most pelagic adult and juvenile finfish (Gatton 2008). However, early life stages that use the channel for nursery habitat would be more susceptible to entrainment. Based on the lack of identified spawning or nursery habitat within the BSC, the loss of eggs and larvae during cooling water intake is expected to be minor.

Cooling water return temperatures vary widely depending on the type of LNG carrier and mode of operation. Based on a review of available information for a similar project in the Gulf of Mexico, we anticipate that cooling water discharged at the LNG Terminal site could range between 2.7 and 7.2 °F warmer than ambient water temperatures (FERC 2015). Fish and invertebrates within the immediate vicinity of the LNG carrier could be temporarily affected by this increase in temperature; however, many of the species present are mobile and would be expected to relocate to more suitable conditions during discharges. Given the volume of cooling

---

[28] Applicable laws, programs, and regulations include the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990; the National Invasive Species Act of 1996; the National Aquatic Invasive Species Act of 2003, as amended; the National Ballast Water Management Program; the Shipboard Technology Evaluation Program; NVIC 07-04, Change 1; and Vessels Carrying Oil, Noxious Liquid Substances, Garbage, Municipal or Commercial Waste, and Ballast Water.

water discharged relative to the total volume of water within the BSC, and the mobility of resident species, we have determined that impacts on aquatic resources from cooling water discharge would be intermittent and minor.

Increased Noise Levels

Engine noise produced by LNG carriers would result in temporary increases in underwater noise levels near the transiting ships. Noise generated by LNG carriers is generally omni-directional, emitting from all sides of the vessel (Whale and Dolphin Conservation Society 2004). However, sound levels 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 shipping 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 BSC and the mobility of resident species, we have determined impacts on aquatic resources associated engine-noise produced by LNG carriers during operation of the LNG Terminal would be intermittent and minor.

<u>Site Construction and Stormwater Runoff</u>

Clearing and ground disturbance for construction of the LNG Terminal 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. During operation, the amount of impervious surface that would be constructed for the LNG Terminal would result in an increased volume of stormwater runoff. Potential impacts from stormwater runoff on aquatic resources include increased turbidity and suspended solid levels, which are discussed above (see section 4.6.2.2, *Dredging*).

RG LNG would install erosion and sediment controls in accordance with its Plan and Procedures prior to beginning construction of the LNG Terminal (see appendices D and E). An EI would monitor field conditions daily in areas of active construction to ensure that the erosion and sediment controls were properly installed, adequate, and functional. Measures to control erosion and sedimentation during construction are discussed in detail in section 4.2.2.1 and in RG LNG's SWPPP. Per our recommendation in section 4.2.2.1, a final construction SWPPP as well as copies of RG LNG's operational SWPPP would be filed with the Secretary prior to construction. To manage runoff at the LNG Terminal site, RG LNG would construct a stormwater levee, drainage system, and stormwater ponds. The stormwater levee would be constructed surrounding the LNG Terminal site to protect the site from flooding, which is further discussed in section 4.1.3.3.

During construction and operation of the LNG Terminal, stormwater runoff would be discharged to the BSC via the drainage system and ponds, and would not be directed to the hypersaline Bahia Grande. Where stormwater could be contaminated by spills or leaks of hazardous materials, such as near the LNG trains and truck loading areas, it would be directed through an oil water separator prior to discharging to the BSC. Releases from stormwater ponds to the BSC would be controlled to reduce potential shoreline scour. Based on this drainage design and adherence to measures described in the SWPPP, the potential for impacts on fisheries resources from stormwater runoff and spills would be negligible.

Facility Water Use

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 BSC and treated via filtration or use of a corrosion inhibitor, if needed, before use, as described in section 4.3.2.2. The water withdrawal process could entrain fish eggs and juvenile fish present near the intake structures within the BSC. RG LNG would appropriate water from the BSC at a rate of 3.7 to 5.0 million gallons per day (between 2,604 and 3,472 gpm) and would place the intake structures (screened with 5- to 8-millimeter mesh) as deep as possible to reduce the impingement of biological organisms and debris from the intake screens. RG LNG developed a draft LNG Tank Hydrostatic Test Plan for the use of water from the BSC for hydrostatic testing, which would be finalized prior to construction in accordance with our recommendation in section 4.3.2.2. RG LNG is also consulting with NMFS and TPWD to identify requirements and mitigation measures for water withdrawal. With the implementation of these measures, impacts on aquatic resources as a result of water intake would be temporary and negligible.

Freshwater would be used to hydrostatically test freshwater storage tanks and piping and would be discharged to the BSC. RG LNG would minimize the amount of water required for hydrostatic testing by reusing water at multiple test locations, as practicable. Where possible, this water would also be reused for dust suppression or other onsite uses. Following completion of the hydrostatic tests, municipal water would be tested for contamination prior to release. The volume of discharge would be negligible compared with the total volume of the BSC (estimated to be about 25 billion gallons). As aquatic organisms in the BSC are subjected to salinity changes from precipitation events and tidal fluctuations, we have determined that impacts on aquatic resources due to the discharge of hydrostatic test water would be temporary and negligible.

Firewater System

During operation of the LNG Terminal, a firewater system would be maintained for fire emergencies. When in operation, the system would be supplied by a freshwater storage tank filled with municipal water. If the tank were depleted or unavailable, seawater would be pumped from the BSC, via a short water intake channel, at a rate of about 6,770 gpm. Intake structures would be screened to minimize entrainment of aquatic resources and prevent debris from entering the system. After use, water would be directed into the LNG Terminal's stormwater drainage system before being discharged back into the BSC. Because of the infrequent operation of the seawater system and use of screening to minimize entrapment of aquatic resources, we conclude that the firewater system would have intermittent and negligible impacts on aquatic resources.

Lighting

Illumination of surface waters during construction and operation 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. The Project would require adequate lighting for construction, facility operations, and safety; however, RG LNG would minimize the effects of artificial lighting by limiting outdoor lighting to that required by regulation, and designing shielded or downward facing lighting to minimize dispersion. Generally, impacts on aquatic species from nighttime lighting at the LNG Terminal site would be minor, if present within or immediately adjacent to illuminated areas, as these species may change their feeding habits over time. However, we have determined that the overall impacts on aquatic resources from increased lighting during construction and operation of the LNG Terminal would be negligible given the measures to minimize the dispersion of nighttime lighting.

Inadvertent Spills

During construction and operation, hazardous materials entering the BSC from spills or leaks could have adverse impacts on aquatic resources. The impacts are caused either by the physical nature of the material (e.g., physical contamination and smothering) or by its chemical components (e.g., toxic effects and bioaccumulation). These impacts would depend on the depth and volume of the spill, as well as the properties of the material spilled. As discussed in section 4.3.2.2, RG LNG would implement its SPCC Plan during construction and operation of the LNG Terminal, which includes spill prevention measures, mitigation measures, and cleanup methods to reduce potential impacts should a spill occur. The draft SPCC Plan also addresses storage and transportation of hazardous materials; we have recommended that these plans be finalized prior to construction in section 4.2.2.1. Given these impact minimization and mitigation measures, we conclude that the probability of a spill of hazardous materials entering the BSC is small and any resulting impacts on aquatic resources would be temporary and minor.

Pipeline Facilities

Header System and Pipeline 1

Impacts on aquatic resources from construction and operation of the Header System and Pipeline 1 could result from in-water construction, inadvertent spills, and hydrostatic testing. One intermittent waterbody would be crossed by the Header System via open cut. The centerline of Pipeline 1 would cross 62 waterbodies, including 21 perennial streams, 19 intermittent streams, 9 ephemeral streams, and 13 ponds and reservoirs. RB Pipeline would cross 26 waterbodies via trenchless construction methods, including 5 by conventional bore and 21 by HDD. In addition, four waterbodies would be within the construction workspace but not crossed by the Pipeline 1 centerline, and three waterbodies would be located within ATWS for Pipeline 1. A detailed characterization of the waterbodies that would be crossed by the Pipeline System is provided in section 4.3.2 and appendix G. Following construction of Pipeline 1, waterbody contours would be restored to pre-construction conditions, and riparian areas would be revegetated using native grasses, legumes, and woody species. However, riparian areas are not expected to return to pre-construction conditions in the relatively short period between construction of Pipeline 1 and Pipeline 2.

Pipeline 2

Construction of Pipeline 2 would commence about 18 months after Pipeline 1 is placed in service, but would be collocated with Pipeline 1 and would have similar impacts on aquatic resources. Construction of Pipeline 2 would cross 60 of the waterbodies crossed by Pipeline 1 using the same methods. Two waterbodies would be crossed using different methods: farm pond HY-T05-002 at MP 114.07 would be crossed by the centerline of Pipeline 1 and would be in the construction workspace for Pipeline 2, and ephemeral stream SS-T09-004 at MP 130.0 would be crossed by the centerline of Pipeline 2, but within the construction workspace for Pipeline 1 (see appendix G).

General Impacts of the Pipeline System

In general, impacts on fisheries resulting from pipeline construction activities at waterbody crossings could include sedimentation and turbidity, alteration or removal of in-stream and stream bank cover, and introduction of water pollutants (see section 4.3.2). Suspension of deposited organic material and inorganic sediments could cause an increase in biological and chemical use of oxygen, potentially resulting in a decrease of dissolved oxygen concentrations in the affected area. Lower dissolved oxygen concentrations could cause temporary displacement of mobile organisms, such as fish, and may kill non-mobile organisms within the affected area.

Because intermittent and ephemeral waterbodies provide limited habitat value for aquatic resources, impacts on aquatic resources as a result of crossing these waterbodies would be negligible. RB Pipeline would use open-cut and trenchless waterbody crossing methods as described in section 2.5.2.1. An open-cut crossing would result in short-term increases in turbidity downstream of the pipeline crossing. The concentration of suspended solids would decrease rapidly after completion of in-water work, but the increased siltation may cause degradation of benthic habitat and decreased flow of oxygenated water to benthic organisms. Direct loss of benthic invertebrates and protective cover may occur at open-cut crossing locations due to trenching and backfilling in the streambed.

Impacts on aquatic organisms within waterbodies that would be crossed by trenchless construction methods (conventional bore and HDD) would generally be avoided since the waterbody and its banks would not be disturbed by clearing or trenching. However, if an inadvertent release of HDD drilling fluid occurs within a waterbody, the resulting turbidity could have a short-term effect on aquatic organisms. RB Pipeline would implement its HDD Contingency Plan,[29] which addresses methods for detecting and responding to inadvertent returns. For water withdrawals required for HDD operation, the intakes would be screened with 100 mm mesh to minimize entrainment of aquatic organisms. Further, in accordance with the Project-specific Procedures, pumps operating within 100 feet of a waterbody would be within appropriate containment to prevent spills.

---

[29] RG Developers' HDD Contingency Plan is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20160829-5283.

RB Pipeline would implement the measures in its Procedures to minimize impacts on aquatic resources, including maintaining adequate flow rates throughout construction to protect aquatic life and prevent the interruption of downstream uses; installing and maintaining erosion and sediment controls; and restoring and stabilizing waterbody contours following construction. To provide greater protection for warmwater fisheries, RB Pipeline would complete in-water construction activities between June 1 and November 30, unless otherwise expressly permitted in writing by the TPWD and FWS. In addition to construction through waterbodies, RB Pipeline has also proposed to withdraw water from multiple waterbodies for use during hydrostatic testing, HDD construction, and dust suppression (see section 4.3.2.2).

Where waterbodies are located within construction workspaces, but not crossed by the pipeline, RB Pipeline would install erosion controls, matting, and/or temporary equipment bridges where needed in accordance with its Procedures.

Refueling of vehicles and storage of fuel, oil, or other hazardous materials near surface waters or wetlands could result in accidental spills that could impact aquatic resources through physical contamination, smothering, habitat degradation, toxic effects, and bioaccumulation. RB Pipeline would implement its SPCC Plan during construction, which would include spill prevention measures and cleanup methods to reduce potential impacts should a spill occur. In addition, refueling and storage of hazardous materials would be restricted within 100 feet of a wetland or waterbody. With adherence to the mitigation measures in these plans, impacts of potential spills on aquatic resources associated with the Pipeline System would be minimal.

Hydrostatic Testing

Following construction, the pipelines would be hydrostatically tested using water withdrawn from multiple surface waterbodies (see section 4.3.2.2). Water withdrawals could result in temporary loss of habitat, change in water temperature and dissolved oxygen levels, and entrainment or impingement of fish or other aquatic organisms. Where practicable, RB Pipeline would minimize surface water withdrawals for hydrostatic testing by transferring test water between pipeline segments. RB Pipeline would withdraw surface water at a maximum rate of 2,000 gpm, such that downstream flow is maintained, and pump intakes would be screened with 4-millimeter mesh to minimize potential entrainment of aquatic organisms. Hydrostatic test water would be discharged via energy dissipating devices and in accordance with hydrostatic test discharge permits and the Project-specific Plan and Procedures. With RB Pipeline's proposed mitigation measures, we conclude that hydrostatic testing would not significantly impact aquatic resources.

Aboveground Facilities

RB Pipeline would construct three compressor stations, eight metering sites, and additional appurtenant facilities as part of the proposed Project; impacts from Compressor Station 3 are discussed above, as it would be within the boundaries of the LNG Terminal site. No waterbodies are located within the aboveground facilities and RB Pipeline would install erosion and sediment controls to prevent migration of sediment outside of construction workspace; therefore, no direct or indirect impacts on aquatic resources would be associated with the aboveground facilities.

Contractor/Pipe Yards

Three contractor/pipe yards would be used during construction of the pipeline facilities. No waterbodies are located within the contractor/pipe yards, and RB Pipeline would install erosion and sediment controls to prevent migration of sediment outside of contractor/pipe yards; therefore, no direct or indirect impacts on aquatic resources from the use of contractor/pipe yards would result.

Access Roads

Temporary and permanent access roads would be used for access to the pipeline facilities during construction. Where temporary access roads would cross waterbodies or are sited in estuarine wetlands, as discussed in sections 4.3.4.2 and 4.4.2.1, impacts on aquatic resources could include temporary loss of habitat and increased erosion and sedimentation. One waterbody would be crossed by permanent access road HS-001, which is associated with the Header System. RB Pipeline would minimize potential impacts on wetlands and waterbodies by installing and maintaining erosion and sediment controls per its Plan and Procedures.

Existing roads that would be used for temporary access to the pipeline facilities for construction would require five waterbody crossings. One waterbody would be crossed by permanent access road HS-001, which is associated with the Header System. Waterbodies would be crossed by installation of a new culvert, using existing culverts, or installation of equipment mats, where appropriate. RB Pipeline would not use fill in wetlands crossed by access roads, and would place mats over saturated soils in crossed wetlands to reduce impacts from rutting and compaction. The construction of access roads within wetlands is an alternative measure to the FERC Procedures, and is discussed further in sections 3.3.2 and 4.4.2.1. Temporary access roads would not require modification, other than the modifications described above for wetland and waterbody crossings.

In conclusion, construction of the Rio Grande LNG Project would result in minor impacts on aquatic resources due to water quality impacts and direct mortality of some immobile individuals during dredging and installation of the Pipeline System across waterbodies. Further, noise from pile-driving would result in temporary and minor impacts on fish. In addition, spills of hazardous materials could affect water quality and affect aquatic organisms during construction and operations; however, implementation of mitigation measures in RG Developers' SPCC Plans and Plan and Procedures would minimize potential impacts. During operations, the Project would have minor impacts on aquatic resources due to maintenance dredging and increased vessel traffic. Permanent impacts on aquatic habitat would occur where open water would be converted to industrial/commercial land within the LNG Terminal site and where dredging would convert existing wetlands and mudflats to open water; however, the permanent reduction in wetland and mudflat habitat within the Project area is not expected to result in significant displacement of aquatic species.

4.6.3 Essential Fish Habitat

4.6.3.1 Regulatory Background

One of the goals of the MSFCMA, as amended in 1996, is promoting the protection of EFH in the review of projects 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. All estuaries and estuarine habitats in the northern Gulf of Mexico are considered EFH (NMFS 2010). 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 and the ESA, to reduce duplication and improve efficiency. 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 the 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 should include a description of the proposed action; an analysis of the effects (including cumulative effects) of the proposed action on EFH, the 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 would provide recommendations to the action agency regarding measures that can be taken by that agency to conserve EFH; and
- Agency Response – The action agency must respond to NMFS within 30 days of receiving recommendations from NMFS. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impacts 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.

The FERC proposes to incorporate EFH consultation for the Rio Grande LNG Project with the interagency coordination procedures required under NEPA. As such, we request that NMFS consider the draft EIS, and RG Developers' draft EFH assessment (appendix L), as our initiation of EFH consultation. We will update our EFH assessment and consultation with NMFS, if necessary, as we receive additional Project information from RG Developers.

4.6.3.2 Characterization of Essential Fish Habitat

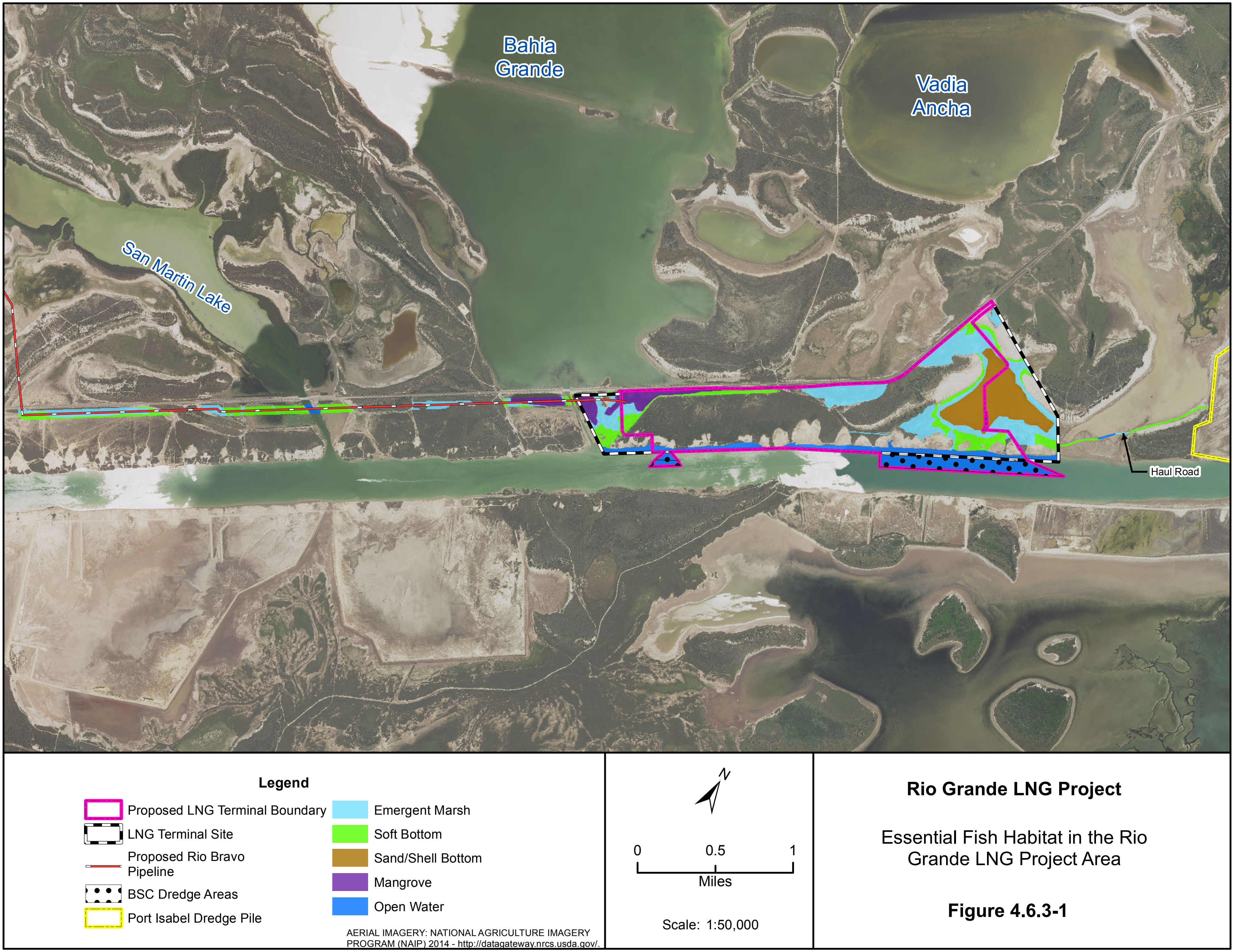
NMFS and the Gulf of Mexico Fishery Management Council (GMFMC) have identified EFH for shrimp, red drum, reef fish, coastal migratory pelagic, and highly migratory pelagic species in the vicinity of the Rio Grande LNG Project (NMFS 2015, GMFMC 2004). Table 4.6.3-1 identifies the managed species and life stages with designated EFH that potentially occur in the Project area. Habitats within the Project vicinity that are designated as EFH include estuarine emergent and scrub-shrub (mangrove) marsh, estuarine unconsolidated bottom habitat (including soft-bottom and sand-shell bottom habitats), and open water (see figure 4.6.3-1). As discussed in section 4.3.2.2, additional open water areas within the BSC may be affected by dredging.

Estuarine emergent marsh habitat occurs along the southern extent of the Pipeline System from MP 125.0 to its terminus, as well as at the LNG Terminal site. Marshes require soft sediments, regular tidal inundation, some freshwater, and low to moderate wave energy (GMFMC 2004). Estuarine emergent marsh provides nursey, shelter, and feeding habitat for many fish and estuarine species, including larval and juvenile brown and white shrimp; larval, juvenile, and adult red drum; juvenile dog snapper; and adult gray snapper (GMFMC 2004). Impacts on nursery habitat were identified as an issue of concern in public scoping comments. Many of the wetlands at the LNG Terminal site were isolated by construction of the BSC and SH-48, and have restricted tidal exchange.

Black mangrove-dominated wetlands occur in the Project area along the southern extent of the Pipeline System from MP 134.8 to the terminus, as well as at the LNG Terminal site. Similar to estuarine emergent marshes, black mangrove wetlands provide nursey, shelter, and feeding habitat for many fish and estuarine species. Managed species and life stages that could occur in mangroves in the Project area include adult gray snapper; juvenile lane snapper, dog snapper, and yellowmouth grouper; and larval and juvenile goliath grouper (GMFMC 2004). Mangrove wetlands at the LNG Terminal site were likely isolated by construction of the BSC and SH-48, and have restricted tidal exchange.

Soft-bottom habitat, including mudflats at the LNG Terminal site and along the pipelines between wetlands and open water habitats, include sparsely vegetated areas with a mud or clay substrate. Sand/shell habitats have a sandy substrate and include the Bahia Grande Channel and the open water lagoon at the LNG Terminal site (Aquatic Resource 1). The proposed temporary haul road would cross another sand/shell habitat but its use is still under consideration (see sections 3.3.2 and 4.4.2.1). 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). Managed species and life stages that could occur in unconsolidated bottom habitat in the Project area include larval and juvenile brown and white shrimp; larval, juvenile, and adult red drum; juvenile lane snapper; and adult gray snapper (GMFMC 2004).

Open water habitat designated as EFH in the Project area is present within the BSC, the channel to San Martin Lake, and the Bahia Grande Channel. In addition, open water EFH occurs at potential offshore dredged material disposal sites and the Feeder Berm. Estuarine and nearshore water column habitats support several managed species and their prey at various life stages by providing suitable habitat for spawning, breeding, and foraging. Managed species identified in table 4.6.3-1 could transit or use open water as habitat. The community composition of both the mud substrates and water column within the BSC are subject to frequent disturbance due to maintenance dredging, and vessel transit.



Rio Grande LNG Project

Essential Fish Habitat in the Rio Grande LNG Project Area

Figure 4.6.3-1

Table 4.6.3-1 Life Stage Occurrence for Species with Designated Essential Fish Habitat Occurring in the Rio Grande LNG Project Area						
Common Name	**Scientific Name**	**Fishery Management Plan**	**Eggs**	**Larvae / Neonates**	**Juveniles**	**Adults**
Brown shrimp	*Penaeus aztecus*	Shrimp	--	--	X	--
White shrimp	*Penaeus setiferus*	Shrimp	--	--	X	--
Red drum	*Sciaenops ocellatus*	Red Drum	--	X	X	X
Gray snapper	*Lutjanus griseus*	Reef Fish	--	--	--	X
Lane snapper	*Lutjanus synagris*	Reef Fish	--	--	X	--
Dog snapper	*Lutjanus jocu*	Reef Fish	--	--	X	--
Goliath grouper	*Epinephelus itajara*	Reef Fish	--	X	X	--
Yellowmouth grouper	*Mycteroperca interstitialis*	Reef Fish	--	--	X	--
Cobia	*Rachycentron canadum*	Coastal Migratory Pelagics	--	--	X	X
Spanish mackerel	*Scomberomorus maculatus*	Coastal Migratory Pelagics	--	--	X	X
King mackerel	*Scomberomorus cavella*	Coastal Migratory Pelagics	--	--	X	X
Atlantic sharpnose shark	*Rhizoprionodon terraenovae*	Highly Migratory Species	--	X	X	X
Blacktip shark	*Carcharhinus limbatus*	Highly Migratory Species	--	X	X	X
Bonnethead shark	*Sphyrna tiburo*	Highly Migratory Species	--	X	X	X
Bull shark	*Carcharhinus leucas*	Highly Migratory Species	--	X	X	X
Finetooth shark	*Carcharhinus isodon*	Highly Migratory Species	--	X	--	--
Lemon shark	*Negaprion brevirostris*	Highly Migratory Species	--	X	X	--
Scalloped hammerhead shark	*Sphyrna lewini*	Highly Migratory Species	--	X	X	--
Silky shark	*Carcharhinus falciformis*	Highly Migratory Species	--	X	X	--
Spinner shark	*Carcharhinus brevipinna*	Highly Migratory Species	--	X	X	--
Tiger shark	*Galeocerdo cuvier*	Highly Migratory Species	--	--	--	X
Sources: GMFMC 2004, NMFS 2015.						

In addition, the Laguna Madre and South Bay contain EFH. The Laguna Madre and South Bay connect to the BSC more than 2.5 miles from the LNG Terminal site and would not be within the Project area. Further, impacts of the Project on surface water conditions in the Laguna Madre System would be negligible (see section 4.3.2.1). Therefore, impacts on EFH within the Laguna Madre and South Bay are not addressed further.

4.6.3.3 Impacts and Mitigation

LNG Terminal

Portions of the BSC, wetlands, waterbodies, and mudflats on the LNG Terminal site, the Bahia Grande Channel, and the water column at potential dredged material disposal sites and the Feeder Berm have been designated as EFH. The primary impact from construction of the LNG Terminal would include the loss and conversion of wetland, unconsolidated bottom, and open water areas as described in sections 4.3.2 and 4.4. The total acreage of each EFH type that would be directly affected due to dredging or fill at the LNG Terminal site are described below and are provided in table 4.6.3-2.

Table 4.6.3-2
Essential Fish Habitat affected by Construction and Operation of the Rio Grande LNG Terminal[a]

Facility[b]	Estuarine Emergent Marsh	Estuarine Scrub-Shrub Wetland	Soft Bottom Habitat	Sand/shell Bottom	Open Water	Total
LNG Terminal	114.9	19.8	47.7	47.7	127.1[c]	357.2
Temporary haul road	1.7	0.0	7.7	1.0	0.0	10.4
Offsite storage/parking	0.0	0.0	0.0	0.0	0.0	0.0
Port Isabel dredge pile	--	--	--	--	--	--
Bulk water loading area	0.0	0.0	0.0	0.0	0.0	0.0
Total	**116.6**	**19.8**	**55.4**	**48.7**	**127.1**	**367.6**

[a] Any discrepancies with the acres of EFH included in appendix L are due to rounding.
[b] With the exception of the temporary haul road, areas affected by construction of the LNG Terminal would be within the permanent operational footprint of the facility. The temporary haul road may or may not be used (see sections 3.3.2 and 4.4.2.1).
[c] Including 68.7 acres of open water within the BSC located outside the LNG Terminal site boundary that would be dredged for the marine facilities.

Construction of the LNG Terminal would result in the permanent loss of 230.1 acres of estuarine emergent marsh, estuarine scrub-shrub wetlands, soft bottom, and sand/shell bottom EFH (see table 4.6.3-2). In addition, 127.1 acres of open water EFH would be within construction workspaces. However, dredging for the marine facilities would create 30.2 acres of open water habitat; areas to be converted to open water would include 3.7 acres of estuarine emergent marsh and 10.6 acres of soft bottom EFH (mudflats). The wetlands at the LNG Terminal site are isolated from regular tidal exchange. Without regular tidal exchange, evaporation likely leads to hypersaline and anoxic conditions and therefore these wetlands likely provide limited function as EFH.

To mitigate for impacts on wetlands and waters that may serve as EFH, RG LNG has proposed to implement its Conceptual Mitigation Plan,[30] and provided a detailed Mitigation Alternatives Analysis[31] in October 2017 that describes the proposed mitigation. RG LNG is proposing to use permittee-responsible mitigation via offsite wetland preservation at a site about 1 mile south of the LNG Terminal on the south side of the BSC (the Loma Ecological Preserve). Consultation with the COE and other applicable agencies (including the EPA, FWS, and NMFS) to finalize the plan is ongoing (see section 4.4.2.4); however, construction of the LNG Terminal would not commence prior to finalization of the wetland mitigation plans and issuance of the COE's CWA Section 404/Section 10 permit.

In addition, about 233.8 acres of land, including 103.5 acres of wetlands and mudflats, occur at the LNG Terminal site outside the boundary of planned facilities. Of that area, about 10.5 acres would be dredged for a planned expansion of the Bahia Grande Channel for wetland restoration that is not related to the Rio Grande LNG Project, as discussed in section 4.3.2.2. The remaining areas would not be directly affected by Project construction, but would be retained as natural buffer.

Construction of the LNG Terminal would result in impacts on 127.1 acres of open water habitat within the BSC. The BSC is a man-made channel with steep slopes that is subject to maintenance dredging and disturbance by vessel traffic; therefore, the BSC does not provide conditions needed for the growth of submerged aquatic vegetation or oyster reefs that would provide cover, refuge, and food for managed species. In the event that RG LNG uses the New Work ODMDS, Maintenance ODMDS, or Feeder Berm for disposal of dredged material, open water EFH at these locations would also be affected. Additional detail regarding dredged material placement areas is provided in section 4.2.3. The final management of dredged material would be determined by the BND and COE, in consultation with other federal, state, and local resource agencies and interested stakeholders, such as the EPA, NMFS, FWS, and the TCEQ. RG LNG stated that it will provide updates related to impacts on EFH associated with dredged material disposal. We will use any updated information in our EFH consultation with NMFS; however, we note that NMFS would be involved in the decision to place any dredged materials in offshore locations and that the placement would be appropriately permitted. As such, we believe the results of the EFH consultation in this regard will conclude that any impacts at offshore dredged material placement areas would be adequately minimized.

RG LNG's proposal to construct and use the haul road would temporarily impact about 10.4 acres of EFH; however, as previously discussed, we are exploring possible alternatives to the construction and use of the haul road (see sections 3.3.2 and 4.4.2.1). Project-related activities with the potential to affect EFH and managed species include those associated with dredging and dredged material placement; pile-driving; vessel traffic; site modification and stormwater runoff; water use, including hydrostatic testing and operation of the firewater system; facility lighting; and spills or leaks of hazardous materials as described in section 4.6.1. RG

---

30 RG LNG's Conceptual Mitigation Plan is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20161006-5114.

31 RG LNG's Mitigation Alternative Analysis is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20171117-5156.

LNG would minimize the potential for these impacts using its Plan, Procedures, SPCC Plans, SWPPPs, and mitigation measures required by state and federal agencies as fully discussed in section 4.6.2. Although the activities would result in the alteration of habitat and the mortality or displacement of individuals, the impacts on EFH and the species and life stages that utilize EFH would be permanent, but minor. In addition, the preservation of aquatic habitats proposed as part of the Conceptual Mitigation Plan could result in the permanent protection of EFH in the Project vicinity.

Pipeline Facilities

The pipeline facilities would cross two waterbodies containing EFH, including the channel to San Martin Lake (MP 133.5) and the Bahia Grande Channel (MP 135.2), as well as estuarine emergent and scrub-shrub wetlands and mudflats from MP 131.5 to the pipeline terminus. In addition, The Arroyo Colorado (MP 100.1) and Los Olmos Creek (MP 19.1) both provide EFH about 0.25 mile downstream of the pipeline crossings. A total of 15.9 acres of estuarine emergent marsh and soft bottom EFH would be temporarily disturbed by construction of the Pipeline System. Following construction, these areas would be restored and allowed to revegetate to pre-construction conditions.

The Pipeline System would avoid impacts on EFH within the Channel to San Martin Lake, the Bahia Grande Channel, and some wetlands and unconsolidated bottom habitat by installing the pipelines via HDD. Water for the HDDs at these locations would be obtained from other surface water sources along the Project route in compliance with all state and local permits, and would not be drawn from waterbodies within EFH (see section 2.5.2.1). As discussed in section 4.6.2, impacts on resources crossed by HDD would generally be avoided since the waterbody and its banks would not be disturbed by clearing or trenching. However, if an inadvertent release of HDD drilling fluid occurs within EFH, the resulting sedimentation could temporarily affect water quality. If an inadvertent release were to occur, RB Pipeline would implement its HDD Contingency Plan, which includes methods for detecting and responding to inadvertent returns.

Water would be withdrawn from the Arroyo Colorado (MP 100.1) and Los Olmos Creek (MP 19.1), which both provide EFH about 0.25 mile downstream of the pipeline crossings, for HDD construction, hydrostatic testing, and dust control. As described in section 4.3.2.2, withdrawal of large volumes of water from surface water sources could temporarily affect water quality by changing water temperature and dissolved oxygen levels, and could reduce the amount of available habitat for aquatic resources. Because water withdrawals would be conducted in accordance with applicable permits and approvals, and would not occur within designated EFH, impacts would be minimized and not significant.

EFH adjacent to construction activities could be affected by the migration of sediment outside of construction workspaces or by contamination from spills and leaks of hazardous materials. RB Pipeline would minimize potential impacts by implementing measures in its Plan, Procedures, and SPCC Plan. Following construction, RB Pipeline would restore all wetlands and unconsolidated bottom habitats to pre-construction contours and hydrology. Due to RB Pipeline's proposed mitigation, we have determined that impacts on EFH during construction and operation of the pipeline facilities would be minor.

In conclusion, construction of the Rio Grande LNG Project would result in permanent, minor impacts on EFH and the species and life stages that use EFH through the alteration of habitat and the mortality or displacement of individuals. Impacts would be adequately minimized by implementation of mitigation measures proposed by RG Developers. As part of the consultation under the MSFCMA, NMFS may provide recommendations to FERC regarding further measures that can be taken to conserve EFH. We would respond to any such recommendations per the requirements of the MSFCMA.

4.7 THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

Special status species are those species for which state and/or federal agencies afford an additional level of protection by law, or policy. Included in this category for this EIS are federally listed and federally proposed species that are protected under the ESA, as amended; species that are currently candidates for federal listing under the ESA; state listed threatened or endangered species; and species otherwise granted special status at the state or federal level (e.g., protected under the MMPA of 1972).

Federal agencies are required under Section 7 of the ESA, as amended, to ensure that any actions authorized, funded, or carried out by the agency would not jeopardize the continued existence of a federally listed threatened or endangered species, or result in the destruction or adverse modification of the designated critical habitat of a federally listed species. As the lead federal agency, the FERC is required to coordinate with the FWS and NMFS to determine whether federally listed threatened or endangered species or designated critical habitat are found in the vicinity of the Project, and to determine potential effects on those species or critical habitats.

For actions involving major construction activities with the potential to affect listed species or designated critical habitat, the lead federal agency must prepare a BA and submit its BA to the FWS and/or NMFS. If the action would adversely affect a listed species, the federal agency must also submit a request for formal consultation. In response, the FWS and/or NMFS would issue a Biological Opinion that states whether or not the federal action would likely jeopardize the continued existence of a listed species, or result in the destruction or adverse modification of designated critical habitat.

Based upon our review of publicly available information, agency correspondence, and field survey data, a total of 21 federally listed threatened and endangered species, 3 species that are candidates for listing under the ESA, and 1 species that is under review for potential listing may occur within the counties affected by the Project. Within these counties (or offshore of them), critical habitat has been designated for two species (the loggerhead sea turtle and the piping plover). A discussion of the federally listed species with the potential to occur in the Project area are included in section 4.7.1. Two species, the golden orb and the Texas ayenia, do not have the potential to occur in the vicinity of the proposed facilities and are not discussed further (see table 4.7-1). Other special status species, such as those that are state listed as threatened or endangered, or those protected by the MMPA, are discussed in section 4.7.2.

Table 4.7-1
Federally Listed Species Potentially Occurring in the Vicinity of the Proposed Rio Grande LNG Project

Common Name, *Scientific Name*	Federal Status	State Status	County of Potential Occurrence[a]	Project Components of Potential Occurrence	Determination of Effect[b]
MARINE SPECIES					
Marine/Aquatic Mammals					
Blue whale, *Balaenoptera musculus*	Endangered	-	Offshore	LNG transit routes	*Not Likely to Adversely Affect.* The species inhabits the open ocean. The blue whale could utilize offshore areas along LNG carrier transit routes.
Bryde's whale, *Balaenoptera brydei*	Proposed Endangered	-	Offshore	LNG transit routes	*Not Likely to Adversely Affect.* The Northern Gulf of Mexico Stock occurs almost exclusively in the northeastern Gulf but could utilize offshore areas along LNG carrier transit routes.
Fin whale, *Balaenoptera physalus*	Endangered	-	Offshore	LNG transit routes	*Not Likely to Adversely Affect.* The species inhabits the open ocean. Though rarely documented in the Gulf of Mexico, this species could utilize offshore areas along LNG transit routes.
Sei whale, *Balaenoptera borealis*	Endangered	-	Offshore	LNG transit routes	*Not Likely to Adversely Affect.* The species inhabits the open ocean. Though rarely documented in the Gulf of Mexico, this species could utilize offshore areas along LNG transit routes.
Sperm whale, *Physeter macrocephalus*	Endangered	-	Offshore	LNG transit routes	*Not Likely to Adversely Affect.* The species inhabits deep waters in the open ocean. The sperm whale is widely distributed throughout waters along and offshore of the continental slope. This species could utilize offshore areas along LNG carrier transit routes.

Table 4.7-1 (continued)
Federally Listed Species Potentially Occurring in the Vicinity of the Proposed Rio Grande LNG Project

Common Name, *Scientific Name*	Federal Status	State Status	County of Potential Occurrence[a]	Project Components of Potential Occurrence	Determination of Effect
West Indian manatee, *Trichechus manatus*	Endangered	Endangered	Cameron, Kenedy, Kleberg, Willacy	LNG Terminal and LNG carrier transit routes	*Not Likely to Adversely Affect.* Although extremely rare in the Project area, this species may occasionally occur in the adjacent coastal waters and within the BSC, particularly if moving into the Laguna Madre System. We have recommended that RG LNG implement FWS-recommended conservation measures for identification and treatment of the species.
Marine Reptiles					
Green sea turtle, *Chelonia mydas*	Threatened	Threatened	Cameron, Kenedy, Kleberg, Willacy	LNG Terminal and LNG carrier transit routes	*Not Likely to Adversely Affect* in marine environments. *No effect* on nesting beaches. Adults nest in the Padre Island National Seashore and may occur transiently in the BSC. Adults and juveniles may occur along vessel transit routes.
Hawksbill sea turtle, *Eretmochelys imbicata*	Endangered	Endangered	Cameron, Kenedy, Kleberg, Willacy	LNG Terminal and LNG carrier transit routes	*Not Likely to Adversely Affect* in marine environments. *No effect* on nesting beaches. Adults and juveniles may occur along vessel transit routes.
Kemp's ridley sea turtle, *Lepidochelys kempii*	Endangered	Endangered	Cameron, Kenedy, Kleberg, Willacy	LNG Terminal and LNG carrier transit routes	*Not Likely to Adversely Affect* in marine environments. *No effect* on nesting beaches. Adults nest on ocean-facing beaches on either side of the BSC and may occur transiently within the BSC. Adults and juveniles may occur along vessel transit routes.
Leatherback sea turtle, *Dermochelys coriacea*	Endangered	Endangered	Cameron, Kenedy, Kleberg, Willacy	LNG Terminal and LNG carrier transit routes	*Not Likely to Adversely Affect* in marine environments. *No effect* on nesting beaches. Adults and juveniles may occur along vessel transit routes.
Loggerhead sea turtle, *Caretta*	Endangered	Threatened	Cameron, Kenedy, Kleberg, Willacy	LNG Terminal and LNG carrier transit routes	*Not Likely to Adversely Affect* in marine environments. *No effect* on nesting beaches or critical habitat. Adults and juveniles may occur along vessel transit routes.

Table 4.7-1 (continued)
Federally Listed Species Potentially Occurring in the Vicinity of the Proposed Rio Grande LNG Project

Common Name, *Scientific Name*	Federal Status	State Status	County of Potential Occurrence[a]	Project Components of Potential Occurrence	Determination of Effect
TERRESTRIAL SPECIES					
Birds					
Northern aplomado falcon, *Falco femoralis septentrionalis*	Endangered	Endangered	Cameron, Kenedy, Kleberg, Willacy	LNG Terminal and pipeline facilities	*Likely to Adversely Affect*. Year-round residents in Cameron County. Active nests would be avoided, and RG Developers would implement FWS' recommended BMPs to avoid or minimize indirect impacts. We have recommended that updated nest data be obtained prior to construction, and that preliminary plans to assist in falcon recovery be provided for review; however, adverse impacts on the species may still occur due to loss of potential foraging habitat and potential disruption of nearby nests.
Piping plover, *Charadrius melodus*	Threatened	Threatened	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	LNG Terminal	*Likely to Adversely Affect* piping plovers and critical habitat. Winters in the general Project area where critical habitat is designated and operation of the LNG Terminal would increase ambient noise levels within critical habitat (unit TX-1) for the duration of the Project.
Red knot, *Calidris canutus rufa*	Threatened	-	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	LNG Terminal and pipeline facilities	*Not Likely to Adversely Affect.* Suitable wintering habitat within the operational footprint of the Project would be lost, but adjacent suitable habitat would remain.
Red-crowned parrot, *Amazona viridigenalis*	Candidate	-	Cameron, Willacy	LNG Terminal and pipeline facilities	*Unlikely to result in a trend towards federal listing.* Suitable foraging habitat within the operational footprint of the Project would be lost, but adjacent suitable habitat would remain.
Whooping crane, *Grus americana*	Endangered	Endangered	Jim Wells, Kenedy, Kleberg	LNG Terminal and pipeline facilities	*Not Likely to Adversely Affect.* Winters at the Aransas Pass NWR, about 80 miles north of the Project, and may occur transiently in Project counties while foraging.
Mammals					
Gulf Coast jaguarundi, *Herpailurus yagouaroundi cacomitli*	Endangered	Endangered	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	LNG Terminal and pipeline facilities	*Not Likely to Adversely Affect*. Occurs in similar habitat as the ocelot, but due to lack of confirmed sightings, the potential for occurrence in the Project area is discountable.

Table 4.7-1 (continued)
Federally Listed Species Potentially Occurring in the Vicinity of the Proposed Rio Grande LNG Project

Common Name, *Scientific Name*	Federal Status	State Status	County of Potential Occurrence[a]	Project Components of Potential Occurrence	Determination of Effect
Ocelot, *Leopardus pardalis*	Endangered	Endangered	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	LNG Terminal and pipeline facilities	*Likely to Adversely Affect.* Known to occur in the Laguna Atascosa NWR adjacent to the LNG Terminal site, where indirect impacts would occur. Direct loss of potential habitat would occur within the LNG Terminal site.
Amphibians					
Black-spotted newt, *Notophthalmus meridionalis*	Under review	Threatened	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Pipeline facilities	*Unlikely to result in a trend towards federal listing.* May occur in freshwater streams and wet habitats along the pipeline route, but no freshwater streams would be crossed within the buffer of historic occurrences, and these areas would be restored post-construction.
Mollusks					
Golden orb, *Quadrula aurea*	Candidate	-	Jim Wells	Pipeline facilities	*No effect.* Occurs in freshwater streams in the Guadalupe-San Antonio and Nueces-Rio river basins. Only one, intermittent stream would be crossed in Jim Wells County.
Plants					
Black lace cactus, *Echinocereus reichenbachii var. albertii*	Endangered	Endangered	Jim Wells, Kleberg	Pipeline facilities	*Not Likely to Adversely Affect.* Species-specific surveys are pending but would be completed prior to construction, and avoidance/minimization measures would be implemented if found.
Slender rush-pea, *Hoffmannseggia tenella*	Endangered	Endangered	Kleberg	Pipeline facilities	*Not Likely to Adversely Affect.* Species-specific surveys are pending but would be completed prior to construction, and avoidance/minimization measures would be implemented if found.

Table 4.7-1 (continued)
Federally Listed Species Potentially Occurring in the Vicinity of the Proposed Rio Grande LNG Project

Common Name, *Scientific Name*	Federal Status	State Status	County of Potential Occurrence[a]	Project Components of Potential Occurrence	Determination of Effect
South Texas ambrosia, *Ambrosia cheiranthifolia*	Endangered	Endangered	Cameron, Jim Wells, Kleberg	LNG Terminal and pipeline facilities	*Not Likely to Adversely Affect.* Species-specific surveys are pending but would be completed prior to construction, and avoidance/minimization measures would be implemented if found.
Texas ayenia, *Ayenia limitaris*	Endangered	Endangered	Cameron, Willacy	LNG Terminal and pipeline facilities	*No effect*. Prefers subtropical woodlands and shrubland located atop loamy soils associated with the Rio Grande Delta. The FWS has indicated that this species is not expected in the Project area and that no surveys are necessary (FWS 2016e).

[a] County of potential occurrence for federally listed species indicates the county in which a species is listed in the IPaC system and does not necessarily indicate that the species would or could occur within the footprint of Project facilities in that county. County of potential occurrence for the state listed black-spotted newt, which is under review for federal listing, was determined through review of TPWD species lists by county.

[b] Full assessments of each species determined to be potentially affected are provided in the text. Impacts are identified based on the potential for the species to occur within or in proximity to the LNG Terminal site, the pipeline right-of-way, or associated workspaces and facilities, or along the LNG tanker transit routes.

As required by Section 7 of the ESA, as amended, we request that the FWS and NMFS accept the information provided within this EIS as the BA for the proposed Rio Grande LNG Project. Furthermore, we request concurrence with our findings of *not likely to adversely affect* for 17 of the federally listed species in table 4.7-1. We have determined that the Project *is likely to adversely affect* the Northern aplomado falcon (endangered), piping plover (threatened) and its critical habitat, and ocelot (endangered), and request to enter formal consultation for these three species. To assist in compliance with Section 7 of the ESA, RG Developers, acting as the FERC's non-federal representative for the Rio Grande LNG Project (18 CFR 380.13), initiated coordination with the FWS Texas Coastal Ecological Field Office and with the NMFS Protected Resources Division in March 2015. We have also recommended RG Developers to file updated species information for the aplomado falcon and the ocelot to reduce impacts on these species. As necessary, we will use any updated information to facilitate our Section 7 consultation with the FWS.

4.7.1 Federally Listed Threatened and Endangered Species

4.7.1.1 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 FWS and NMFS. Trade of sea turtles is restricted by the Convention on International Trade in Endangered Species; however, not all countries have ceased to harvest these species. The major threats to sea turtle populations are overharvesting, fisheries by-catch, disease, pollution, and coastal development of nesting beaches.

Multiple scoping comments were received regarding impacts on sea turtles, with many comments specifically identifying the Kemp's ridley sea turtle and impacts from ship traffic. Five species of federally listed sea turtles could occur along the portion the Rio Grande LNG transit routes in Cameron County and the Gulf of Mexico, including the green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. These turtles are further described below.

Green Sea Turtle

The green sea turtle is currently federally listed as threatened. On April 6, 2016, the FWS and NMFS published a final rule to list the green sea turtle population as 11 distinct population segments (DPS) that qualify as unique species for the purposes of listing under the ESA (81 FR 20057). As a result, the range-wide listing status was revoked and, in its place, eight DPSs were listed as threatened and three DPSs were listed as endangered. Green sea turtles occurring off the coast of Texas are part of the North Atlantic DPS, which is listed as threatened. Although critical habitat has been designated for the North Atlantic DPS it is located off Puerto Rico and would not be affected by the proposed Project.

Green sea turtles are generally found in shallow waters inside bays, inlets, and reefs with an abundance of seagrass and algae. As one of the more coastal species of sea turtle, adult green sea turtles forage primarily on sea grass and marine algae (NMFS 2016b). 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 (FWS 2016f). After emerging from the nest, hatchlings swim offshore and remain there for a number of years, where they are sometimes associated with *Sargassum* mats for food and shelter (FWS 2016f). Green sea turtles are present near Port Isabel, in the Laguna Madre System, and may be encountered in the BSC during transit into the Laguna Madre (Gorga 2010). Principal benthic foraging habitat in Texas includes Aransas Bay, Matagorda Bay, Laguna Madre (including the Mexiquita Flats area, which was identified as an area of concern during Project scoping), and other Gulf inlets (FWS 2014b). Along the Texas coast, green sea turtles are only known to nest along the Padre Island National Seashore, which is about 35 miles north of the entrance to the BSC (NPS 2016b).

Hawksbill Sea Turtle

The hawksbill sea turtle is federally listed as endangered. This species is widely distributed throughout the Caribbean Sea and western Atlantic Ocean. They occur in shallow coastal areas, oceanic islands, rocky areas, and coral reefs (FWS 2012a). Hawksbill sea turtles feed on sponges, other invertebrates, and algae (NMFS 2013a, b). 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. They nest in low densities on scattered undisturbed deep-sand beaches in the tropics (FWS 2012a).

Critical habitat for the hawksbill sea turtle has been designated near the coast of Puerto Rico (NMFS 1998a, b). Only one hawksbill nest has been documented along the Texas coast, which was at the Padre Island National Seashore in 1998 (NPS 2016c). Although post-hatchlings and juveniles are sighted with some regularity in Texas waters, they are believed to originate from beaches in Mexico (FWS 2014b). Due to the lack of nesting beaches and suitable foraging habitat, there is a low probability of this species occurring in the Project area. However, adult hawksbill sea turtles could potentially utilize the offshore LNG carrier routes for transit and juveniles could potentially utilize these areas for foraging.

Kemp's Ridley Sea Turtle

The federally endangered Kemp's ridley sea turtle primarily inhabits coastal waters in the northwestern Atlantic and the Gulf of Mexico. Adult Kemp's ridleys inhabit shallow coastal and estuarine waters over sand or mud bottoms where they feed on crab, fish, jellyfish, and mollusks. Hatchlings and juveniles are found in ocean open habitats or in association with *Sargassum* mats, generally migrating to adult habitat at approximately 2 years old. No critical habitat has been designated for this species. Collection of eggs, capture for meat and other products, direct take for indigenous use, ingestion of man-made materials, collision with boats, and disturbance or destruction of nesting areas are all factors that have contributed to the decline of this species. Despite these factors, the population appeared to be in the early stages of recovery until 2010, when the number of nests began decreasing (NMFS 2013c, 2016c). The majority of this species nests at one of three beaches in Mexico; however, nesting also occurs along the Texas coast. Padre Island National Seashore, and the adjacent North and South Padre Islands, represent the most prominent nesting location in the United States during the 2016 nesting season alone, 162 nests were documented. An additional nine were documented on Boca Chica Beach (NPS 2016d).

Leatherback Sea Turtle

The federally endangered leatherback is the largest of the sea turtles and spends more of its life in the open ocean environment than other sea turtles. 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 (FWS 2012b; NMFS 2013d). The largest nesting assemblages are found in northern South America and West Africa; however, within the United States, research suggests that southeast Florida, the U.S. Virgin Islands, and Puerto Rico are the primary nesting locations for leatherbacks (NMFS 2013b). Designated critical habitat for the leatherback sea turtle in the United States is along the coast of California and along the U.S. Virgin Islands (NMFS 2013d). Due to the lack of suitable nesting and foraging habitat, there is a low probability of this species occurring in the Project area. However, adult leatherback sea turtles could potentially utilize the offshore LNG carrier routes for transit and juveniles could potentially utilize these areas for foraging.

Loggerhead Sea Turtle

The Northwest Atlantic Ocean DPS of loggerhead sea turtles 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 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 (FWS 2012c, NMFS 2013e). 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, when females return to their natal beach to nest. In the United States, loggerheads can generally be found nesting from Texas to Virginia, though the major nesting concentrations occur in Florida, Georgia, South Carolina, and North Carolina (FWS 2012c). During the 2016 nesting period, one loggerhead nest was identified on Padre Island National Seashore and one nest was identified on South Padre Island (NPS 2016d).

Critical habitat for the Northwest Atlantic Ocean DPS was designated in 2014 to protect both marine and terrestrial habitats. While the terrestrial critical habitat is restricted to the Florida coast, critical marine habitat includes *Sargassum* habitats, for the protection of post-hatchlings and juveniles. *Sargassum* is a species of seaweed that forms floating mats and travels with the Loop Current in the Gulf of Mexico; therefore, critical habitat was established to account for the eastern edge of the Loop Current.

Within the Project area, the extent of mapped critical habitat begins at the 10-meter depth contour offshore of South Padre Island and extends out to the Exclusive Economic Zone (79 FR 39855). Due to the lack of suitable nesting and foraging habitat, there is a low probability of this species occurring in the Project area. However, loggerhead sea turtles could potentially utilize LNG carrier routes for transit and potentially utilize these areas for foraging and LNG carriers could transit areas of critical habitat.

Sea Turtle Impacts and Mitigation

Due to the specific nesting habitat requirements, sea turtles are not likely to be present onshore within the Project area. In general, sea turtles are rare visitors to the immediate Project area and are more likely to be encountered along the LNG carrier transit routes in the Gulf of Mexico and nearshore waters. Many of the sea turtles that could be present have feeding, swimming, or resting behaviors that keep them near the surface, where they may be vulnerable to vessel strikes, especially if the turtles are cold-stunned from cold weather events. To help reduce the risk of strikes or other potential disturbances associated with the presence of additional marine traffic in proximity to the LNG Terminal. RG LNG's support vessels would adhere to the measures outlined in the NMFS *Vessel Strike Avoidance Measures and Reporting for Mariners* (revised February 2008); RG LNG would also request that operators of LNG carriers and associated tugs calling on the LNG Terminal follow these procedures, but could not enforce their use. Although thermal discharges from the LNG Terminal would not occur during regasification processes (as identified in public comments), LNG carriers would release cooling water while docked, as discussed in section 4.3.

RG LNG proposes to dredge the marine berths and turning basin using a mechanical dredge or hydraulic cutterhead dredge. Mechanical dredging and hydraulic cutterhead dredging are not known to take sea turtles by direct mortality, as with hopper dredging, which is the proposed method for deepening the BSC (NMFS 2014a). Dredging activities during construction would be temporary and local in nature because dredging would be confined to the proposed marine berths and turning basin, and maintenance dredging would only occur about once every 2 to 4 years. Dredging actions that could potentially result in injury to any sea turtles directly in the Project area would be incidental. Activities at dredged material placement areas would similarly not affect sea turtles since suitable nesting areas are not present in the placement areas and NMFS has never received reports of injury to a sea turtle resulting in the burial in, or impacts from the disposal of dredged material (NMFS 2014a).

NMFS identified pile-driving as having the potential to affect sea turtles. Studies have shown that the sound waves from pile-driving may result in injury or trauma to fish, sea turtles, or other animals with gas-filled cavities such as swim bladders, lungs, sinuses, and hearing structures (Abbott and Bing-Sawyer 2002). Although sea turtles are not expected to occur in close proximity to the Project except in rare occasions, the potential exists for sea turtles to be injured during the first several strikes of the pile-driving hammer, especially if the turtles are cold-stunned from cold weather events (see table 4.7.1-1). RG LNG has modified its original construction plans to minimize the need for in-water pile-driving, such that only four traditional steel or concrete piles (via impact hammer) and one area of sheet piling (via vibratory hammer) would be installed in-water (see section 2.5.1.3). Table 4.7.1-2 includes the distances required for in-water pile-driving noise to attenuate to below the take levels identified in table 4.7.1-1.

Table 4.7.1-1
Estimated Sound Levels from Underwater Pile-driving for the Rio Grande LNG Project and Effects Levels for Protected Marine Species

Pile-driving Activity or Effect Level	Cumulative Sound Exposure Level (SEL_{cum}) (dB re 1 μPa^{2}s)[a]	Root Mean Square Sound Level (dB RMS) (dB re 1 μPa)[b]	Peak Sound Level (dB re 1 μPa)[c]
36- to 48-inch steel pile (impact hammer)[d]	175 to 185e	185 to 195	198 to 210
36- to 48-inch concrete pile (impact hammer)[d]	166e	176	188
Sheet pile (vibratory hammer / impact hammer)	--	163/195	--
Sea turtle injury	--	180	--
Sea turtle behavioral effects	--	166	--
Marine mammal injury (temporary threshold shift for impulsive / non-impulsive noise)[f,g]	170/178 h	--	224/ --
Marine mammal injury (permanent threshold shift for impulsive / non-impulsive noise)[f,g]	185/198g		
Marine mammal behavioral effects (impulsive / non-impulsive noise)[f]	--	160/120	230/ --

Source: NMFS 2016c, d.

a The cumulative sound exposure level is the energy accumulated over multiple strikes or continuous vibration over a period of time.

b The root mean square exposure level is the square root of the average squared pressures over the duration of a pulse and represents the effective pressure and intensity produced by a sound source.

c Peak sound pressure level is the largest absolute value of instantaneous sound pressure.

d Estimated values include range of underwater sound levels for water-based pile-driving of steel piles between 36 and 60 inches in diameter for land- and marine-based pile-driving, and 24-inch concrete piles (NMFS 2016c).

e These values are single strike values, which are used to develop the cumulative sound levels during modeling.

f Use of impact hammers is considered impulsive noise; use of vibratory hammers is considered non-impulsive noise.

g The injury threshold is the general level for temporary or permanent threshold shift onset for mid-frequency cetaceans as identified by NMFS (2016c); however, threshold shifts are influenced by the frequency of noise received and a cumulative sound exposure exceeding this level may not cause a threshold shift if outside the range of hearing.

RG LNG has stated that it would reduce impacts on sea turtles from in-water activities by employing a dedicated biologist with stop-work authority that would monitor for species presence prior to pile-driving activities and during pile-driving and dredging activities, which would include maintenance dredging during operations. The monitors would implement NMFS' *Sea Turtle and Smalltooth Sawfish Construction Conditions* (NMFS 2006). Although smalltooth sawfish do not occur in the BSC, the construction conditions would provide protection for sea turtles by requiring that:

- RG LNG instruct all construction personnel to observe for sea turtles during in-water construction;
- siltation barriers, as needed, be properly secured and monitored to protect entrapment of sea turtles;
- construction vessels operate at "no wake/idle" speeds while in the construction area where there is less than four feet of clearance between the vessel draft and the channel bottom;
- appropriate precautions are implemented if a sea turtle is seen within 300 feet of construction/dredging operation or vessel movement; and
- operation of moving equipment cease if a sea turtle is within 50 feet of the equipment and allowing the sea turtle to leave the area of its own accord before restarting operations.

As shown in table 4.7.1-2, the threshold for injury to sea turtles would be 328 feet for installation of the sheet piling using an impact hammer, if required; however, RG LNG and NMFS have indicated that 328 feet is a manageable distance for the observers to identify approaching sea turtles and stop work as needed to avoid a take. Although the radius for potential behavioral effects would be larger (up to 600 feet for planned activities and up to 0.5 mile if an impact hammer is required for installation of the sheet pile), behavioral effects would likely be limited to avoidance given the lack of quality foraging/nesting habitat in the BSC. During a meeting in January 2017, NMFS requested that RG LNG conservatively estimate the sound levels that would be produced if the piles for Jetty 2 were installed in-water. RG LNG's subsequent modeling indicated that in-water installation of the 96- to 106-inch steel piles for Jetty 2 would exceed injury thresholds in sea turtles within 1,775.6 feet of pile installation. If RG LNG modifies its proposed approach, which currently avoids in-water pile-driving for Jetty 2, further approval from FERC and NMFS would be required, as well as additional consultation and possible mitigation to ensure that no sea turtles were injured during construction. If the rare occurrence of an individual sea turtle were to overlap with an inadvertent spill, the sea turtle could be at risk due to effects on respiration, skin, blood chemistry, and salt gland function. To address the potential impacts associated with offshore spills of fuel, lubricants, or other hazardous materials, RG LNG would implement its construction and operational SPCC Plans and its SWPPPs. In addition, RG LNG would also implement measures for reporting any observations of sea turtles congregating near outfalls at the LNG Terminal and, in accordance with the vessel strike guidance noted above, would report sightings of dead or injured sea turtles, whether or not they were related to construction and operation of the Project.

Table 4.7.1-2 Estimated Zones of Impact for Protection Marine Species from Underwater Pile-driving Sound				
Pile-driving Activity or Effect Level	**Installation Method**	**Distance to Attenuation Below Take Levels (feet)[a]**		
		Steel Sheet Pile	**Steel Pipe Pile**	**Concrete Pile**
Sea Turtles				
Behavioral (166 dB RMS)	Vibratory	0.0	--	--
	Impact	2,815.0[b]	607.0	150.9
Injury (180 dB RMS)	Vibratory	0.0	--	--
	Impact	328.1[b]	72.2	0.0
Marine Mammals (mid-frequency cetaceans)				
Behavioral (120 dB RMS)	Vibratory	24,133.9	--	--
Behavioral (160 dB RMS)	Impact	7,066.9[b]	1,522.3	383.9
Injury (198 dB SEL_{cum})	Vibratory	3.6	--	--
Injury (185 dB SEL_{cum})	Impact	40.7[b]	2.0	0.3

a Where the distance is 0.0 feet, the source level is less than the noted threshold.
b RG LNG does not propose to install sheet piling using an impact hammer unless refusal is met with the vibratory hammer.

With adherence to the mitigation measures identified above, we have determined that the Project *is not likely to adversely affect* sea turtles in the marine environment. In addition, we find that there would be *no effect* on sea turtles located on nesting beaches, given the lack of known nesting beaches within the BSC. Finally, we find that there would be *no adverse effect* on designated critical habitat for any species of sea turtle.

4.7.1.2 Marine Mammals

All marine mammals are federally protected under the MMPA. The MMPA established, with limited exceptions, a moratorium on the "taking" of marine mammals in waters or on land under U.S. jurisdiction. The act further regulates, with certain exceptions, the "take" of marine mammals on the high seas by persons, vessels, or other conveyances subject to the jurisdiction of the United States. A total of 29 mammals protected under the MMPA may occur along the LNG transit routes in the Gulf of Mexico (NMFS 2012). Six of these species are also listed under the ESA (five whales and the West Indian manatee) and are included in table 4.7-1 and discussed below. The remaining whale and dolphin species and their potential area of occurrence in the Project area are described in section 4.7.2.2.

West Indian Manatee

The West Indian manatee is federally listed as endangered. This species is an herbivorous marine mammal most commonly found in coastal estuaries and rivers in Florida and Georgia, but it has been documented from Texas to Massachusetts. Manatees are sub-tropical mammals 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 (FWS 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 2 to 5 years. Calves may be present throughout the year and usually remain with their mother for up to 2 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 very vulnerable to being hit by vessels (FWS 2014c). Critical habitat has been designated off the coast of Florida.

Although extremely rare in the general Project area, the manatee has occasionally been sighted from South Padre Island (The Brownsville Herald 2014). The FWS recommends that employees of all coastal construction projects: a) be advised that manatees may approach the proposed Project area; b) be provided materials to assist in the identification of manatees; c) be instructed to avoid feeding manatees; and d) contact the FWS and Texas Marine Mammal Stranding Network if a manatee is sighted. We concur with these recommendations and **we recommend that:**

- **<u>Prior to construction of the LNG Terminal</u>, RG LNG should conduct training for construction and operational employees that includes the identification, treatment, and reporting protocols for the West Indian manatee. Training materials should be developed in coordination with the FWS.**

Given the rare occurrence of this species in the Project area, our recommendation to implement FWS-recommended training for workers at the LNG Terminal, and RG LNG's commitment to adhere to the NMFS *Vessel Strike Avoidance Measures and Reporting for Mariners*, we find that the Rio Grande LNG Project *is not likely to adversely affect* the West Indian manatee.

Whales

Whales are long-lived marine mammals that occur throughout the world's oceans. They can be divided into two main groups: toothed whales and baleen whales. Feeding morphology and prey are the major differences between these groups. Many species of whales migrate extremely long distances to take advantage of seasonal food resources or calm wintering grounds for rearing young. Whales generally utilize warm tropical waters during winter months when the polar seas are cold, ice covered, and food-poor, though some species will stay in these regions year-round. Whales could utilize the offshore areas of the Gulf of Mexico along the LNG transit routes for migration and feeding.

The sperm whale is a toothed whale that inhabits the deeper waters of the world's oceans throughout the year, where they feed primarily on squid and other deep-sea creatures. 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 2014b). The sperm whale is the only federally listed whale that is known to commonly occur in the Gulf of Mexico (NMFS 2012). The Bryde's whale is a baleen whale that occurs worldwide in tropical and subtropical waters; however, there is a distinct stock in the Gulf of Mexico that has been almost exclusively sighted in the northeastern Gulf of Mexico at depths between 328 and 1,312 feet. The best estimate for this stock is 33 whales (NMFS 2018).

Other baleen whales, including the fin, sei, and blue whales are listed by NMFS as occurring within the southeast region. These whales are not commonly found in the Gulf of Mexico, but could occur within the Gulf of Mexico LNG vessel transit 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 1998c, 2010b, and 2011). Calving and breeding grounds have not been identified for these species in the Gulf of Mexico

Whales could be vulnerable to vessel strikes during operation of the proposed LNG terminal. Vulnerability to collision with LNG carriers would be greatest while these animals feed, swim, and rest near the surface of the water. In areas of intense ship traffic, whales can experience propeller or collision injuries; however, most of these injuries are caused by small, fast moving vessels. LNG carriers operating within the EEZ in the Gulf of Mexico are generally slower and generate more noise than typical large vessels, and would be more readily avoided by whales. These LNG carriers would use established and well-traveled shipping lanes. As described in section 4.7.1.1, RG LNG would provide the operators of LNG carriers with NMFS' *Vessel Strike Avoidance Measures and Reporting for Mariners* (NMFS 2008) and request that these measures be used when transiting to and from the Rio Grande LNG Terminal. Based on the whales' characteristics and habitat requirements, and because RG LNG would provide the operators of LNG carriers with NMFS' recommended strike avoidance measures, we have determined that the Rio Grande LNG Project *is not likely to adversely affect* federally listed whales.

4.7.1.3 Birds

Northern Aplomado Falcon

The northern aplomado falcon is a federally endangered species of raptor. The current range in the United States is restricted to south Texas, New Mexico, and Arizona, although the New Mexico and Arizona falcons are part of a non-essential, experimental population.[32] The species is mainly non-migratory in the United States and depends on expansive, open grasslands and associated avian communities, as it preys on numerous species of smaller birds. Northern aplomado falcons do not build their own nests; rather, they use abandoned nests constructed by other raptors or corvids. Due to recovery and reintroduction practices, many pairs also use nests built by humans. Nesting times are variable, and although egg-laying has been documented from January through September, March through May is the peak period.

---

32 An experimental population is a population that has been released outside of its currently occupied range, but within its probable historic range, to further species conservation. An experimental population is further deemed "essential" if its loss would be likely to appreciably reduce the likelihood of species survival in the wild, or "non-essential" if its loss would not appreciably reduce the likelihood of survival. Essential or non-essential experimental populations are treated as threatened if they occur on an NWR or on NPS land; otherwise, they are treated as a species that is proposed for listing.

The FWS estimates a home range of about 8,401 acres, or about a 2-mile radius around nest sites (FWS 2014d). No critical habitat has been designated for the northern aplomado falcon. The primary threats to the species include predation (mainly by great horned owls); habitat modification that leads to changes in vegetation and the reduction of grassland bird (potential prey) abundance; mortality of individuals and prey species at wind farms; drought; and climate change (which causes increased aridity of grasslands, making them more susceptible to habitat loss from livestock grazing) (FWS 2014d).

Northern aplomado falcons were reintroduced along the southern coast of Texas in 1993 at 22 locations; release of captive-bred falcons is ongoing. About 29 pairs of falcons currently reside in Texas, with 19 of those pairs occurring near Brownsville. The Brownsville area pairs are found within a corridor about 34 miles long and 3 to 7 miles wide, stretching from the Mexican border to an area north of the Laguna Atascosa NWR. Local nesting occurs on the NWR, municipal land at the Port of Brownsville, private ranches, and larger expanses of seasonally inundated salt prairie, which stretch from Brownsville to Port Isabel (FWS 2014d). The Peregrine Fund surveys suitable habitat in the Project area on a yearly basis to identify nests and nesting activities of aplomado falcons. Results of survey data collected between 2000 and 2016 indicate that no aplomado falcons nest in Jim Wells, Kleberg, and Kenedy Counties, likely due to limited habitat and a robust population of great horned owls (The Peregrine Fund 2017). One breeding pair is known in Willacy County; however, the pair's territory does not include areas affected by the proposed Project. Within Cameron County, the Project would overlap with six aplomado falcon territories (one of which overlaps with the LNG Terminal site), each of which has a currently or historically active nest within 1 mile of Project workspaces (The Peregrine Fund 2017, FWS 2016g).

The FWS' recovery plan for the northern aplomado falcon includes maintenance or restoration of coastal prairies and desert grasslands through grazing, prescribed fire, and brush control. Multiple members of the public expressed concern regarding the potential for the LNG Terminal to preclude the prescribed fire/burns in the Project area. Habitat in the south Texas coastal prairie has suffered from invasion of brushland species; as woody plant cover increases, the occurrence of the northern aplomado falcon decreases. In an effort to restore the prairies, federal and state land management agencies, and their partners, have mechanically removed invading trees (such as mesquite and huisache) and have conducted prescribed burns and herbicide application to manage the invading brush in prairie habitat. Brush removal in the Bahia Grande area has recently opened and restored about 2,700 acres of coastal prairie habitat; as of 2014, the FWS' goal was to restore another 1,500 acres in the Bahia Grande area within a few years. However, although grassland restoration shows promise, the ultimate success at achieving historical habitat quality has not been determined (FWS 2014d).

The Rio Grande LNG Project would result in temporary and permanent impacts on five vegetation communities collectively considered upland herbaceous land (south Texas loma, disturbance, and sandy mesquite savanna grasslands; sea ox-eye daisy flats; and Gulf Coast salty prairie), which may provide suitable foraging habitat for the northern aplomado falcon. The proposed pipeline facilities in Cameron County would result in a temporary impact of about 220.7 acres of upland herbaceous land, of which about 33.3 acres would be subject to regular vegetation maintenance. As active and historic nests occur within 1 mile of the proposed pipeline workspaces, construction activities along the southern portion of the route (from about

MP 124.0) could result in impacts on northern aplomado falcons due to increased noise and human presence in proximity to active nests. However, impacts associated with the pipeline facilities within occupied northern aplomado habitat would be temporary, and no increase in competition between falcons in adjacent territories would be anticipated.

Within the boundaries of the Rio Grande LNG Terminal, 191.5 acres of potential foraging habitat would be permanently converted to industrial land. An additional 19.2 acres of upland herbaceous habitat would be temporarily disturbed during construction resulting from use of the offsite facilities for the LNG Terminal. The last active nest identified within 1 mile of the LNG Terminal site was in 2006; however, an active territory is present in close proximity to the proposed staging area in the Port of Brownsville (The Peregrine Fund 2017). As no known nesting occurs on the LNG Terminal site or offsite facilities, no direct impact on the falcons or their nests would occur. However, loss or disturbance of suitable habitat would result in the decreased presence of foraging habitat and prey species, potential impacts on habitat restoration efforts (e.g., prescribed burns), and temporary displacement from current home ranges near areas of increased Project-related noise and light.

The permanent loss of potential foraging habitat within the LNG Terminal site would likely not result in a significant impact on northern aplomado falcons, given the presence of undisturbed quality habitat within the adjacent Laguna Atascosa NWR, although we are concluding the effect would likely be adverse. Impacts on migratory birds, which include prey of the northern aplomado falcon, are discussed in detail in section 4.6.1. In addition, prescribed burning, although not allowed on the LNG Terminal site itself, would not be precluded in the adjacent areas currently subject to habitat restoration. To minimize the potential for impacts on nesting and foraging northern aplomado falcons, RG Developers have indicated that they would implement the FWS' BMPs for the northern aplomado falcon,[33] as modified through discussions with the FWS. Measures proposed to be implemented by RG Developers include, but are not limited to:

- training all construction and maintenance staff on the species, the BMPs identified for species protection, and the role of the construction monitor;
- constructing the pipeline between August 1 and January 31 (outside of the breeding season), or using biological monitors during the breeding season to monitor active nests within 0.5 mile of construction activities, and during construction through suitable habitat where no pre-construction surveys are available;
- constructing the LNG Terminal and associated offsite facilities that are within 1 mile of active nests between August 1 and January 31; and
- designing security lighting to minimize light pollution by using down-shielded, low-level lights.

---

33 The BMPs for the northern aplomado falcon is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession number 20160928-5172.

Although no active nests were identified within the footprint of the proposed facilities during the 2016 surveys, nest sites may move from year to year within a given territory, and nest sites may change prior to beginning construction of Project facilities. In addition, the FWS' BMPs for northern aplomado falcons recommends measures to support aplomado falcon recovery through participation in efforts such as grassland restoration or inventory of potential habitat; however, RG Developers have not identified plans to support recovery efforts, and construction of the LNG Terminal would result in a loss of potential foraging habitat. Further, RG Developers have indicated that biological monitors would be used to monitor buffer areas around active nests, rather than occupied habitat, as identified in the BMPs. Therefore, **we recommend that:**

- **<u>Prior to construction of each pipeline and the LNG Terminal</u>, RG Developers should file with the Secretary documentation confirming that they obtained updated records of active nests from The Peregrine Fund for the appropriate breeding season and consulted with the FWS to determine if any additional mitigation is warranted based on the new nest data. RG Developers should also identify in the filing, their intent to have biological monitors monitor construction activities within 0.5 mile (pipelines) or 1.0 mile (LNG Terminal) of occupied habitat during the breeding season, in accordance with the northern aplomado falcon BMPs, and provide the locations of such habitat by milepost.**

- **<u>Prior to the end of the draft EIS comment period</u>, RG Developers should file with the Secretary, their preliminary plans to support aplomado falcon recovery, as recommended in the BMPs for the northern aplomado falcon, specifically identifying any intent to mitigate for the loss of foraging habitat at the LNG Terminal site. RG Developers should include in their filing evidence of correspondence with the FWS and The Peregrine Fund regarding potential mitigation.**

Given RG Developers' commitment to use of FWS' BMPs for northern aplomado falcons, and our recommendations to verify nest locations and identify preliminary plans to assist in the continued recovery of the species, we find that impacts on the species would be less than significant; however, under Section 7 of the ESA, as adverse impacts may still occur on the species from loss of potential foraging habitat and construction in proximity to active nests, we have determined that the proposed Project *is likely to adversely affect* the northern aplomado falcon.

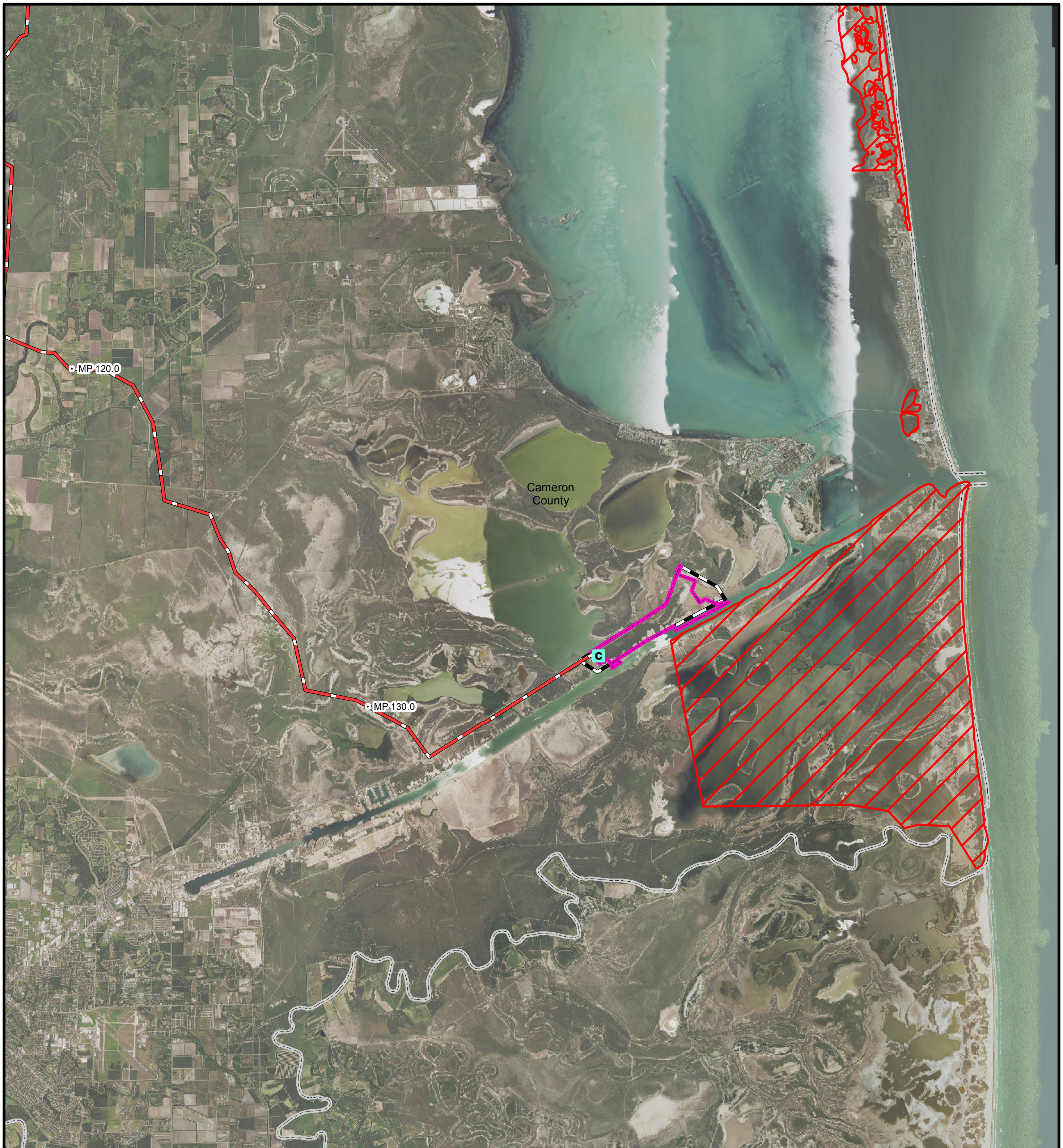
Piping Plover

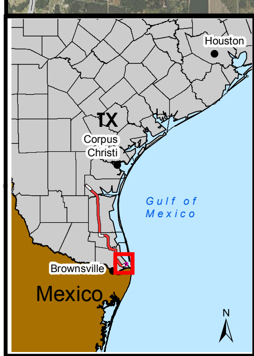
Piping plovers are small shorebirds that migrate from northern breeding grounds to southern and eastern wintering grounds. Piping plovers are listed as endangered in their breeding grounds, which are located on the northern Great Plains, in the Great Lakes, and along the Atlantic coast of the United States and Canada. Wintering habitat for each of the breeding populations is shared and stretches from the coast of North Carolina to Texas; and into Mexico, the Bahamas, and the West Indies. Piping plovers are listed as threatened in all non-breeding habitat, including in the vicinity of the proposed Project. During the winter, they use a mosaic of habitat patches, including sand spits, small islands, tidal flats, ephemeral pools, and seasonally emergent seagrass beds. Critical habitat has been designated for two of the three breeding grounds (excluding the Atlantic Coast population) and for 141 units of wintering habitat from North Carolina to Texas. Critical wintering habitat supports roosting, foraging, and sheltering activities (FWS 2015c).

Plovers typically begin migrating south in July or August and stay in the wintering grounds between February and May. In Texas, piping plovers generally begin arriving in mid-July and most have left by mid-May. They feed on insects, crustaceans, and other small marine animals. When not feeding, they roost in sheltered spots, such as behind driftwood or small dunes. Most of the plovers wintering in Texas are found in the lower Laguna Madre area, where they feed on the wind-tidal flats. Declines in the piping plover population has resulted from habitat loss/alteration, human disturbance, and predation (TPWD no date [nd] a). Given the larger number of piping plovers that utilize the surrounding areas in the winter, and the presence of suitable mudflat habitat, it is likely that individuals would also occasionally be present within the LNG Terminal site. As the FWS assumes presence, no surveys at the LNG Terminal site were required (FWS 2016a). Critical habitat for wintering piping plovers has been designated in the immediate vicinity of the proposed LNG Terminal site, including a 7,217-acre area (habitat unit TX-1) on the opposite side of the BSC, directly across from the LNG Terminal site and encompassing the South Bay area. Additional areas of critical habitat include an area on the bayside of South Padre Island, as well as areas further north on South Padre Island. Critical habitat for the piping plover is depicted in figure 4.7.1-1. Primary constituent elements for critical piping plover wintering habitat are those that are essential for foraging, sheltering, and roosting; they include coastal areas that support intertidal beaches and flats (between annual low tide and annual high tide) and associated dune systems and flats above annual high tide (66 Federal Register 36038). Habitat unit TX-1 covers portions of South Bay and Boca Chica following the BSC, and includes wind tidal flats that are infrequently inundated by seasonal winds (66 Federal Register 36038). More than 150 piping plovers are believed to winter in habitat unit TX-1 (FWS 2015).

Piping plovers are known to exhibit a high degree of intra- and inter-annual fidelity to wintering areas. One study indicated that 97 percent of surveyed birds remained in the same region, and often on the same beach (Gratto-Trevor et al. 2012, FWS 2015). Mean average home range identified in southern Texas in an earlier study was 7.8 miles, with a mean core area of 1.8 miles (Drake et al. 2001, FWS 2015).

Dredged material placement areas considered for use are present within the critical habitat south of the BSC; however, the COE, in its BA for the Brazos Island Harbor Improvement Project, determined that dredging activities within the BSC would not likely to adversely affect the piping plover or its critical habitat. The FWS concurred with this determination given the COE’s planned mitigation to survey the placement areas prior to dredged material placement if certain climatic conditions were present (FWS 2014b). As discussed in section 4.2.3, the BND is assessing the potential disposal locations for all projects proposed for the BSC, in coordination with federal, state, and local resource agencies and interested stakeholders, including the BND, COE, EPA, NMFS, FWS, and the TCEQ. Any mitigation required for dredged material placement at specific locations would be determined through that review process.





Legend

- Piping Plover Critical Habitat
- Milepost
- Proposed Header System
- Proposed Rio Bravo Pipeline
- Proposed Compressor Station
- LNG Terminal Site
- Proposed LNG Terminal Boundary

0 2 4

Miles

N

Scale: 1:175,000

AERIAL IMAGERY: NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP) 2014 - http://datagateway.nrcs.usda.gov/.

Rio Grande LNG Project

Critical Habitat for the Piping Plover in the Vicinity of the Rio Grande LNG Terminal Site

Figure 4.7.1-1

As described in section 4.11.2.3, RG LNG estimated the impact of noise from LNG Terminal site preparation, construction, and operation. Site preparation and construction activities could result in an increase over ambient levels of 7.1 dB and 1.8 dB, respectively at piping plover critical habitat located on the south side of the BSC across from the LNG Terminal site (see table 4.7.1-3, below).

Construction-related noise could affect animal behavior and foraging patterns, and could result in individual birds moving away from the noise or relocating in order to avoid the disturbance. Impacts associated with construction noise would be temporary and limited to the construction period for the Project. No direct loss of individuals is expected given that the highly mobile species would likely leave areas of active construction. Thus, while effects may be adverse (see our Section 7 determination below), we do not believe impacts on the piping plover would be significant. Sound from site preparation activities, which would result in the greatest increase over ambient levels, would be temporary and would occur during Stage 1 of construction (see table 2.2.3-1).

Operation of the LNG Terminal would result in a 12.5 dB increase over existing ambient sound levels at the nearest piping plover critical habitat measurement location, for a total noise level of 67.5 dBA (see table 4.7.1-4). While these noise levels would not result in hearing damage, the sound level increase would be audible and therefore could cause behavior and/or physiological effects including avoidance (Dooling and Popper 2007, FHWA 2004). Noise from LNG Terminal operation would attenuate with increasing distance from the site, and noise levels in critical habitat would return to ambient levels within about 1.5 miles (see figure 4.11.2-1), an area that covers about 1,100 acres (about 15.2 percent) of habitat unit TX-1.

Although we anticipate that adverse impacts on bird behavior and use of the critical habitat would be limited to areas of considerable sound increases (i.e., an area less than the 1,100 acres noted above), no readily available data identify noise levels at which piping plovers may avoid critical habitat. As critical habitat is designated for the conservation of the species, an increase in ambient noise resulting in a reduction in quality of critical habitat may result in adverse effects on the species. Therefore, we conclude that the Project *is likely to adversely affect* the piping plover and its critical habitat.

Red Knot

The red knot, a shorebird, was federally listed as threatened in 2015. It breeds and nests in arctic tundra habitats located as far north as the Canadian Artic; however, it utilizes sandy coast habitats, from the U.S. Gulf Coast and into South America for migration and wintering (Cornell Lab of Ornithology 2013, FWS 2013b). The red knot generally migrates into the south between July and October and returns to the northern breeding grounds between April and June (TPWD 2016g). They feed on clams, mussels, and other invertebrates. In addition, the red knot generally roosts along sandy beaches and feeds along intertidal sandy mud areas. Primary threats to this species include coastal development, shoreline stabilization, dredging, and anthropogenic disturbances which may impact availability of food sources (FWS 2016h). This species is known to winter in south Texas, including all counties crossed by the proposed Project, with the exception of Jim Wells County (TPWD 2016g). No critical habitat has been designated.

Table 4.7.1-3
Estimated Noise Level Contributions for Site Preparation and Construction of the Rio Grande LNG Terminal at Nearby Sensitive Habitats

Location	Distance from LNG Terminal Site (miles)[a]	Direction from LNG Terminal Site	Existing Daytime Ambient (dBA)	Contribution L_{max} (dBA)		Combined Existing and Construction Noise Level L_{max} (dBA)		Expected Increase (dBA)	
				Site Preparation	Construction	Site Preparation	Construction	Site Preparation	Construction
Laguna Atascosa NWR	0.5	West	56.7	51.7	42.7	57.9	56.9	1.2	0.2
Piping Plover Critical Habitat	0.5	South	54.9	61.1	52.1	62.0	56.7	7.1	1.8
Wildlife Corridor	2.4	Southwest	57.8	51.3	42.3	67.9	67.8	0.1	0.0

[a] Distances are measured to the approximate center of the site for reference. Acoustic modeling was conducted to estimate construction noise levels, and considers the location of specific construction activities across the LNG Terminal site.

Table 4.7.1-4 Composite Noise Levels from the Rio Grande LNG Terminal at Nearby Sensitive Habitats during Operations					
Noise Sensitive Area	Distance and Direction from LNG Terminal (miles)	Existing Ambient L_{dn} (dBA)	Predicted LNG Terminal Contribution L_{dn} (dBA)	Ambient + LNG Terminal L_{dn} (dBA)[b]	Predicted Increase in Ambient Sound Level (dBA)
Laguna Atascosa NWR	0.5 west	59.8	71.4	71.7	11.9
Piping Plover Critical Habitat	0.5 south	55.0	67.2	67.5	12.5
Wildlife Corridor	2.4 southwest	68.9	60.3	69.5	0.6

[a] Distances are measured to the approximate center of the site for reference. Acoustic modeling was conducted to estimate construction noise levels, and considers the location of specific construction activities across the LNG Terminal site.

[b] Sound pressure levels are measured on a logarithmic scale; therefore, the predicted increase in ambient sound level at the noise sensitive areas during operation of the LNG Terminal would not be the sum of the two noise levels.

As discussed for the piping plover, individuals using the LNG Terminal site would likely leave the area as construction progresses and some potential foraging habitat would be lost. However, given the availability of adjacent habitat and the limited tidal influence of habitats on the LNG Terminal site, we conclude that construction and operation of the proposed Project *is not likely to adversely affect* the red knot.

Red-crowned Parrot

The red-crowned parrot is federally listed as a candidate species. This species is endemic to northeastern Mexico but may also occur in the Lower Rio Grande Valley and other parts of Texas. Habitat for the red-crowned parrot typically includes tropical lowlands and foothills, tropical deciduous forest, gallery forest, floodplain forest, thornscrub, and partially cleared or cultivated fringe habitat (FWS 2011). The red-crowned parrot is a non-migratory species but has been described as nomadic during the winter season when other species of birds flock to their habitat. This species generally forages in the tops of trees, occasionally dropping to low-lying bushes in pursuit of food. The red-crowned parrot feeds on seeds and fruits and further supplements its diet with buds and flowers of other plants. This species nests in pre-existing tree cavities from March to August.

In recent years, the red-crowned parrot population has declined primarily from extensive habitat loss, degradation of nests, and predation (Cornell Lab of Ornithology 2016, FWS 2011). The red-crowned parrot is only known to occur along the southernmost part of the Project (Cameron and Willacy Counties) where there is no forest land, therefore no suitable nesting habitat would be crossed. Although south Texas salty thorn scrub habitat (potential foraging habitat) would be disturbed and/or lost during construction and operation of the LNG Terminal, the species is mobile and would likely move away from areas of increased noise and human presence; therefore, the Project is *unlikely to result in a trend towards federal listing* for the red-crowned parrot.

Whooping Crane

The federally endangered whooping crane has three wild populations, including the Aransas-Wood Buffalo National Park population, which is the only remaining self-sustaining wild population. This population nests at and near the Wood Buffalo National Park in Canada and winters in coastal marshes at the Aransas NWR on the southern coast of Texas (FWS 2016i). Migrations to the Aransas NWR begin in mid-September, arriving around November, and leave the NWR in late March or early April. Wintering habitat includes salt flats and marshes, swales and ponds present within areas of coastal prairie, and cropland adjacent to these habitats (TPWD 2016h, Cornell Lab of Ornithology 2015). Whooping cranes are omnivorous, with food sources depending on their location. The Aransas NWR population will eat aquatic organisms, small reptiles and mammals, plant material, and waste grains from agricultural fields (Cornell Lab of Ornithology 2015). The biggest threats to the species are power lines, illegal hunting, and habitat loss (TPWD 2016h).

The Aransas NWR is more than 80 miles northeast of the proposed Project, which coincides with the closest area of whooping crane critical habitat. Although the species is generally noted as potentially occurring only in the northern counties of the Pipeline System (north of MP 66.0), FWS staff have observed multi-year sightings near the LNG Terminal site, indicating a potential expansion of the species' range (FWS 2016i).

Suitable wintering habitat is present within the footprint of the proposed Project. Specifically, the northern portion of the pipeline route includes grassland, cropland, and some wetlands; the southern portion of the pipeline route, and the LNG Terminal site, include coastal marsh habitat. If whooping cranes were present at the time, construction within these habitats would temporarily displace them to nearby habitat. Operation, especially of the LNG Terminal, would result in the permanent conversion of potential habitat to developed land that whooping cranes would likely avoid in favor of quieter, undisturbed habitat in the adjacent land. Given the lack of breeding/nesting in the southern United States, and implementation of RG Developers' Plan and Procedures to restore habitats within temporary workspaces, we find that construction and operation of the proposed Project *is not likely to adversely affect* the whooping crane.

4.7.1.4 Mammals

Ocelot

The federally endangered ocelot is a solitary feline species distributed from Texas and Arizona, south through Mexico and into South America (FWS 2010c). Preferred habitat is characterized as dense brush with 75 percent canopy or more, and may include chaparral thickets, mesquite-thorn scrub, and live oak mottes (TPWD 2016g, FWS 2015d); the most crucial habitat is that with dense vegetation cover less than 3 feet high (FWS 2015d). The ocelot is primarily nocturnal, hunting small mammals, birds, and reptiles at night and resting during the day in trees or sheltered dens (FWS 2010c, TPWD 2016i).

The primary threats to this species are collisions with vehicles, habitat loss and fragmentation, and loss of genetic diversity as populations dwindle and are isolated from each other (FWS 2012d). No critical habitat has been designated for the ocelot. Multiple scoping comments were received raising concerns about impacts on ocelots, specifically those located at the Laguna Atascosa NWR, and how the LNG Terminal would affect those individuals.

There are two breeding populations in south Texas, with an estimated total of 53 individuals between the two. One population occurs in Willacy and Kenedy Counties, primarily on private land; the other (about 17 individuals) occurs primarily on the Laguna Atascosa NWR in Cameron County (FWS 2015d, 2016j). At least some ocelots of the Willacy/Kenedy County population are known to den in the El Jardin and San Perlita Conservation Area, which lies about 2.6 miles north of the proposed Pipeline System at MP 79.0 (see figure 4.6.1-1). The Laguna Atascosa NWR is a 97,000-acre area; the proposed LNG Terminal site is located immediately adjacent to its southern border, across SH-48 (a distance of about 212.2 feet). In addition, the proposed Pipeline System skirts the southwestern boundary of the Laguna Atascosa NWR, with a minimum separation of 52.8 feet at multiple spots between MPs 126.0 and 135.5 (see table 4.8.1-3). In addition to the counties with known breeding populations, ocelots have also been observed in Hidalgo and Jim Wells Counties (FWS 2015d). As discussed in section 4.8.1.5, there are three easements crossed by the pipeline in Cameron County that are designated for the protection of ocelot habitat; we have recommended that RB Pipeline work with the Farm Service Agency (FSA) to determine the specific location of these parcels and to avoid, minimize, or mitigate for impacts on them.

Ocelots live within a home range, which typically ranges from 1 to 4 square miles (TPWD 2016m); home ranges may overlap for cats of different sexes, but not for those of the same sex (FWS 2015d). Ocelots can bear young year-round and the females create well-hidden dens in dense, thorny scrub, caves, tree or log hollows, and bunched grasses. The mother cares for the kittens until such a time that they can take care of themselves. When the cats are about one to 2 years old, they typically disperse from the natal range; males always disperse to establish their own home range while females may or may not leave the natal area. One study that tracked six dispersing juveniles from the Laguna Atascosa NWR indicated that dispersal to find and establish an independent home range took between 7 and 9 months; established home ranges were between 1.6 and 5.6 miles from the natal range (center to center). During dispersal, these young cats used narrow corridors of brush, between 16 and 328 feet wide, along resacas, drainage ditches, and small scrub patches within agricultural or pasture land (FWS 2015d).

In the last 30 years, about 45 percent of the tracked deaths in south Texas have been due to vehicular incidents. Given the high rate vehicular mortality, TxDOT has begun installing wildlife underpasses and culverts at major roadways, including SH-48 and SH-100. One such project included installation of a wildlife corridor for the protection of ocelots, Gulf Coast jaguarundi (discussed below), and other wildlife under SH-48 during its recent expansion. This expansion included the addition of two lanes (for a total of four lanes) and a concrete barrier; the FWS' biological opinion in 2004 provided for a take of one ocelot and one jaguarundi, neither of which had occurred through the report date (December 2015). Expansions and modifications along SH-100, which runs from Port Isabel north of the Laguna Atascosa NWR have also been including wildlife crossing areas to minimize the potential for the endangered cats to be hit by vehicles, as discussed in section 4.6.1.4 (FWS 2015d).

As discussed in section 4.9, up to 5,225 workers would be present onsite during construction of the LNG Terminal; RG LNG has estimated that 4,600 roundtrips (9,200 individual transits) would occur between the LNG Terminal site and worker housing/parking areas. Although the traffic levels would be within the planned capacity of the roadway, it would represent a considerable increase in the traffic currently experienced on SH-48 (about 12,000 transits per day), and other local roadways, which could result in the direct mortality of ocelots. As ocelots injured along SH-48 would most likely belong to the Laguna Atascosa NWR population, which is estimated to include 17 cats, each direct mortality would result in a 6 percent reduction in the local population. Although the loss of one cat would result in a significant impact on ocelots, RG LNG's high-volume use of SH-48 during construction would be within the design capacity of the SH-48 expansion (40,000 transits per day); therefore, the FWS' biological opinion on the expansion of SH-48 has accounted for the potential increase in traffic and determined that the expansion project was not likely to result in jeopardy of ocelots. Traffic associated with construction of the LNG Terminal would generally occur during the day, although morning shifts may start before sunrise depending on the time of year; minimizing nighttime driving would limit the potential for vehicular collisions with the nocturnal cats. In addition, worker training would include information on the ocelot, its habitat, and activity, and reduced speed limits would be enforced within, to, and from construction workspaces for the entire Project. The operational staff for the LNG Terminal would include about 330 people, which would result in a permanent, but minor impact on local roadway traffic.

Construction and operation of the proposed Project could affect ocelots through direct injury/mortality during habitat clearing. Indirect effects could also occur from the habitat disturbance/fragmentation, increased human presence, and increased noise during construction and operation. Although ocelots would occur in the vicinity of the LNG Terminal site and pipeline facilities, direct impacts on ocelots during vegetation clearing along the pipelines is unlikely due to the mobility of the species and the routing of the pipelines to avoid the centers of known populations, such that any individuals using the construction footprint would likely be transient. The LNG Terminal site does include suitable habitat for ocelots; however, RG LNG has agreed to complete pre-construction surveys and hazing at the LNG Terminal property to flush wildlife from the site prior to completing the fencing.

Indirect disturbance from habitat loss or fragmentation along the Pipeline System could result in short-term displacement if the habitat were occupied, and disruption of dispersion from natal areas and transient movements, which typically follow habitat corridors. To provide habitat and a safe travel corridor for wildlife, but particularly for ocelots, the FWS has identified a Coastal Corridor acquisition area which, when acquired by the agency and its partners, would protect land between the Bahia Grande unit of the Laguna Atascosa NWR (directly north of the LNG Terminal site) and a larger unit located further north in Cameron County (FWS 2010d; see figure 4.6.1-1); the acquisition area would not be crossed by the Project. However, potential habitat would be crossed by the Pipeline System outside of the acquisition area, including about 542.3 acres of upland shrub/forest habitat, which would be temporarily disturbed during construction of the Pipeline System. Of that, 336.1 acres would be maintained in an herbaceous state for the life of the Project.

Given the linear nature of the Pipeline System, shrub/forest land would be converted to herbaceous land within a 75-foot-wide corridor through areas potentially used as habitat corridors; however, as ocelots are known to transit through other habitat types (albeit possibly due to the lack of available scrub-shrub), we conclude that a creation of such a corridor through transient habitat would not result in a significant adverse effect on ocelots.

Scoping comments were raised regarding impacts on the ocelot corridor that is present west of the LNG Terminal site. As part of the SH-48 expansion project, discussed above, the BND granted the FWS a 19-year conservation easement along the BSC, including an area about 1,000 feet wide and stretching from SH-48 (at the wildlife corridor) to the BSC. Although camera traps have been installed at the wildlife corridor, no ocelots (or jaguarundi) have been recorded using it (FWS 2015d). To avoid impacts on this corridor, which would be crossed by the pipeline route from MP 134.5 to MP 134.7, RB Pipeline would install the pipeline via HDD crossing methods, which would avoid surface impacts from MP 134.4 to MP 135.5, with the exception of hand-clearing within a 2-foot-wide corridor for placement of the HDD guide wire. Ocelots, jaguarundi, or other wildlife could temporarily avoid use of the wildlife corridor due to noise during active HDD construction, which could occur up to 24 hours per day, 7 days a week, for up to 10 weeks.

During restoration of the construction workspaces, RG Developers would implement their Plan and Procedures, which includes measures to restore original contours, minimize disturbance at wetlands and waterbodies, and revegetate using seed mixes appropriate for the region, as developed in consultation with the NRCS. To minimize the potential for invasive species in areas disturbed by construction, RG Developers would implement their Noxious and Invasive Weed Plan, which includes measures to prevent the introduction of weeds and treat for any weeds that may become established in construction workspaces. RG Developers would also implement their SPCC Plans for the LNG Terminal and Pipeline System, which include measures to minimize the potential for inadvertent spills of hazardous materials.

In addition to land temporarily disturbed during construction, the proposed Project would result in the loss (conversion to developed land) of 189.1 acres of upland shrub habitat at the LNG Terminal site, of which 138.3 a include mesquite-thorn scrub vegetation. As discussed in section 4.5.4, a 63.9-acre loma that currently exists on the LNG Terminal site would also be lost during development of the property; loma habitat is important feeding habitat for ocelots. Although no individuals have been observed on the property, possibly due to the lack of specific studies conducted on the property, loss of these habitats would result in a potential decrease in foraging habitat for cats within the Laguna Atascosa NWR.

In order to offset the loss of wetlands at the LNG Terminal site, RG LNG has proposed to preserve land within the Loma Ecological Preserve, south of the BSC (see section 4.4.2.4); ocelots have been recorded within and adjacent to the Loma Ecological Preserve and therefore preservation of this land may also benefit ocelots. However, as the recovery plan for ocelots, which was noted by the public during scoping, identifies preservation and expansion of ocelot habitat, as well as protection of habitat surrounding known ocelot populations, loss of potential habitat at the LNG Terminal site is in opposition to the recovery actions identified in the recovery plan and preservation of habitat across the BSC may not be consistent with the final recovery plan (FWS 2016j). Therefore, we have recommended below that RG LNG finalize its mitigation, in coordination with the FWS, to offset the direct loss of suitable ocelot habitat within the footprint of the LNG Terminal site, in a manner that adheres to the final recovery plan.

Construction and operation of the proposed Project could also displace ocelots using suitable habitat adjacent to the Project facilities due to the increase in noise and light, particularly near the LNG Terminal site and the portion of the Pipeline System near the Laguna Atascosa NWR. Although the actual timing of construction would be determined by the receipt of all required permits, RG LNG originally anticipated that construction activities at the LNG Terminal site would be staggered over a 7-year period, predominantly during daylight hours. Construction-related noise could affect ocelot behavior, foraging, or breeding patterns, as they may move away from the noise or relocate in order to avoid the disturbance. RG LNG estimates that the composite noise level produced during facility grading and construction would result in maximum noise levels of 51.7 dBA at the Laguna Atascosa NWR, which is considered moderate (see tables 4.11.2-1 and 4.7.1-3). Where the Laguna Atascosa NWR is near the northern boundary of the LNG Terminal site, the sound level increase over ambient levels during Terminal site preparation and construction would be below 3 dB and would not likely be perceptible. Similarly, at the wildlife corridor under SH-48 (about 2.4 miles west of the of the LNG Terminal site's center), sound levels from site preparation would result in a negligible increase over existing ambient levels that would not likely be perceptible, and construction would not result in an increase in ambient sound levels (see table 4.7.1-3). Construction of the Pipeline System would occur over a limited duration at any one location (see section 4.11.2.3).

Operational noise would result in an increase in the ambient sound levels in the immediate vicinity of the Project. At the boundary of the LNG Terminal site, operational sound levels would be about 75 dBA. Where the Laguna Atascosa NWR is near the northern boundary of the LNG Terminal site, noise levels during terminal operations would be 71.4 dBA, and would result in an expected increase of about 11.9 dB over ambient levels (see table 4.7.1-4). Within about 1 mile, construction noise would drop to about 60 dBA, which is audible, but likely not a nuisance, and at a distance of about 2 miles, noise would drop to about 50 dBA, which is considered quiet (see figure 4.11.2-1). The wildlife corridor under SH-48 is about 2.4 miles west of the of the LNG Terminal site; at this distance, noise levels from site preparation, construction, and operation of the LNG Terminal would result in a negligible increase (less than 1 dB) over existing ambient levels (see table 4.7.1-4). Sound would attenuate with increased distance from construction activity and general wildlife is expected to be accustomed to similar sound levels due to the current noise levels produced by high-speed vehicles on highways (70 to 80 dBA at 50 feet) and recreational marine vessels along the BSC (generally around 86 dBA) (FHWA 2003, Coast Guard 2003). Since conducting the noise impact analysis, RG LNG has adopted certain mitigation (see section 4.11.2.3); however, these modifications did not result in significant changes in noise attenuation identified above.

We have reviewed habitat within the Laguna Atascosa NWR that falls within a 1-mile radius of the proposed LNG Terminal site where construction noise from the LNG Terminal would be about 60 dBA, as described above. In total, about 2,464 acres would fall within the 1-mile radius, of which about 437 acres (17.7 percent) are classified as having scrub-shrub vegetation (TPWD 2017a). Although this habitat would not be directly impacted by the Project facilities, any change in ocelot behavior, including temporary or permanent displacement away from noisy areas, may increase intra-species competition for home ranges and resources; therefore, increases in noise within suitable habitat in the southern portion of the Laguna Atascosa NWR could affect individual ocelots using the area.

To avoid a decrease in quality of potentially suitable ocelot habitat within a federally protected NWR where ocelots are known to exist, and to finalize mitigation for the loss of potential foraging/migratory habitat within the LNG Terminal site, **we recommend that:**

- **Prior to construction of the LNG Terminal, RG Developers should consult with the FWS to determine the likelihood for ocelots to use land in the lower Laguna Atascosa NWR that are within 1 mile of the LNG Terminal site, develop a plan to mitigate for a decrease in the quality of potential habitat within the NWR, and finalize the proposed mitigation for direct loss of potential habitat within the LNG Terminal site in a manner that adheres to the Final Recovery Plan for the ocelot. This mitigation plan should be filed with the Secretary along with written records of concurrence or other comments from the FWS.**

The overall increase in nighttime lighting during construction and operation of the Project would result in a permanent, but minor impact on ocelots, if they utilize habitat in the lower Laguna Atascosa NWR. RG LNG has developed mitigation measures to minimize the impacts of nighttime lighting at the LNG Terminal site, including limiting the amount of outdoor lighting installed, dimming lights at night, and directing light downward.

The RG Developers have proposed multiple mitigation measures for use during construction and operation of the proposed Project to minimize impacts on ocelots. These measures include siting the Project to avoid direct impacts on habitats designated or managed for the protection of ocelots, as well as implementation of their Plan, Procedures, Noxious and Invasive Weed Plan, and SPCC Plans. Although increases in local traffic may affect the ocelot, the majority of Project traffic would occur during daylight hours, and traffic levels would be within the design capacity of SH-48; therefore, the increase in traffic has already been assessed by the FWS and a determination of non-jeopardy was made. However, as indicated by our recommendation, indirect effects on ocelots within the lower Laguna Atascosa NWR may occur from an increase in ambient sound levels for the life of the Project. In addition, suitable habitat would be lost within the LNG Terminal site boundaries, and potential pipeline impacts may occur on CRP-SAFE land that may be protective of ocelot habitat (see section 4.8.1.5). As the loss of suitable habitat, through either direct or indirect pathways, has the potential to result in significant impacts on ocelots and ocelot recovery, we find that the proposed Project *is likely to adversely affect* the ocelot.

Gulf Coast Jaguarundi

The elusive Gulf Coast jaguarundi is a federally endangered feline species that was historically distributed from the Lower Rio Grande Valley to eastern Mexico. Habitat generally includes dense shrubland and woodland areas adjacent to open areas containing dense thorn scrub and woody vegetation. The Gulf Coast jaguarundi feeds primarily on birds, small mammals, and reptiles. The primary threats to this species include habitat loss, degradation, and fragmentation. In Cameron County, approximately 91 percent of woodlands were historically lost to agricultural use; however, recently rapid population growth resulting in urban expansion is converting this land into highly fragmented, mixed urban habitat (FWS 2013c). No critical habitat has been designated. No confirmed sightings of the species have occurred since 1986, despite significant efforts in the regional NWRs to photograph or catch small felids; however, unconfirmed sightings from FWS staff include a sighting within the Laguna Atascosa NWR in 2004 (FWS 2015d). If present in the area, the jaguarundi would experience impacts similar to those discussed for the ocelot, although they are predominantly diurnal (active during the day; Caso 2013). However, given the general lack of sightings, we anticipate that the potential for the species to occur is extremely limited and we therefore find that the Project *is not likely to adversely affect* the Gulf Coast jaguarundi.

4.7.1.5 Amphibians

Black-spotted Newt

The black-spotted newt is under review by FWS to determine if listing under the ESA is warranted, but it currently has no federal protection. This species is located along the Gulf Coast Plain, from south of San Antonio to Mexico, but has never been identified more than 80 miles inland. This species is generally found in wetter areas including arroyos, canals, ditches, and shallow depressions (Flores-Villela et al. 2008, TPWD 2016g). As there is potential habitat for the black-spotted newt within and adjacent to the freshwater streams and ponds crossed by the Pipeline System, open-cut crossing of streams has the potential to cause direct mortality of any newts within the footprint of construction, and indirect effects from turbidity and sedimentation, if newts are located immediately downstream of active construction.

Texas occurrence records indicate that the black-spotted newt was historically known to occur within 1 mile of Project workspaces between MPs 55.5 and 67.3, MPs 69.2 and 72.0, MPs 75.3 and 81.0, and MPs 123.0 and 130.5; however, with the exception of locations between MPs 55.5 and 67.3, observations are greater than 60 years old. (TXNDD 2017). The Pipeline System would cross the majority of (all but 2) freshwater waterbodies within 1 mile of historic observations using dry crossing methods (HDD or bore). Given the general avoidance or minimization of impacts on historically used habitat and RB Pipeline’s implementation of its Procedures and SPCC Plan, which would minimize impacts on crossed waterbodies to the extent practicable, as well as our recommendations to minimize impacts at waterbody crossings in section 4.3.2.2, we find that construction and operation of the proposed Project *is unlikely to result in a trend towards federal listing* for the black-spotted newt.

4.7.1.6 Plants

Black Lace Cactus

The black lace cactus, which is federally listed as endangered, is a small, pink-flowering cactus that generally occurs within and adjacent to dense brush habitat along the coastal plains. This cactus prefers saline soils and exists only along the Gulf Coast plain, between the coastal grasslands and Rio Grande plain shrub. It typically grows in open, unshaded areas amongst mesquite brush, located along streams of the coastal plain; however, it has also been found on grasslands, thorn shrubland, and mesquite woodland areas (FWS 2006). It is generally found in areas that have not been subject to ground disturbances (TPWD 2016e). Flowering occurs from March to June, with a peak flowering period of from April to May, and it is believed to regenerate by seed-dispersal from ants and fur-bearing mammals. The largest threat posed to the black lace cactus is loss of habitat and habitat degradation. As of 2007, there were two known populations of the black lace cactus in Kleberg and Refugio Counties, although it is possible that populations also exist in Jim Wells County (FWS 2006). The closest known occurrence for the black lace cactus is approximately 3.5 miles northeast of the Project in Kleberg County (TXNDD 2017).

Slender Rush-pea

The federally listed endangered slender rush-pea is a small, perennial legume that produces three to five salmon/orange colored flowers (TPWD 2016j). The slender rush-pea also contains a woody taproot and may form colonies. This species typically reproduces during the spring and summer months, produces fruit from February through July, and flowers from March to June (TPWD 2016j, FWS 2008b). This species prefers coastal prairie grassland located on relatively flat uplands as well as gently sloping drainages containing short- and mid-grasses or sparse vegetation.

In addition, the slender-rush pea prefers blackland clay soil types; however, it may also occur in soils that are coarse textured and lighter in matrix hues than the blackland clay. The majority of documented occurrences of this species have been recorded in patches of short-grass prairie habitat adjacent to intermittent or perennial creeks. Further, this species has been noted as unable to persist in areas which had been severely disturbed which could include, but are not limited to, pastures, cropland, and rights-of-way.

Known populations of the slender rush pea, including historic and extant communities, are restricted to areas of Nueces and Kleberg Counties that are approximately 10 miles east of the Project, extending from Robstown in Nueces County westward near Kingsville in Kleberg County (FWS 2008b, FWS 2017). The primary threats to this species include limited geographic distribution, and habitat conversion and fragmentation (FWS 2008b, TPWD 2016j, k, and TXNDD 2017).

South Texas Ambrosia

The south Texas ambrosia is federally listed as endangered. This herbaceous plant is a 10- to 60-centimeter tall silver to grayish-green perennial that produces green, pink, or cream-colored flowers. This species typically reproduces from late summer to fall, depending upon localized climate conditions (FWS 2010e, TPWD 2016l). The south Texas ambrosia prefers grassland and shrubland dominated by mesquite, primarily along the Coastal Plain atop the Beaumont Formation. This plant is generally present in a variety of heavy soil types ranging from clay loams to sandy loams (FWS 2010e, TPWD 2016l, FWS 2010e, USGS 2018).

The primary threats to this species include limited geographic distribution, habitat conversion to agricultural land, and urbanization/development. Historically, this species was known in Cameron, Jim Wells, Kleberg, and Nueces Counties across south Texas and into

Mexico; however, the seven known populations occur only from north-central Kleberg County through Nueces County (TPWD 2016m, FWS 2017). No known occurrences of the south Texas ambrosia were reported within approximately 2.5 miles of the Project area (TXNDD 2017). Further, the only area where the Beaumont Formation would only be crossed by the Project is in Cameron and Willacy Counties, where extant populations are not known to occur.

Plant Impacts and Mitigation

As plants are immobile, construction has the potential to cause direct impacts through destruction of habitat or individual plants or habitat conversion or alteration, which may result in rendering an area unsuitable for species growth. Indirect impacts could include the introduction of invasive plant species, and inadvertent spills that may affect the quality of local soils.

No known populations or individuals of the three federally listed plant species occur in close proximity to the Project area. In addition, preferred habitat for the species may not be present along the northern portions of the route where these species are known to occur. The disturbed (agricultural) nature of most of the route in these northern counties would not be suitable for the black lace cactus or slender rush-pea, and the typical geologic features preferred by the south Texas ambrosia would not be crossed in counties with known, extant populations. However, it is possible that individual plants, or their habitat, do occur and could be directly impacted by construction and operation of the pipeline facilities, particularly within the northern counties, particularly in the northern counties; FWS indicated during early consultation that the south Texas ambrosia is not expected in Cameron County. Therefore, RB Pipeline has committed to conducting a single season of species-specific surveys for the three federally listed plants with the potential to occur in the Project area. The surveys would be conducted using FWS-approved botanists, protocols, and timing, and would be conducted in locations determined in coordination with the FWS. Mitigation for any identified individuals would be determined in coordination with the FWS but may include micro-siting or relocation.

Indirect impacts would be minimized through RG Developers' Noxious and Invasive Weed Plan, which would minimize the potential for the introduction or spread of plants that may outcompete the listed species. In addition, RG Developers would implement their SPCC Plans for construction and operation of the Project to minimize the potential for inadvertent spills of hazardous material, and their Plan and Procedures, which would allow for the restoration of areas not permanently encumbered by the LNG Terminal or aboveground facilities.

With implementation of the Project plans discussed above, indirect impacts on the federally listed species are unlikely. Further, to ensure direct impacts are avoided to the extent possible, **we recommend that:**

- **<u>Prior to construction of the Rio Bravo Pipeline</u>, RB Pipeline should file with the Secretary, the results of its completed surveys for the black lace cactus, slender rush-pea, and south Texas ambrosia as well as any comments from the FWS regarding the results. If applicable, RB Pipeline should file avoidance/minimization measures that it would implement if individual plants are found, developed in consultation with the FWS.**

Given our recommendation to complete surveys and develop and implement avoidance/minimization measures if individuals were found, and the assurance that any necessary follow-up consultation based on survey results would be completed prior to construction being authorized, we conclude that construction and operation of the proposed Project *is not likely to adversely affect* the black lace cactus, slender rush pea, and south Texas ambrosia. As noted in table 4.7-1, we have determined that the Project would have no effect on the Texas ayenia as the FWS has indicated that it is not expected in the Project area (FWS 2016e). A variety of measures have been proposed by RG Developers that would minimize impacts on federally listed species, including implementation of their Plan and Procedures, SPCC Plans, and NMFS' vessel strike and sea turtle construction practices. In addition, we have recommended that RG Developers implement additional mitigation for the protection of federally listed species to further minimize the potential for impacts. However, because consultation with the FWS and NMFS is ongoing, **we recommend that:**

- **RG Developers should not begin construction activities until:**

  a. FERC staff receives comments from the FWS and NMFS regarding the proposed action;

  b. FERC staff completes ESA Section 7 consultation with the FWS and NMFS; and

  c. RG Developers have received written notification from the Director of OEP that construction or use of mitigation may begin.

4.7.2 State Listed Species

In addition to federally listed species, or those that are under review for federal listing, the State of Texas provides protections for those species listed as state endangered or state threatened. Those species are discussed in section 4.7.2.1. Federal protection is also provided to all marine mammals through the MMPA; those marine mammals that may occur in the Project area, including the LNG transit routes within the Gulf of Mexico, are discussed in section 4.7.3.

4.7.2.1 State Listed Species

The TPWD annotated county lists of rare species for counties crossed by the Project include 43 state listed endangered or threatened species (see table 4.7.2-1); state listed species that are also federally listed within the Project area are discussed in section 4.7.1. We have determined that 13 of these species would not be impacted by the Project because the Project is not within the known range of the species, the species has been extirpated in the Project area, there is no suitable habitat in the Project area, or the species would only occur in the Project area as an occasional transient. These species are listed in table 4.7.2-1 but are not discussed further. The remaining 30 state listed species could potentially occur in the vicinity of the Project. These species are discussed in the following sections.

Birds

Sixteen species of state listed birds have the potential to occur in the Project area; each species, its state listed status, and its habitat are included in table 4.7.2-1. During spring (2017) surveys of the LNG Terminal site, two state listed birds were observed; each observation (four observations of the reddish egret and two observations of the white-tailed hawk) were of these species flying over the LNG Terminal site rather than directly using the habitat. As discussed in section 4.6.1.3, BCCs also are present in the Project area; these birds, their preferred habitat, and their potential for occurring in the Project area are listed in appendix K.

To minimize impacts on bird species, RG Developers have developed the MBCP, which includes measures to avoid clearing during the FWS-recommended nesting period, as practicable, or to survey for and avoid active nests. These measures are discussed in detail in the MBCP and summarized in section 4.6.1.3, along with our recommendation to finalize the plan. As the measures in the plan would only be implemented as RG Developers determine to be practicable at the time of construction, some birds and nests would likely be lost as a result of construction. As further discussed in section 4.6.1.3, we have determined that adult birds would likely leave areas of active construction, but any nests/eggs within the construction footprint would be lost.

Although the loss of nests/eggs would represent an adverse impact, it is unlikely to cause a noticeable effect on avian populations. Further, as no state listed birds were identified using the habitat at the LNG Terminal site during surveys, and because RG LNG would conduct wildlife hazing at the site prior to constructing the fence, we find that the probability of state listed species nesting onsite upon commencement of construction would be minimal. However, we agree that the measures in RG LNG's MBCP, as finalized in accordance with our recommendation, are appropriate for use and would adequately protect BCCs as well as state listed birds.

Overall, construction of the proposed Project would result in permanent, minor to moderate impacts on birds in general due to loss of habitat in an area heavily used by birds during the migration period. The impact on certain bird species may be offset through the preservation of habitat in the nearby Loma Ecological Preserve, which is being proposed as mitigation for wetland impacts (see section 4.4); the proposed restoration activities at this location are being evaluated by the FWS for their value to migratory birds, and by the COE for wetland mitigation. However, with implementation of the MBCP, we conclude that there would be no significant impacts on the 16 state listed migratory bird species during construction and operation of the Project.

Table 4.7.2-1
State Listed Species Potentially Occurring in the Vicinity of the Proposed Rio Grande LNG Project[a]

Species Name *Scientific Name*	State Status	Counties of Potential Occurrence	General habitat	Determination of Effect
Birds				
American peregrine falcon *Falco peregrinus anatum*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in the United States and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.	*No significant impact*
Cactus ferruginous pygmy-owl *Glaucidium brasilianum cactorum*	T	Cameron, Kenedy, Willacy	Riparian trees, brush, palm, and mesquite thickets; during day also roosts in small caves and recesses on slopes of low hills; breeding April to June.	*No significant impact*
Common black-hawk *Buteogallus anthracinus*	T	Cameron, Willacy	Cottonwood-lined rivers and streams; willow tree groves on the lower Rio Grande floodplain; formerly bred in south Texas.	*No significant impact*
Eskimo curlew *Numenius borealis*	E	Cameron, Kenedy, Kleberg, Willacy	Historic. Nonbreeding: grasslands, pastures, plowed fields, and less frequently, marshes and mudflats.	*No impact*
Gray hawk *Asturina nitida*	T	Cameron	Locally and irregularly along the United States-Mexico border; mature riparian woodlands and nearby semiarid mesquite and scrub grasslands; breeding range formerly extended north to southernmost Rio Grande floodplain of Texas.	*No significant impact*
Interior least tern *Sterna antillarum athalassos*	E	Cameron	Subspecies is federally and state listed only when more than 50 miles from a coastline. Nests along sand and gravel bars within braided streams/rivers; also know to nest on man-made structures. Eats small fish and crustaceans; when breeding forages within a few hundred feet of colony.	*No significant impact*
Northern beardless-tyrannulet *Camptostoma imberbe*	T	Cameron, Kenedy, Kleberg, Willacy	Mesquite woodlands; near Rio Grande frequents cottonwood, willow, elm, and great leadtree; breeding April to July.	*No significant impact*
Peregrine falcon *Falco peregrinus*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (*F.p. anatum*) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, *F.p. tundrius* is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.	*No significant impact*

Table 4.7.2-1 (continued)
State Listed Species Potentially Occurring in the Vicinity of the Proposed Rio Grande LNG Project[a]

Species Name *Scientific Name*	State Status	Counties of Potential Occurrence	General habitat	Determination of Effect
Reddish egret *Egretta rufescens*	T	Cameron, Kenedy, Kleberg, Willacy	Resident of the Texas Gulf Coast; brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear. Four separate individuals were observed flying over the LNG Terminal site during spring 2017 surveys.	*No significant impact*
Rose-throated Becard *Pachyramphus aglaiae*	T	Cameron, Kenedy, Willacy	Riparian trees, woodlands, open forest, scrub, and mangroves; breeding April to July.	*No significant impact*
Sooty tern *Sterna fuscata*	T	Cameron, Kenedy, Kleberg, Willacy	Predominately 'on the wing'; does not dive, but snatches small fish and squid with bill as it flies or hovers over water; breeding April-July.	*No significant impact*
Texas Botteri's Sparrow *Aimophila botterii texana*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Grassland and short-grass plains with scattered bushes or shrubs, sagebrush, mesquite, or yucca; nests on ground of low clump of grasses.	*No significant impact*
Tropical parula *Parula pitiayumi*	T	Cameron, Kenedy, Willacy	Dense or open woods, undergrowth, brush, and trees along edges of rivers and resacas; breeding April to July.	*No significant impact*
White-faced ibis *Plegadis chihi*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats.	*No significant impact*
White-tailed hawk *Buteo albicaudatus*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral; breeding March-May. Two separate individuals were observed flying over the LNG Terminal site during spring 2017 surveys.	*No significant impact*
Wood stork *Mycteria americana*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960.	*No significant impact*

Table 4.7.2-1 (continued)
State Listed Species Potentially Occurring in the Vicinity of the Proposed Rio Grande LNG Project[a]

Species Name *Scientific Name*	State Status	Counties of Potential Occurrence	General habitat	Determination of Effect
Zone-tailed hawk *Buteo albonotatus*	T	Cameron, Kenedy, Willacy	Arid open country, including open deciduous or pine-oak woodland, mesa or mountain county, often near watercourses, and wooded canyons and tree-lined rivers along middle-slopes of desert mountains; nests in various habitats and sites, ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in high mountain regions.	*No significant impact*
Mammals				
Coues' rice rat *Oryzomys couesi*	T	Cameron, Kenedy, Willacy	Cattail-bulrush marsh with shallower zone of aquatic grasses near the shoreline; shade trees around the shoreline are important features; prefers salt and freshwater, as well as grassy areas near water; breeds April-August.	*No impact*
Jaguar *Panthera onca*	E	Cameron, Kenedy, Kleberg, Willacy	Extirpated; dense chaparral; no reliable TX sightings since 1952.	*No impact*
Southern yellow bat *Lasiurus ega*	T	Cameron, Kenedy, Kleberg, Willacy	Associated with trees, such as palm trees (*Sabal mexicana*) in Brownsville, which provide them with daytime roosts; insectivorous; breeding in late winter.	*No impact*
White-nosed coati *Nasua narica*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Woodlands, riparian corridors and canyons; most individuals in Texas probably transients from Mexico; diurnal and crepuscular; very sociable; forages on ground and in trees; omnivorous; may be susceptible to hunting, trapping, and pet trade.	*No impact*
Amphibians				
Mexican treefrog *Smilisca baudinii*	T	Cameron, Kenedy, Willacy	Subtropical region of extreme southern Texas; breeds May-October coinciding with rainfall, eggs laid in temporary rain pools.	*No significant impact*
Sheep frog *Hypopachus variolosus*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Predominantly grassland and savanna; moist sites in arid areas.	*No significant impact*
South Texas siren (large form) *Siren sp 1*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Wet or sometimes wet areas, such as arroyos, canals, ditches, or even shallow depressions; aestivates in the ground during dry periods, but does require some moisture to remain; southern Texas south of Balcones Escarpment; breeds February-June.	*No significant impact*
White-lipped frog *Leptodactylus fragilis*	T	Cameron	Grasslands, cultivated fields, roadside ditches, and a wide variety of other habitats; often hides under rocks or in burrows under clumps of grass; species requirements incompatible with widespread habitat alteration and pesticide use in south Texas.	*No significant impact*

Table 4.7.2-1 (continued) State Listed Species Potentially Occurring in the Vicinity of the Proposed Rio Grande LNG Project[a]				
Species Name ***Scientific Name***	**State Status**	**Counties of Potential Occurrence**	**General habitat**	**Determination of Effect**
Reptiles				
Black-striped snake *Coniophanes imperialis*	T	Cameron, Kenedy, Willacy	Extreme south Texas; semi-arid coastal plain, warm, moist micro-habitats and sandy soils; proficient burrower; eggs laid April-June.	*No significant impact*
Northern cat-eyed snake *Leptodeira septentrionalis septentrionalis*	T	Cameron, Kenedy, Kleberg, Willacy	Gulf Coastal Plain south of the Nueces River; thorn brush woodland; dense thickets bordering ponds and streams; semi-arboreal; nocturnal.	*No significant impact*
Reticulate collared lizard *Crotaphytus reticulatus*	T	Jim Wells	Requires open brush-grasslands; thorn-scrub vegetation, usually on well-drained rolling terrain of shallow gravel, caliche, or sandy soils; often on scattered flat rocks below escarpments or isolated rock outcrops among scattered clumps of prickly pear and mesquite. The Project in Jim Wells County is restricted to ranch land.	*No impact*
Speckled racer *Drymobius margaritiferus*	T	Cameron, Willacy	Extreme south Texas; dense thickets near water, Texas palm groves, riparian woodlands; often in areas with much vegetation litter on ground; breeds April-August. RG Developers indicated that this habitat was not present along the Project route.	*No impact*
Texas horned lizard *Phrynosoma cornutum*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September.	*No significant impact*
Texas indigo snake *Drymarchon melanurus erebennus*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Texas south of the Guadalupe River and Balcones Escarpment; thornbush-chaparral woodlands of south Texas, in particular dense riparian corridors; can do well in suburban and irrigated cropland if not molested or indirectly poisoned; requires moist microhabitats, such as rodent burrows, for shelter.	*No significant impact*
Texas scarlet snake *Cemophora coccinea lineri*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September.	*No significant impact*
Texas tortoise *Gopherus berlandieri*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Open brush with a grass understory is preferred; open grass and bare ground are avoided; when inactive occupies shallow depressions at base of bush or cactus, sometimes in underground burrows or under objects; longevity greater than 50 years; active March-November; breeds April-November.	*No significant impact*

Table 4.7.2-1 (continued)
State Listed Species Potentially Occurring in the Vicinity of the Proposed Rio Grande LNG Project[a]

Species Name *Scientific Name*	State Status	Counties of Potential Occurrence	General habitat	Determination of Effect
Mollusks				
False spike mussel *Quadrula mitchelli*	T	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	Possibly extirpated in Texas; probably medium to large rivers; substrates varying from mud through mixtures of sand, gravel and cobble. Rio Grande, Brazos, Colorado, and Guadalupe (historic) river basins.	*No impact*
Mexican fawnsfoot mussel *Truncilla cognata*	T	Cameron	Largely unknown; possibly intolerant of impoundment; possibly needs flowing streams and rivers with sand or gravel bottoms based on related species needs; Rio Grande basin.	*No impact*
Salina mucket *Potamilus metnecktayi*	T	Cameron	Lotic waters; submerged soft sediment (clay and silt) along river bank; other habitat requirements are poorly understood; Rio Grande Basin.	*No impact*
Texas hornshell *Popenaias popeii*	T	Cameron	Both ends of narrow shallow runs over bedrock, in areas where small-grained materials collect in crevices, along river banks, and at the base of boulders; not known from impoundments; Rio Grande Basin and several rivers in Mexico	*No impact*
Fish				
Mexican goby *Ctenogobius claytonii*	T	Cameron	Southern coastal area; brackish and freshwater coastal streams.	*No significant impact*
Opossum pipefish *Microphis brachyurus*	T	Cameron, Kenedy, Kleberg, Willacy	Brooding adults found in fresh or low salinity waters and young move or are carried into more saline waters after birth; southern coastal areas.	*No significant impact*
Rio Grande silvery minnow *Hybognathus amarus*	E	Cameron	Extirpated. Historically Rio Grande and Pecos River systems and canals and reintroduced in Big Bend area. Pools and backwaters of medium to large streams with low or moderate gradient in mud, sand, or gravel bottom; ingests mud and bottom ooze for algae and other organic matter; probably spawns on silt substrates of quiet coves.	*No impact*
River goby *Awaous banana*	T	Cameron	Southern coastal waters; clear water with slow to moderate current, sandy or hard bottom, and little or no vegetation; also enters brackish and ocean waters.	*No significant impact*

Table 4.7.2-1 (continued)
State Listed Species Potentially Occurring in the Vicinity of the Proposed Rio Grande LNG Project[a]

Species Name *Scientific Name*	State Status	Counties of Potential Occurrence	General habitat	Determination of Effect
Smalltooth sawfish *Pristis pectinata*	E	Cameron, Kenedy, Kleberg, Willacy	Young found very close to shore in muddy and sandy bottoms, seldom descending to depths greater than 32 ft; in sheltered bays, on shallow banks, and in estuaries or river mouths. Adults are encountered in various habitat types (mangrove, reef, seagrass, and coral), in varying salinity regimes and temperatures, and at various water depths, feed on a variety of fish species and crustaceans	*No significant impact*
Plants				
Star cactus *Pristis pectinata*	E	Cameron	Gravelly clays or loams, possibly of the Catarina Series (deep, droughty, saline clays), over the Catahoula and Frio formations, on gentle slopes and flats in sparsely vegetated openings between shrub thickets within mesquite grasslands or mesquite-blackbrush thorn shrublands. Plants sink into or below ground during dry periods; flowering from mid-March-May, may also flower in warmer months after sufficient rainfall, flowers most reliably in early April; fruiting mid-April-June. Range is outside of Project area.	*No impact*

[a] Federally listed species with the potential to occur within the Project area were determined through review of the FWS IPaC system and correspondence with the FWS.

Amphibians

Stated-listed amphibians with the potential to occur in the Project area include the Mexican tree frog, sheep frog, south Texas siren, and Mexican white-lipped frog. Amphibians require moist areas and may be found along streams and in wetlands, roadside ditches, or shallow depressions. TPWD species records indicate that the white-lipped frog is incompatible with widespread habitat alteration and pesticide use in south Texas (TPWD 2017a,b). The remaining three species have historic occurrence data overlapping the path of the pipeline facilities (TXNDD 2017). In addition, the TPWD has indicated that the three species with historic occurrences are known to occur in roadside ditches along U.S. Highway 77, which is parallel to the pipeline route in Kenedy County and is crossed via HDD in Willacy County.

To minimize potential impacts on state listed amphibians, the TPWD has recommended that RB Pipeline follow appropriate BMPs during construction, including minimizing impacts on wetlands, open water features, depressions, and riverine habitats; maintaining hydrologic regimes; installing barrier fencing to direct animal movement away from construction activities (which may be sediment barriers or other erosion control devices); advise personnel to avoid harming the species; minimize impacts on habitat adjacent to water; and avoid use of plastic netting during stabilization of disturbed areas.

RG Developers would minimize the potential for impacts on wetlands and streams by following their Procedures, which would result in decreased crossing widths and in-water durations, minimize activities within 50 feet of stream or wetland boundaries, require installation of sediment barriers upon initial disturbance of the feature, and restrict use of synthetic mesh/netted erosion control materials in sensitive wildlife habitat. As discussed in section 4.6.1.2, less mobile species (such as amphibians) may experience direct mortality or permanent displacement. However, we conclude that, with implementation of the Project-specific Procedures, which are similar to the BMPs recommend by the TPWD, the potential for impact on state listed amphibians has been appropriately minimized.

Reptiles

Six state listed reptile species have the potential to occur in the Project area, including the black-striped snake, northern cat-eyed snake, Texas horned lizard, Texas indigo snake, Texas scarlet snake, and Texas tortoise (see table 4.7.2-1). Each of these species has occurrence data overlapping or adjacent to Project workspaces.

Although much of the occurrence data is from historic observations that are greater than 20 years old, the Texas horned lizard was documented between MPs 109.7 to 111.1 of the Pipeline System in 2014, indicating suitable habitat currently exists in that area. In addition, the Texas tortoise was identified during field surveys of the LNG Terminal site, and as such, it is discussed in detail below.

To minimize the potential for impact on state listed reptiles, RB Pipeline has committed to use of the TPWD's Texas Tortoise BMPs (TPWD nd b), which include employing a biologist to survey all trenches left open overnight to inspect them for state listed reptiles; if reptiles are found, they would be removed by the biologist. In addition, the BMPs require that fencing be installed and maintained in areas of active construction where state listed species have been removed. With implementation of the Project-specific Plan, SPCC Plan, and BMPs, we conclude that there would be no significant impact on state listed reptiles during construction and operation of the Project.

Texas Tortoise

The Texas tortoise, which is state listed as threatened, feeds heavily on prickly pear and other available succulent plants within its range, which extends from South-central Texas into Mexico. Although its life history is uncertain, the Texas tortoise is thought to attain breeding status at 15 years old and live for about 60 years (TPWD 2016n). Recent occurrence records indicate the potential presence of this species within or near Project workspaces from MPs 109.7 to 111.1, and from about MP 131.0 to the LNG Terminal site. In addition, Project-specific surveys observed the Texas tortoise on the terminal site.

Any individuals within the construction footprint could be lost during construction, as tortoises are relatively slow-moving animals. To minimize the potential for direct impacts on the species during construction, RB Pipeline would employ a qualified biologist(s) to monitor construction activities and move tortoises out of the construction area prior to clearing activities. In addition, open trenches could present a hazard to this species through impeding movement or acting as traps should individuals fall in. To minimize the impacts of open trenches, RB Pipeline has committed to following the Texas Tortoise BMPs (TPWD nd b), which include having a qualified biologist survey any trenches left open overnight, and removing tortoises as applicable to another area within their home range (5 to 10 acres).

For tortoises within the footprint of the LNG Terminal site, the TPWD does not currently recommend relocation as they typically do not survive outside of their home range; however, the TPWD is working to implement offsite conservation for an ongoing mining Project that may be appropriate for the Rio Grande LNG Project. With implementation of the Texas Tortoise BMPs, we conclude that construction and operation of the Rio Grande LNG Project would not significantly affect the Texas tortoise; however, we note that RG Developers may need to consult with the TPWD regarding impacts on individual Texas tortoises to adhere to the Texas Parks and Wildlife Code, Chapter 67 and Sections 65.171 through 65.176 of the Texas Administrative Code.

Fish

The Mexican goby, opossum pipefish, river goby, and smalltooth sawfish have the potential to occur in low-salinity or estuarine streams crossed by the Project (see table 4.7.2-1). The pipelines would cross all perennial estuarine streams via HDD crossing methods, thereby avoiding direct impacts; all other estuarine streams crossed by the pipelines are ephemeral and are not expected to provide quality habitat. Certain waterbodies that would be crossed by HDD methods would have water withdrawn for use during HDD construction, but water intake structures would be screened to avoid impingement/entrainment of fishes. Given the measures to avoid or minimize impacts on streams with an estuarine component, we conclude that the Project would have no significant effect on state listed fishes.

4.7.3 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 land under U.S. jurisdiction. The act further regulates, with certain exceptions, the "take" of marine mammals on the high seas by persons, vessels, or other conveyances subject to the jurisdiction of the United States. A total of 29 mammals protected under the MMPA may occur along the LNG transit routes (NMFS 2012). Six of these species are also listed under the ESA (five whales and the West Indian manatee) and are included in table 4.7.1-1 and discussed in section 4.7.1.2. The remaining 23 whale and dolphin species and their potential area of occurrence along the LNG transit routes are described in table 4.7.2-2 and discussed below.

Table 4.7.2-2
Non-Endangered Species Act Listed Marine Mammals Potentially Occurring Along the LNG Transit Routes

Common Name	Scientific Name	Area Where Mammal May Occur
Dolphins		
Atlantic spotted dolphin	*Stenella frontalis*	Gulf of Mexico
Bottlenose dolphin	*Tursiops truncatus*	BSC and Gulf of Mexico
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
North Atlantic right whale	*Eubalaena glacialis*	Gulf of Mexico
Pygmy sperm whale	*Kogia breviceps*	Gulf of Mexico
Sowerby's beaked whale	*Mesoplodon bidens*	Gulf of Mexico
Source: NMFS 2012.		

Impacts on marine mammals occurring along the LNG transit routes would be similar to those discussed in section 4.7.1.2 regarding the West Indian manatee and federally listed whales. The primary threat to marine mammals resulting from LNG carrier transits would be an increased risk of vessel strikes during operation. LNG transit vessels operating within the EEZ in the Gulf of Mexico are generally slower and generate more noise than typical large vessels, and would be more readily avoided by marine mammals. Additionally, LNG ships push a considerable bow wave when underway on the open ocean because of their design and large displacement tonnage. This wave pushes water, flotsam, and other small objects (e.g., dolphins) away from the vessel.

LNG carriers would use established and well-traveled shipping lanes. As described in section 4.7.1.2, RG LNG would provide the operators of LNG carriers with NMFS' guidance document on vessel strike avoidance, and request that it be used during transit to and from the proposed LNG Terminal. Based on RG LNG's proposed use of existing, highly traveled shipping lanes and proposed mitigation measure, we have determined that construction and operation of the LNG Terminal (including the potential for vessel strikes and increased noise associated with vessels) would have no significant adverse impacts on marine mammals.

NMFS, in consultation with RG Developers have indicated that only two marine mammals, the bottlenose and spotted dolphins, have the potential to be impacted by in-water construction at the LNG Terminal. In addition to impacts from potential vessel strikes, these dolphins could be affected by noise from construction, and specifically from pile-driving, which has the potential to injure or harass marine mammals. As shown in tables 4.7.1-1 and 4.7.1-2, pile-driving noise levels would attenuate to non-injurious levels within 3.6 feet of planned activities, or within 40.7 feet if an impact hammer were required to install the sheet pile.

The thresholds of behavioral effects for dolphins would extend up to 4.6 miles from pile-driving activities, which may require an incidental take authorization from NMFS. RG LNG is currently consulting with NMFS regarding noise impacts on marine mammals to ensure consistency with the MMPA. As consultation is ongoing **we recommend that**:

- **<u>Prior to construction of the LNG Terminal</u>, RG LNG should file with the Secretary, for review and written approval by the Director of OEP, its proposed mitigation measures to avoid or minimize take of bottlenose and spotted dolphins during in-water pile-driving at the LNG Terminal site, developed in consultation with NMFS, and, if applicable, a copy of its MMPA Incidental Take Authorization.**

Although not proposed for construction, RG LNG also modeled in-water installation of the 96- to 106-inch steel piles for Jetty 2 at NMFS' request. Noise associated within this in-water installation would exceed injury thresholds for dolphins within 65.0 feet of pile installation and would exceed behavioral thresholds within 7.2 miles (see tables 4.7.1-1 and 4.7.1-2). If RG LNG modifies its proposed approach, which avoids in-water pile-driving for Jetty 2, further approval from FERC and NMFS would be required, as well as additional mitigation to avoid or minimize take of bottlenose and spotted dolphins.

Given RG LNG's proposed implementation of NMFS' guidance document on vessel strike avoidance, as applicable and appropriate, and our recommendation to minimize acoustical impacts on marine mammals during in-water pile-driving through use mitigation measures determined in consultation with NMFS, no take of marine mammals under the MMPA would be anticipated during construction or operation of the Project.

4.8 LAND USE, RECREATION, AND VISUAL RESOURCES

4.8.1 Land Use

The Rio Grande LNG Project comprises two major components; the Rio Grande LNG Terminal and the Rio Bravo Pipeline System. RG LNG would construct the LNG Terminal in Cameron County. RB Pipeline's Pipeline System consists of a 2.4-mile Header System and 135.5 miles of dual 42-inch-diameter natural gas pipeline that would cross 5 counties in Texas (see section 2.1). Land use in the vicinity of the Project is generally classified into the following categories: shrub/forest land, open land, non-forested wetlands, barren, open water, industrial/commercial, and agricultural. Installation of facilities for the Project would require temporary disturbance of about 3,655.6 acres of land. Following construction, the LNG Terminal site and permanent rights-of-way would encompass about 2,147.8 acres. The remaining 1,507.8 acres would return to pre-construction conditions and uses. Table 4.8.1-1 summarizes the acreages of each land use type that RG Developers would affect during construction and operation of the Project. The definitions of each land use type are as follows:[34]

- Shrub/Forest Land[35] – includes shrubland, upland forest, palustrine forested wetlands, and scrub-shrub wetlands (including mangroves);
- Open Land – includes grassland, grazing land, and land with thick brush;
- Emergent Wetlands – includes palustrine and estuarine emergent wetlands and mud flats;
- Barren – barren land, including dredge spoil;
- Open Water – includes waterbodies, such as streams, lakes, and ponds;
- Industrial/Commercial – includes impervious surfaces such as roads and industrial facilities; and
- Agricultural – includes active or rotated cropland.

---

34 Maintained (vegetated) rights-of-way were allocated to the corresponding land use type category based on vegetation type; therefore, existing utility corridors are captured in the following land use types: agricultural, open land, open water, and wetlands. Similarly, the area to be dredged for the marine facilities within the LNG Terminal site is allocated across open land, barren, open water, and wetland land use type categories as appropriate.

35 South Texas Sandy Mesquite/Evergreen Woodland, Coastal and Sandsheet Deep Sand Live Oak Forest and Woodland, South Texas Loma Evergreen Shrubland, South Texas Sandy Mesquite Woodland and Shrubland, and South Texas Sandy Mesquite Dense Shrubland (Ludeke, German, and Scott 2010; see section 4.5.1).

Table 4.8.1-1
Land Use Types Affected by Construction and Operation of the Rio Grande LNG Project (in acres)

Facilities	Shrub/Forest Land		Open Land		Emergent Wetlands		Open Water		Barren		Industrial / Commercial		Agricultural Land		Total	
	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op
LNG TERMINAL																
LNG Terminal[a]	208.9	208.9	191.5	191.5	162.5	162.5	106.1	106.1	81.4	81.4	0.0	0.0	0.0	0.0	750.4	750.4
MOF and berthing / turning basin dredge area	0.0	0.0	0.0	0.0	0.0	0.0	68.7	68.7	0.0	0.0	0.0	0.0	0.0	0.0	68.7	68.7
Temporary haul road[b]	0.0	0.0	0.3	0.0	9.4	0.0	1.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	11.0	0.0
Port of Brownsville temporary storage area	0.0	0.0	18.9	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.2	0.0	0.0	0.0	20.8	0.0
Port Isabel temporary storage area	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0
Port Isabel dredge pile	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	293.4	0.0	0.0	0.0	0.0	0.0	293.4	0.0
Bulk water loading area	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
LNG Terminal Total	***208.9***	***208.9***	***210.7***	***191.5***	***171.9***	***162.5***	***175.8***	***174.8***	***380.8***	***81.4***	***0.2***	***0.0***	***0.0***	***0.0***	***1,148.4***	***819.1***
PIPELINE FACILITIES																
Pipeline System and ATWS																
Header System and Pipeline 1																
Header System ROW	21.9	11.9	8.8	4.9	0.0	0.0	<0.1	<0.1	0.1	0.1	0.1	0.1	0.0	0.0	30.9	17.0
Header System ATWS	1.2	0.0	0.8	0.0	0.0	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	2.0	0.0
Pipeline 1 ROW	456.9	283.8	822.2	495.4	116.4	94.2	7.8	6.4	4.3	2.5	2.7	2.7	514.5	321.2	1,925.0	1,206.2
Pipeline 1 ATWS	13.8	0.0	9.4	0.0	5.5	0.0	<0.1	0.0	1.4	0.0	0.1	0.0	19.4	0.0	49.6	0.0
Subtotal	***493.6***	***295.7***	***841.3***	***500.3***	***121.9***	***94.2***	***7.9***	***6.4***	***5.9***	***2.6***	***2.9***	***2.8***	***533.9***	***321.2***	***2,007.5***	***1,223.1***
Pipeline 2																
Pipeline 2 ROW	0.0	0.0	1,266.5	768.6	129.1	104.8	7.8	6.4	4.3	2.5	2.7	2.7	514.5	321.2	1,925.0	1,206.2

Table 4.8.1-1 (continued)
Land Use Types Affected by Construction and Operation of the Rio Grande LNG Project (in acres)

Facilities	Shrub / Forest Land		Open Land		Emergent Wetlands		Open Water		Barren		Industrial / Commercial		Agricultural Land		Total	
	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op
Pipeline 2 ATWS	0.0	0.0	23.2	0.0	5.6	0.0	<0.1	0.0	1.4	0.0	0.1	0.0	19.4	0.0	49.6	0.0
Subtotal	***0.0***	***0.0***	***1,289.7***	***768.6***	***134.6***	***104.8***	***7.8***	***6.4***	***5.8***	***2.5***	***2.8***	***2.7***	***533.9***	***321.2***	***1,974.6***	***1,206.2***
Access Roads																
Header System access roads	0.2	0.2	0.7	0.6	0.0	0.0	<0.1	<0.1	4.7	4.7	3.1	1.6	0.0	0.0	8.7	7.1
Pipelines 1 and 2 access roads	1.8	0.6	73.7	4.8	8.3	0.0	0.1	0.0	1.6	0.0	14.9	0.1	0.5	0.0	100.7	5.5
Subtotal	2.0	0.8	74.4	5.4	8.3	0.0	***0.1***	***0.0***	6.3	4.7	18.0	1.6	0.5	0.0	109.5	12.6
Contractor / Pipe Yards																
Contractor / Pipe Yard 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	135.6	0.0	135.6	0.0
Contractor / Pipe Yard 2	9.1	0.0	16.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.5	0.0
Contractor / Pipe Yard 3	0.0	0.0	136.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	136.1	0.0
Subtotal	***9.1***	***0.0***	***152.5***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***135.6***	***0.0***	***297.2***	***0.0***
Aboveground Facilities																
Header System																
Metering Site HS-1	1.9	1.9	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	2.1
Metering Site HS-2	1.2	1.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4
Metering Site HS-3	1.1	1.1	0.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0
Metering Site HS-4	1.3	1.3	<0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4
Subtotal	***5.6***	***5.6***	***1.3***	***1.3***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***6.9***	***6.9***
Pipelines 1 and 2[c]																
Compressor Station 1	37.2	37.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.2	37.2
Compressor Station 2	0.0	0.0	28.6	28.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.6	28.6
Interconnect Booster Station 1	7.1	7.1	2.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.7	9.7

Table 4.8.1-1 (continued)
Land Use Types Affected by Construction and Operation of the Rio Grande LNG Project (in acres)

Facilities	Shrub / Forest Land		Open Land		Emergent Wetlands		Open Water		Barren		Industrial / Commercial		Agricultural Land		Total	
	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op	Con	Op
Interconnect Booster Station 2	0.0	0.0	9.7	9.7	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	9.9	9.9
MLVs	0.3	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.8	0.8
Subtotal	***44.6***	***44.6***	***41.0***	***41.0***	***0.0***	***0.0***	***0.0***	***0.0***	***0.2***	***0.2***	***0.0***	***0.0***	***0.4***	***0.4***	***86.2***	***86.2***
Aboveground Facilities Subtotal	***50.2***	***50.2***	***42.3***	***42.3***	***0.0***	***0.0***	***0.0***	***0.0***	***0.2***	***0.2***	***0.0***	***0.0***	***0.4***	***0.4***	***93.1***	***93.1***
Header System and Pipeline 1 Total[d]	**555.1**	**346.7**	**1,110.4**	**548.0**	**130.1**	**94.2**	**8.0**	**6.4**	**12.4**	**7.5**	**20.9**	**4.4**	**670.4**	**321.6**	**2,507.2**	**1,328.7**
Pipeline 2 Total[e]	**0.0**	**0.0**	**1,612.2**	**859.5**	**142.9**	**104.8**	**7.9**	**6.4**	**7.6**	**2.8**	**17.7**	**2.8**	**670.4**	**321.6**	**2,458.7**	**1,297.8**
Pipelines 1 and 2[f]	**526.2**	**329.0**	**1,098.8**	**541.1**	**130.1**	**94.2**	**7.9**	**6.4**	**7.6**	**2.8**	**17.7**	**2.8**	**670.4**	**321.6**	**2,458.7**	**1,297.8**
Pipeline System Total[g]	**555.1**	**346.7**	**1,110.4**	**548.0**	**130.1**	**94.2**	**8.0**	**6.4**	**12.4**	**7.5**	**20.9**	**4.4**	**670.4**	**321.6**	**2,507.2**	**1,328.7**
Rio Grande LNG Project Total[g]	**763.9**	**555.5**	**1,321.2**	**739.5**	**302.0**	**256.7**	**183.8**	**181.2**	**393.2**	**88.9**	**21.1**	**4.4**	**670.4**	**321.6**	**3,655.6**	**2,147.8**

[a] Acreages for the LNG Terminal include those acreages associated with Compressor Station 3 and the marine facilities. As discussed in section 4.3.2.2, additional open water areas within the BSC may be affected by dredging.

[b] Placement of this access road is a deviation to our Procedures (see sections 3.3.2 and 4.4.2.1).

[c] These facilities would be disturbed during the construction of Pipeline 1. Although use and modification of these facilities would occur during the construction of Pipeline 2, no additional operational footprint would be required.

[d] All impacts associated with construction of the Header System and Pipeline 1, including right-of-way, ATWS, contractor/pipe yards, and aboveground facilities.

[e] All impacts associated with construction of Pipeline 2, including right-of-way, ATWS, contractor/pipe yards, and aboveground facilities, which were previously disturbed during construction of Pipeline 1. Shrub/forest land restored following construction of Pipeline 1 would revegetate to open land and emergent wetland conditions prior to construction of Pipeline 2, rather than the pre-construction vegetation cover. Therefore, construction of Pipeline 2 would have a greater impact on open land and emergent wetlands than Pipeline 1.

[f] This total includes the footprint of Pipelines 1 and 2, rather than the sum of its individual components. Because Pipeline 2 would be constructed in the same footprint as Pipeline 1, the entire construction footprint for Pipeline 2 overlaps with the affected acreage proposed for Pipeline 1.

[g] This total includes the footprint of the entire Pipeline System, rather than the sum of its individual components. Because Pipeline 2 would be constructed in the same footprint as Pipeline 1, the entire construction footprint for Pipeline 2 overlaps with the affected acreage proposed for Pipeline 1.

4.8.1.1 Environmental Setting

LNG Terminal

The LNG Terminal site would be on 984.2 acres of land owned by the BND along the northern embankment of the BSC in Cameron County. The site is currently undeveloped and contains areas of dredge spoil from the original dredging of the BSC. RG LNG would utilize 750.4 acres of the site, which includes shrub/forest land (27.8 percent), open land (25.5 percent), non-forested wetlands (21.7 percent), and barren land (10.8 percent); the remaining 14.1 percent is open water. The shrub/forest land at the LNG Terminal site is predominately south Texas Sandy Mesquite Dense Shrubland (138.3 acres), South Texas Loma Evergreen Shrubland (50.7 acres), and mangroves (19.8 acres; categorized as emergent scrub-shrub wetlands in section 4.4).

No buildings, aboveground structures, or utilities are present within the LNG Terminal site. The closest residences are in Port Isabel and Laguna Heights, over 2.2 miles from the LNG Terminal site. As RG LNG has located the LNG Terminal site outside of city boundaries, the parcel is not subject to zoning designations, therefore re-zoning of the site would not be required. The LNG Terminal site is bounded on the north and west by SH-48 and the Bahia Grande Channel, respectively. The BSC runs along the southern boundary of the parcel, while undeveloped land, including mud flats and shallow open water, frame the eastern boundary. As discussed in section 4.3, the Bahia Grande Channel was constructed in 2005 to connect the BSC to the Bahia Grande to restore tidal exchange to the Bahia Grande (FWS 2015a). The Bahia Grande is part of the larger Laguna Atascosa NWR, which is managed by the FWS and located immediately north of the LNG Terminal site. A second NWR, the Lower Rio Grande Valley NWR, is about 2.6 miles from the LNG Terminal site, but south of the BSC (see 4.1.8.4). Recreational fishing occurs in the local bay system, as well as on the LNG Terminal site along the shoreline of the Bahia Grande Channel and BSC, although these areas are not officially designated for fishing. While other uses of the LNG Terminal site may currently exist, such as use by off-road vehicles, these uses are unauthorized.

As discussed in sections 1.4 and 2.1.1.7, utilities (electric, water, and sewer) at the Terminal site currently do not exist; however, the BND is planning to expand the water and sewage systems as part of an overall effort to provide service to existing and future customers in the Port of Brownsville, as well as to enhance reliability and grid interconnectivity with Port Isabel and South Padre Island. Similarly, AEP is planning upgrades to its existing electric transmission system that would connect the power grid in the Port of Brownsville to the LNG Terminal and the Port Isabel area. These new utilities would be constructed in a utility corridor adjacent to SH-48, along the northern boundary of the LNG Terminal site. As described in section 2.1.1.7, these utilities would not be in service until after RG LNG's anticipated construction start date. During the initial construction phase and until permanent utilities are available, RG LNG would purchase freshwater from the BND, pump sewage from its internal sewage system into trucks and have it delivered to the sewage treatment plant, and utilize a temporary power supply from AEP, as well as portable diesel generators. The temporary power line would be installed within an existing TxDOT right-of-way and would connect the LNG Terminal to AEP's existing substation in Port Isabel (see section 2.1.1.7).

Portions of the BSC (those outside of the navigable channel), would be dredged during construction of the marine loading berths, turning basin, and the MOF, which would be used to support construction activities and delivery of material. As discussed in section 4.4.2.4, RG LNG has committed to maintaining 223.3 acres of the site as natural buffer that includes non-forested wetlands, open water, and barren land (specifically, dredge spoil). The remaining 10.5 acres would be dredged for a planned expansion of the Bahia Grande Channel for wetland restoration that is not related to the Rio Grande LNG Project.

Pipeline Facilities

The pipeline facilities would be in south Texas within Jim Wells, Kleberg, Kenedy, Willacy, and Cameron Counties. These facilities would generally be sited on rural, unincorporated areas, with the northern portion of the pipeline route through Kleberg and Kenedy Counties characterized by large tracts of land used for ranch and cattle operations. King Ranch, an 825,000-acre ranch, makes up the majority of the land. As the pipeline route moves south into Willacy and Cameron Counties, the land is predominately grassland and cropland. Based on RB Pipeline's field investigations, the primary crops currently in production in the Project area include cotton, sorghum, and corn.

Although not crossed by the proposed pipelines, the two NWRs, discussed above, characterize land near the terminus of the Pipeline System as it approaches the LNG Terminal site. As discussed in section 2.2.2.1, portions of the pipeline right-of-way would be collocated with existing pipelines, power lines, roads, railroads, and canals.

The proposed pipelines would cross one area, between about MP 123.7 to MP 126.0, within city limits and that is zoned as a dwelling use district by the City of Brownsville. Based on RB Pipeline's review of the municipal codes, this zoning type does not conflict with the siting of the pipelines and RB has initiated consultation with the City of Brownsville to confirm its findings. To date, no response from the city has been received. The pipeline facilities, once operational, would be located on open land (41.2 percent), shrub/forest land (26.1 percent), agricultural land (24.2 percent), and non-forested wetlands (7.1 percent); the remaining 1.4 percent would be open water, barren and industrial/commercial land.

4.8.1.2 Land Use Impacts and Mitigation

Construction of the LNG Terminal and the pipeline facilities would affect a total of 3,655.6 acres of land over a 7-year construction period. Of this, 2,147.8 acres would be permanently affected by operation of the Project, and 1,507.8 acres would be allowed to revert to the existing land use type after the completion of construction activities. Reseeding of disturbed areas and routine monitoring would be conducted in accordance with RG Developers' Plan and Procedures, as discussed in section 4.5.2.2. Impacts on land use types by acreage are discussed below. Impacts and mitigation on wetlands and vegetation cover types are discussed in detail in sections 4.4 and 4.5, respectively.

LNG Terminal

Construction and operation of the proposed Rio Grande LNG Terminal, including Compressor Station 3, would affect 750.4 acres of land, including 208.9 acres of shrub/forest land, 191.5 acres of open land, 162.5 acres of non-forested wetlands, 106.1 acres of open water, and 81.4 acres of barren land; all of which would be permanently converted to industrial/ commercial land. No industrial/commercial or agricultural land would be impacted by the construction or operation of the LNG Terminal. As described in section 4.3.2.2, about 94.3 acres of land within the LNG Terminal site, and within and adjacent to the BSC, would be dredged or excavated for the marine facilities. Additional open water areas within the BSC and outside the LNG Terminal site that would be affected by dredging are also addressed in section 4.3.2.2. The marine loading berths and a portion of the turning basin would require dredging to depths of about -43 feet (plus -2 feet of overdepth allowance) and the MOF would be dredged to a depth of about -10 feet (plus -2 feet of overdepth allowance) (see section 2.5.1.4).

In addition to the facilities proposed for the LNG Terminal site, RG LNG proposes to construct a temporary haul road to the Port Isabel dredge pile to obtain fill materials, and would use two offsite storage/parking areas to support construction activities. The temporary haul road would be about 1.8 miles long and would temporarily impact about 11.0 acres, including 9.4 acres of wetlands with some open water (1.0 acre), open land (0.3 acre), and barren land (0.3 acre); however, the use of this road would be an alternative measure to our Procedures, and we are exploring alternatives to its use (see sections 3.3.2 and 4.4.2.1). About of 4.0 acres of the Port Isabel site would be used as a storage area during construction of the Project.

The 20.8-acre storage area proposed in Brownsville is predominately open land (18.9 acres) with some barren land (1.7 acres) and industrial/commercial land (0.2 acre). Following construction, the Port Isabel and Brownsville storage areas would be restored to pre-construction conditions, unless requested otherwise by the landowner. No agricultural land would be impacted by the use of the offsite facilities during construction. Impacts from the LNG Terminal and offsite facilities, by land use type, are discussed below.

Shrub/Forest Land

Construction and operation of the LNG Terminal would permanently impact 208.9 acres of shrub/forest land, including 19.8 acres of mangroves categorized as emergent scrub-shrub wetlands in section 4.4. As described in section 4.5, most of the land is upland shrub habitat. None of the offsite facilities would affect shrub/forest land.

Open Land

Construction of the LNG Terminal would affect 210.7 acres of open land, of which 19.2 acres are associated with the offsite support facilities and the temporary haul road. Impacts on the remaining 191.5 acres of open land would be permanent due to the conversion of the affected area within the LNG Terminal site to industrial/commercial use.

Non-forested Wetlands

A total of 162.5 acres of non-forested wetlands that are present within the LNG Terminal site would be permanently filled and converted to industrial/commercial land to support land-based facilities. RG LNG has committed to maintaining a 223.3-acre natural buffer area on land within the larger leased parcel, but outside of the LNG Terminal site; however, as described in section 4.4, RG LNG would complete all wetland permitting and compensatory mitigation required by the COE and would implement all applicable wetland protective measures included in its Procedures. In addition, the haul road, as currently proposed, would temporarily impact 9.4 acres of wetlands.

Barren Land

As a result of the original dredging of the BSC, 81.4 acres of dredge spoil is at the LNG Terminal site. The entire site would be permanently converted to industrial/commercial land. The offsite facilities, including the temporary haul road, the two storage/parking areas, and bulk water loading area, contain 0.3, 5.7, and less than 0.1 acre, respectively, of barren land. The Port Isabel dredge pile (293.4 acres) would provide spoil for leveling and build-up of the LNG Terminal site as described in section 2.5.1.4. Following construction, 299.4 acres of barren land would revert to pre-construction uses.

Open Water

Construction and operation of the LNG Terminal would permanently impact 174.8 acres of open water, including waters of the BSC and a shallow lagoon within the LNG Terminal site. Construction of the haul road as currently proposed would temporarily impact an additional 1.0 acre of open water. Use of open water within the BSC associated with construction and operation of the marine facilities would also include increased marine traffic and reduced access for recreational users when an LNG carrier is in transit through the BSC. Impacts on recreational use of the BSC and marine vessel traffic are described in sections 4.8.1.4 and 4.9.8.2, respectively. Dredging and dredged material placement are discussed in sections 4.3.2.2 and 4.2.3, respectively.

Industrial/Commercial

The Port of Brownsville storage area consists of 0.2 acre of industrial/commercial land. Minor modifications such as grading and graveling would be required at the site resulting in negligible, temporary impacts on this land use type during construction. No other offsite facilities, or the LNG Terminal, would affect existing industrial/commercial land.

While impacts on land affected by construction and operation of the LNG Terminal would be permanent, the LNG Terminal would be consistent with the BND's long-term plan, which identifies the area as intended for heavy industrial use. In addition, the LNG Terminal would be located outside of city limits, on land that is not subject to zoning restrictions. Further, although wetlands would be permanently lost within the facility boundaries, RG LNG would be required to mitigate for such losses in accordance with any Section 404/10 permit issued by the COE.

Pipeline Facilities

Pipeline System and Additional Temporary Workspace

Header System and Pipeline 1

RB Pipeline has requested a 100-foot-wide construction right-of-way for the portion of Header System that would accommodate a single 42-inch-diameter pipeline (MP HS-0.8 to HS-2.4) and a 125-foot-wide construction right-of-way for both Pipeline 1 and the portions of the Header System that would accommodate dual 42-inch-diameter pipelines (MP HS-0.0 to HS-0.8). RB Pipeline would maintain a 50-foot-wide permanent right-of-way for the single-pipeline portion of Header System and a 75-foot-wide permanent right-of-way for portions of the Header System with dual pipelines, as well as for Pipeline 1.

Construction of these pipelines, including ATWS, would affect 2,007.5 acres of land, consisting of 841.3 acres of open land, 533.9 acres of agricultural land, 493.6 acres of shrub/forest land (including 9.6 acres of forested wetlands), 121.9 acres of non-forested wetlands, 7.9 acres of open water, 5.9 acres of barren land, and 2.9 acres of industrial/commercial land. Following construction, 500.3 acres of open land, 321.2 acres of agricultural land, 295.7 of shrub/forest land, 94.2 acres of non-forest wetlands, 6.4 acres of open water, 2.8 acres of industrial/commercial land, and 2.6 acres of barren land within the permanent easement would be restored to pre-construction conditions but would be subject to routine maintenance. About 7.4 acres of forested wetlands would be within the permanent right-of-way and would be permanently maintained in an herbaceous state. The remaining 784.4 acres of land within construction workspaces would be allowed to revert to pre-construction conditions in accordance with the Project-specific Plan and Procedures. Specific mitigation for impacts on wetlands is discussed in section 4.4.

Pipeline 2

Pipeline 2 would be installed within the same 125-foot-wide construction right-of-way affected by Pipeline 1. As such, all land disturbed by the construction of Pipeline 2 would have been previously disturbed during the construction of Pipeline 1. Similarly, land associated with ATWS, access roads, contractor/pipe yards, and aboveground facilities would have been previously disturbed. Following construction, land affected by Pipeline 2 would be restored to pre-construction conditions.

General Impacts of the Pipeline System

As described in section 2.3, RB Pipeline would complete the installation of the Header System and Pipeline 1 before installing Pipeline 2. This phased construction approach would result in delayed impacts for portions of the land described below. As previously noted, the pipelines would require ATWS in areas proposed for specialized crossing methods or in areas with specific resources or features present. As discussed in section 2.2.1.3, RB Pipeline identified several areas where it stated that site-specific conditions require the use of ATWS outside of the proposed nominal 100- and 125-foot-wide construction right-of-way. Appendix F lists the locations of these ATWSs, their dimensions, area affected, justification, and other information.

As discussed in section 2.3.2, RB Pipeline proposes to install cathodic protection along the pipeline route to mitigate corrosion. While the specific locations of the cathodic protection groundbeds have not been identified, RB Pipeline has stated that the groundbeds would be within the permanent right-of-way near county roadways with available electrical power connections. Therefore, no additional impacts on land are expected from the construction and operation of the cathodic protection beds. If RB Pipeline determines that additional land would be required for the groundbeds, a request for such land would fall under the variance process described in section 2.5.4.

Operational activities associated with the Pipeline System would be primarily associated with maintenance of the permanent right-of-way, routine inspections, and associated cleaning and pipeline repairs. To facilitate pipeline inspection, operation, and maintenance, the entire permanent right-of-way in upland areas would be maintained in an herbaceous or scrub-shrub vegetated state. This maintained right-of-way would be mowed no more than once every 3 years, but a 10-foot-wide strip centered over each pipeline may be mowed more frequently to maintain herbaceous cover (outside of the bird nesting season, as discussed in section 4.6.1.3). In total, the permanent right-of-way for the Pipeline System would include 1,223.1 acres during operation (17.0 acres for the Header System and 1,206.2 acres for Pipelines 1 and 2).

Open Land. Open land would be the primary land use impacted by construction of the pipeline facilities. This includes grassland and land used for ranch and cattle operations. Construction-related impacts on open land would include the removal of vegetation and disturbance of soils, as well as temporary disruptions to ranch and cattle operations. RB Pipeline has committed to working with landowners to establish crossing locations where cattle and ranching operations would be crossed to allow for safe movement of cattle and wildlife. A quarantine area for cattle fever tick disease would be crossed in Cameron County between MPs 102.6 and 135.5. In addition to working with landowners regarding the movement of cattle in and out of the quarantine area, RB Pipeline would provide educational training for construction personnel to mitigate the spread of the disease. Impacts on open land would be temporary and short-term and would be minimized by the implementation of the Project-specific Plan. Following construction, most open land uses would be able to continue. However, some activities, such as the building of new commercial or residential structures, would be prohibited on the permanent right-of-way.

Agricultural Land. The primary impact on agricultural areas would be the temporary loss of production during and shortly after construction is completed. Additional impacts could include soil rutting or compaction due to construction equipment. RB Pipeline would minimize the potential for these impacts through implementation of the measures in its Plan, including topsoil segregation, erosion control, and soil compaction mitigation. Impacts could also include damage to existing irrigation systems; however, no drain tiles or irrigation systems have been identified to date. RB Pipeline would continue to consult with landowners to determine the presence of these systems, or those that would be installed within 3 years of construction, and would repair or replace any such system impacted by construction. Finally, RB Pipeline would bury the pipeline with a minimum cover of 3 feet and has collocated with, or is adjacent to, existing disturbance for about 66.4 percent of the Pipeline System.

Through field surveys and coordination with the county representatives of the U.S. Department of Agriculture, no specialty crops or land currently managed under the Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program, or other Agricultural Conservation Easement Program have been identified along the proposed pipeline route in Kenedy or Kleberg Counties. In Cameron County the Project would intersect parcels under contract as part of the CRP program to improve wildlife habitat; these areas are discussed further in section 4.8.1.5. Representatives from the Willacy County FSA are still assessing RG Developers request for information.

Shrub/Forest Land. Shrub/forest land would be crossed by the pipelines, including forested wetlands near MP 0.0 of Pipelines 1 and 2. RB Pipeline would minimize impacts on shrub/forest land by implementing its Plan and Procedures. In addition, RB Pipeline would be required to implement the conditions of its CWA Section 404 and 401 permits to mitigate for wetland impacts. Although trees cleared within temporary construction work areas would be allowed to regenerate to pre-construction conditions following construction, impacts on forest land would last for several years. Following construction, the maintained portion of the right-of-way would be permanently converted to an herbaceous or early scrub-shrub condition.

Non-forested Wetlands. Palustrine and estuarine emergent and scrub-shrub wetlands would be crossed by Pipelines 1 and 2; the Header System would not cross wetlands. RB Pipeline would minimize wetland impacts by implementing its Procedures. In addition, RB Pipeline would be required to implement the conditions of its CWA Section 404 and 401 permits to mitigate for wetland impacts. Following construction, these wetlands would be allowed to regenerate to pre-construction conditions, with the exception of a 10-foot-wide strip centered on the pipelines that would be maintained in an herbaceous condition in scrub-shrub wetlands (see section 4.4).

Industrial/Commercial. Impacts on the use of industrial/commercial areas during construction would result from increased dust from exposed soils, construction noise, and traffic congestion. Impacts from dust and noise levels would be minimized as described in sections 4.11.1 and 4.11.2, respectively. Impacts associated with construction traffic are discussed in section 4.9.8.

Open Water. Impacts on open water resulting from construction activities could include increased sedimentation rates, turbidity levels, and water temperature; decreased dissolved oxygen concentrations; and release of chemical or nutrient pollutants from sediments (see detailed discussion in section 4.3.2.2). However, these impacts would be temporary and would not preclude these areas from functioning as open water. Impacts on open waters would be minimized by the implementation of the Project-specific Procedures. No impacts on open water are anticipated during operation of pipeline facilities.

Barren Land. Barren land includes unvegetated land that may be subject to increased erosion during construction. RB Pipeline would implement the erosion control measures in its Plan to minimize the potential for erosion within these areas.

Aboveground Facilities

RB Pipeline would install three compressor stations, two booster stations, eight metering sites, and additional appurtenant facilities. Impacts from Compressor Station 3 are discussed above, as it would be within the boundaries of the LNG Terminal site. The remaining aboveground facilities installed along the Pipeline System would require about 93.1 acres during construction, the majority of which would be located on shrub/forest land (49.9 acres) and open land (42.2 acres), with a small amount of barren land (0.2 acre).

Construction of the pipelines facilities would also require six MLV sites with two valves per sites. Each MLV site would be about 0.1 acre, affecting at total of 0.8 acre of land, including 0.4 acre of agricultural land, and 0.3 acre of shrub/forest land, and 0.1 acre of open land.

Following construction, land within construction workspaces but outside of the compressor and interconnect booster station footprints would be allowed to revert to pre-construction conditions in accordance with the Project-specific Plan and Procedures. Each aboveground facility would be fenced to ensure safety and security of the site. The fenced area would total about 53.0 acres, the remaining 32.4 acres outside of the fence lines would not be maintained.

The compressor stations, booster stations, and metering sites constructed for the Pipeline 1 would also be used for Pipeline 2. Although some modifications to these facilities would be required to accommodate a second pipeline, all work would be conducted within areas disturbed during the original construction of those facilities and no additional land, or its use, would be impacted.

Contractor/Pipe Yards

RB Pipeline would utilize three contractor/pipe yards along the pipeline route in Kenedy, Willacy, and Cameron Counties. The contractor/pipe yards would be located on a total of 297.5 acres within open land (152.5 acres), agricultural land (135.6 acres), and shrub/forest land (9.1 acres). Modifications at the contractor/pipe yards would be limited to the placement of limestone and/or gravel on geotextile fabric to allow stable storage areas for materials and to minimize ground impacts from stockpiled pipe.

The construction of dirt berms ranging from 1 to 2 feet in height would be required to elevate the pipe stored at these locations for ease of lifting and handling by equipment such as a forklift. RB Pipeline proposes to construct the dirt berms with native soils from the respective site and, following construction, the berms would be removed through the process of leveling the site to pre-construction contours. These contractor/pipe yards would also be used for Pipeline 2.

Access Roads

In addition to public access roads, RB Pipeline proposes to use a total of 64 roads (including 52 temporary and 12 permanent access roads) to access the right-of-way during construction (see appendix C). Of the 64 roads proposed for use during construction, 7 would require grading and the addition of gravel. All of these improved roads would be maintained for operation of the Project, and improvements associated with five of the seven access roads would be implemented entirely within the proposed permanent right-of-way. In addition, six access roads would cross waterbodies via the use of existing culverts, installation of a new culvert, or installation of equipment mats (see section 4.3.2.2).

Appendix C lists the access roads along with their lengths, required improvements, and locations by milepost. Use and improvement of these roads would temporarily impact 109.5 acres, including 74.4 acres of open land, 18.0 acres of industrial/commercial land, 8.3 acres of non-forested wetlands, 6.3 acres of barren land, 2.0 acres of shrub/forest land, 0.5 acre of agricultural land, and 0.1 acre of open water. The 53 existing access roads to be used during construction would temporarily impact 96.9 acre of mixed land types (see appendix C). Following construction, temporary access roads would be restored. As noted in section 4.4.2.2, no fill would be placed in wetlands where access roads are proposed for use, aside from the placement of temporary mats.

Operations would be supported by the use of 13 permanent access roads, which would impact a total of 12.6 acres consisting of 5.4 acres of open land, 4.7 acres of barren land, 1.6 acres of industrial/commercial land, and 0.8 acre of shrub/forest land. Of the 13 permanent access roads, 5 would be newly constructed and would impact about 0.3 acre of mixed land types including open land, agricultural land, and shrub/forest land. During construction of Pipeline 2, RB Pipeline would use only those access roads that were previously disturbed or developed during the construction of Pipeline 1; therefore, there would be no new ground disturbance associated with access roads for Pipeline 2.

4.8.1.3 Existing and Planned Residences and Commercial Developments

RG Developers have contacted affected county representatives regarding planned developments. No planned residential developments have been identified within 0.25 mile of the Rio Grande LNG Project; identified commercial developments are discussed below, along with residences in the vicinity of the Project.

LNG Terminal

There are no residences within 0.25 mile of the LNG Terminal site. The nearest occupied residential areas are in Port Isabel and Laguna Heights, which are about 2.2 miles north and northeast, respectively, of the LNG Terminal site boundary. While it would be possible to see the LNG Terminal from elevated vantage points in Port Isabel and Laguna Heights, such as the Port Isabel Lighthouse (see section 4.8.2), the distance and vegetation cover between the residences and the LNG Terminal would result in a negligible impact on the viewshed for these residences. Residents transiting near the LNG Terminal site would be exposed to increases in local traffic and noise, especially during construction; these impacts are discussed further in sections 4.9.8, and 4.11.2, respectively.

One planned commercial development, the Texas LNG Project, which would be adjacent to the proposed LNG Terminal site along the northeast boundary, was identified within 0.25 mile of the LNG Terminal site. Also, the Annova LNG Project is proposed for a 650-acre site about 0.3 mile south of RG LNG's proposed LNG Terminal. These projects are currently under review by the applicable agencies (including FERC), with the applicants initially anticipating in-service dates in 2021 (Annova LNG) or 2022 (Texas LNG). A discussion of cumulative impacts associated with the Rio Grande LNG Project, these developments, and other planned industrial/commercial developments in the broader area is provided in section 4.13.

Pipeline Facilities

A total of 11 structures are within 50 feet of work areas proposed for use during construction of the Project (see table 4.8.1-2). Four of these structures are within 50 feet of the proposed construction right-of-way, including a horse stall that would be 7 feet inside the temporary workspace of Pipelines 1 and 2 near MP 120.7. Prior to construction, RB Pipeline plans to either relocate the horse stall or compensate for its removal, as preferred by the landowner. No residences are within 50 feet of the proposed right-of-way or the aboveground facilities. The nearest residence to the aboveground facilities is 1.7 miles away (Noise Sensitive Area 1 in proximity to Booster Station 2 is discussed in section 4.11.2).

Seven structures, including two residential structures, were identified within 50 feet of access roads (see table 4.8.1-2). These access roads are existing and would not require any improvements to support construction of the pipeline facilities. To mitigate impacts for these residences, RB Pipeline would provide site-specific training for all construction personal, post warning signs, reduce speed limits, install posts and flagging to identify overhead utility lines, and implement dust suppression techniques.

Table 4.8.1-2
Structures within 50 feet of Rio Grande LNG Project Workspaces

Structure Type	Pipeline System Workspace	Distance to Workspace (feet)	Closest MP
Plant guard shack	Access Road (AR-005)	11.8	HS-2.4
Structure	Access Road (AR-005)	46.1	HS-0.9
Residential structure	Access Road (AR-019)	30.7	38.1
Unknown structure[a]	Access Road (AR-029)	8.3	53.1
Unknown structure[a]	Access Road (AR-029)	39.3	53.1
Barn	Temporary Workspace	10	63
Trailer	Temporary Workspace	11	63.1
Unknown structure[a]	Access Road (AR-39)	47.3	67.1
Residential structure	Access Road (AR-050)	47.6	113
Livestock feeding lean-to	Temporary Workspace	34.2	120.7
Horse stall	Temporary Workspace	7.0 inside workspace	120.7

[a] Unknown structures represent small structures that are not thought to be regularly occupied.

In addition to the two commercial developments discussed above (Texas LNG and Annova LNG), RB Pipeline identified two existing wind farms along the proposed route. The

San Roman Wind Farm is less than 1 mile from the proposed right-of-way, and the Cameron Wind Farm would be traversed by the Pipeline System between MPs 107.1 and 116.2; however; no infrastructure associated with the wind farm is located at the crossing location. Additional discussion of these wind farms can be found in section 4.13.

Temporary construction impacts on residential and commercial developments can include increased noise and dust generated by construction equipment, personnel, and trenching through roads or driveways; removal of trees or other vegetation screening between residences and the right-of-way; potential damage to wells; and removal of aboveground structures, such as sheds or trailers, from the right-of-way. Visual impacts are discussed in section 4.8.2, and transportation impacts are discussed in section 4.9.8. Dust and noise impacts on nearby residences are discussed in section 4.11.1 and 4.11.2, respectively.

While there are no residences within 50 feet of the proposed Pipeline System route, the right-of-way would cross driveways and lawns at three locations (MPs 71.6, 89.5, and 112.8). RB Pipeline proposes to bore the driveway at MP 71.6, which would allow continued use of the driveway and would mitigate impacts on local traffic for the corresponding road within the path of the bore. RB Pipeline proposes to cross the remaining two locations using the open-cut method. To minimize impacts at these locations, the driveways would not be cut until the pipeline was ready to be installed and the trench would be backfilled as quickly as possible. RB Pipeline would notify landowners 24 to 48 hours prior to activities that would result in short-duration obstructions of driveways or local roadways, lasting no more than 2 hours. At the end of each construction day, safety fencing or barriers would be installed where open trench is in proximity to these driveways. Lawns and landscaping within the construction work areas would be restored promptly after the backfilling of the trench in accordance with individual landowner easements.

As discussed in section 4.3.1.1, 13 wells are within 200 feet of construction workspace for the pipeline facilities. These wells are used for industrial purposes including withdrawal of water for oil and gas development, supply for livestock, and water sources for public or private use (see table 4.3.1-4). One industrial water well was identified as being within the proposed construction workspace at MP 5.9 (within King Ranch), in an area where field surveys have not yet been completed. RB Pipeline is working with the landowner to verify the location of this well and to identify site-specific mitigation measures or acceptable compensation, as appropriate. RB Pipeline has proposed to offer both pre- and post-construction testing of water quality and yield for all wells within 150 feet of construction work areas for Pipeline 1 and Pipeline 2 to mitigate any damages caused by construction.

4.8.1.4 Landowner and Easement Requirements

LNG Terminal

The LNG Terminal would be installed on land owned by the BND in Cameron County. RG LNG has entered into an agreement with the BND to lease 984.2 acres of land along the north side of the BSC for a minimum of 20 years, and up to a term of 50 years.

Pipeline Facilities

A portion of the proposed pipeline rights-of-way would be within the city limits of Brownsville. RB Pipeline consulted with the City of Brownsville Planning Division regarding the city's zoning regulations and associated requirements, including the potential for re-zoning of the area within city limits (from about MP 123.7 to 126.0). Based on this consultation, re-zoning would not be required; however, RB Pipeline would need to obtain a permit from the city for any drilling (HDD) activities required during construction of the pipelines.

Pipeline operators must obtain easements from existing landowners to construct and operate authorized facilities, or acquire the land on which the facilities would be located. Easements can be temporary, granting the operator the use of the land during construction (e.g., ATWS, temporary access roads, contractor/pipe yards), or permanent, granting the operator the right to operate and maintain the facilities once constructed.

RB Pipeline would need to acquire new easements or acquire the necessary land to construct and operate the new pipelines. These easements would convey both temporary (for construction) and permanent rights-of-way to the applicant. RB Pipeline is seeking to obtain a 75-foot-wide permanent easement for the entire pipeline right-of-way to accommodate the dual pipelines, with the exception of the Header System between MP HS-0.0 and HS-0.8 where the single pipeline would require a 50-foot-wide permanent easement. Following construction of Pipeline 1 and before construction of Pipeline 2, RB Pipeline would maintain only the portion of the permanent easement for Pipeline 1 (50 feet). The easement acquisition process is designed to provide fair compensation to landowners for the right of RB Pipeline to use the property during construction and operation of the pipelines. Easement agreements also would also specify the allowable uses and restrictions on the permanent right-of-way after construction. These restrictions could include prohibition of construction of aboveground structures such as house additions, garages, patios, pools, or any other objects not easily removable; roads or driveways over the pipeline; or the planting and cultivating of trees or orchards within the permanent easement. Alternatively, most agricultural uses would be allowed to continue within the permanent easement and would not be permanently impacted. The areas used as temporary construction right-of-way and ATWS would be allowed to revert to preconstruction uses with no restrictions. Landowners would be notified prior to the start of pre-construction surveys and staking, typically a minimum of 2 weeks, or as established during easement negotiations.

In accordance with 18 CFR 157.6, RG Developers have provided landowners with written information on how to contact them in the event that there are complaints or incidences that need to be addressed during construction. RG Developers have also provided landowners (directly affected and owners of abutting land) with the number for the FERC Landowner Helpline if landowners do not get an adequate response from RB Pipeline. If an easement cannot be negotiated with a landowner and if the pipeline Project is approved by the Commission, RB Pipeline may use the right of eminent domain conveyed by any Certificate the Commission might issue for the Project to acquire the property necessary to construct and operate its Project. RB Pipeline would still be required to compensate the landowner for the right-of-way and damages incurred during construction. However, the level of compensation would be determined by a court according to state or federal law.

4.8.1.5 Recreation and Special Interest Areas

Construction and operation of the Project would not cross or directly affect any national or state-designated Wild and Scenic Rivers, waterbodies on the Nationwide River Inventory, land managed by the U.S. Bureau of Land Management, land managed under the Wetland Reserve Program or Grassland Reserve Program, national forests, national or state parks, or Indian Reservations. Two NWRs are within 0.25 mile of the Project. In addition, a National Historic Landmark (King Ranch); the Jamie J. Zapata Memorial Boat Ramp, Fishing Pier, and Kayak Launch Pad (Zapata boat launch); land planned for conservation through the Bahia Grande Coastal Corridor Project; and four Great Texas Coastal Birding Trails, would be crossed by the pipelines (see table 4.8.1-3).

In addition, three CRP parcels would be crossed at unspecified locations, as discussed below. Potential impacts on recreational areas in the vicinity of the Project are discussed below, and associated impacts on tourism and recreational fishing are discussed in section 4.9.3.

Three areas managed by the NPS, including the Palo Alto Battlefield, Palmito Ranch Battlefield, and Resaca de la Palma Battlefield, are more than 0.25 mile from the Rio Grande LNG Project. Potential impacts on these areas are discussed in sections 4.8.2 and 4.10.

National Wildlife Refuges

The Lower Rio Grande Valley and Laguna Atascosa NWRs are less than 0.25 mile from the Project. The Lower Rio Grande Valley NWR is a 97,908-acre coastal marsh refuge that was established in 1979 with a management plan focused on protecting biodiversity (FWS 2010f, 2015b). In addition to wildlife viewing opportunities and nature trails, over 6,000 acres of the refuge are designated for big game hunting (FWS 2015b). The NWR also encompasses Boca Chica Beach, which is 5.5 miles southeast of the LNG Terminal site. The Lower Rio Grande Valley NWR would be just east of the Pipeline System between MPs 112.9 and 117.1 at distances ranging from 53 to 1,320 feet. As currently proposed, ATWS would extend into the NWR at three locations between MPs 115.9 and 116.6; however, we have recommended in section 4.6.1.4 that RB Pipeline adjust these workspaces to avoid impacts on the NWR. Private land that is held by the FWS in an easement associated with the Lower Rio Grande Valley NWR is north, east, and south of the Pipeline System between MPs 112.9 and 115.9, at distances ranging from 53 to 1,320 feet.

Established in 1946, the Laguna Atascosa NWR is an 89,845-acre coastal marsh refuge that provides habitat for wintering waterfowl and other migratory birds (FWS 2013a, 2015a). Considered a premiere destination for bird-watching, visitors to the NWR also participate in recreational fishing, hunting, biking and hiking. The Laguna Atascosa NWR is about 211.2 feet from the northern boundary of the LNG Terminal site. The NWR would also be between 53 and 1,320 feet of the Pipeline System in three locations, including MPs 126.0 to 126.2, MPs 132.3 to 134.5, and MPs 134.7 to 135.5 (see table 4.8.1-3). In addition, BND land that is subject to an easement held by the FWS and which serves as a wildlife corridor for terrestrial animals (including the ocelot) would be crossed by the Pipeline System between MPs 134.5 and 134.7; this wildlife corridor would be crossed by HDD and is discussed further in section 4.6.

Table 4.8.1-3
Recreation Areas Located within 0.25 Mile of the Rio Grande LNG Project[a]

County / Facility	Landowner / Easement Holder[a]	Existing Land Use Type[b]	Enter MP	Exit MP	Closest Distance (feet)	Crossing Length (miles)	Crossing Method(s)	Construction Impacts (acres)	Operation Impacts (acres)
Cameron									
Pipelines 1 and 2	Private land in easement with Lower Rio Grande Valley NWR	N/A	112.9	115.9	52.8	N/A	N/A	N/A	N/A
	Lower Rio Grande Valley NWR	N/A	115.9	116.0	0.0	0.1	Workspace only	<0.1[c]	0.0
		N/A	116.3	116.4	0.0	0.1	Workspace only	<0.1[c]	0.0
		N/A	116.6	116.7	0.0	0.1	Workspace only	<0.1[c]	0.0
		N/A	116.7	117.1	52.8	N/A	N/A	N/A	N/A
	Laguna Atascosa NWR	N/A	126.0	126.2	52.8	N/A	N/A	N/A	N/A
	Laguna Atascosa NWR	N/A	132.3	134.5	52.8	N/A	N/A	N/A	N/A
	Laguna Atascosa NWR	N/A	134.7	135.5	52.8	N/A	N/A	N/A	N/A
	BND land	FL, NW	134.5	134.7	0.0	0.2	HDD	0.0	0.0
	Zapata boat launch	I/C	135.5	135.6	0.0	0.1	HDD	0.0	0.0
LNG Terminal	Laguna Atascosa NWR	N/A	--	--	211.2	N/A	N/A	N/A	N/A
Kenedy (none crossed)									
Kleberg									
Pipelines 1 and 2	King Ranch	OL, OW, FL, NW; I/C	0.0	19.1	0.0	19.1	Various[d]	918.1	338.4
		N/A	45.7	49.0	52.8	N/A	N/A		
		OL, I/C, OW, NW, FL	49.0	60.1	0.0	11.1	Various[d]		
		OL	60.6	60.7	0.0	0.1	Various[d]		

Table 4.8.1-3 (continued)
Recreation Areas Located within 0.25 Mile of the Rio Grande LNG Project[a]

County / Facility	Landowner / Easement Holder[a]	Existing Land Use Type[b]	Enter MP	Exit MP	Closest Distance (feet)	Crossing Length (miles)	Crossing Method(s)	Construction Impacts (acres)	Operation Impacts (acres)
Willacy (none crossed)									
Jim Wells									
Header System	King Ranch	I/C, OL, OW, FL	HS-2.4	HS-0.0	0.0	2.4	Various[d]	79.4	31.0

Notes: N/A = Special use area would not be crossed by the Rio Grande LNG Terminal Project.

[a] Four Great Texas Birding Trails would be crossed by the pipelines; however, as these features are larger areas (not linear trails) and without discrete boundaries, they are discussed in the text but excluded from this table.

[b] I/C – industrial/commercial; OL – open land; OW –open water; NW – non-forested wetlands; FL – shrub/forest land; N/A – not crossed.

[c] Impacts are associated with portions of ATWS that overlap with the refuge, which RB Pipeline expects to avoid upon completion of final surveys performed by the pipeline contractor. We have also recommended that these ATWS be modified in section 4.6.

[d] Crossing methods include open cut, as well as specialized construction methods at discrete resources such as waterbodies, wetlands, and roads, as described in section 2.3.2.1.

In general, the NWRs and associated land in proximity to the Project are expected to experience some temporary impacts during construction. Designated hunting land within these NWRs would not be crossed; the closest parcel where hunting is allowed would be 0.8 mile north of MP 102. Clearing activities, increased noise and dust, and limited access may prevent or curtail use of the NWRs by the public at discrete locations; however, given the size of each NWR, the public could make use of those areas unaffected by construction. As the distance to construction work areas increase, impacts would generally decrease. Where recreational use would be allowed to proceed near construction activities, RG Developers would implement mitigation measures similar to those described in section 4.8.1.3, and in consultation with land managers.

Given the distance to huntable land of the Lower Rio Grande Valley NWR and Boca Chica Beach (about 5.5 miles to the southeast), no direct impacts on these areas are expected. Further, users of the Laguna Atascosa NWR near the BSC may observe a small increase in vessel traffic during the construction period and may also observe LNG carrier traffic through the channel during operation of the LNG Terminal. However, because LNG carrier traffic would be consistent with the existing use of the BSC, we have determined that the resulting impact on users of the Laguna Atascosa NWR would be minor. Impacts associated with construction traffic are discussed in section 4.9.8.

King Ranch National Historic Landmark

As discussed further in section 4.10, King Ranch was established in 1853 and was designated as a National Historic Landmark in 1961 (King Ranch 2016). A popular tourist destination, King Ranch is an 825,000-acre ranch that is divided into four divisions: Santa Gertrudis, Laureles, Norias, and Encino. Collectively these divisions span about 1,300 square miles of land in south Texas. In addition to ranching and farming operations, King Ranch offers hunting opportunities for deer, antelope, wild turkey, quail, javelina, and wild hog. The entire 2.4-mile-long Header System and Compressor Station 1 (MP 0.0) would be on King Ranch. In addition, Pipelines 1 and 2 would cross King Ranch at three locations for a total crossing distance of 30.3 miles (see table 4.8.1-3).

Impacts on King Ranch from pipeline construction would be similar to those discussed above in section 4.8.1.2 (Agricultural and Open Land). Where construction activities would occur in close proximity to visitors, RB Pipeline would post signs, establish reduced speed limits, and provide safety training regarding site-specific uses and safety concerns to minimize impacts and enhance safety during construction. RB Pipeline is continuing to coordinate with managers of the ranch to identify designated hunting land. If hunting areas are identified adjacent to or within proposed construction work areas, and if requested by the landowner, RB Pipeline would develop a site-specific mitigation plan to be implemented during hunting season.

Jamie J. Zapata Memorial Boat Ramp, Fishing Pier, and Kayak Launch Pad

Cameron County's Zapata boat launch is a public access site that contains a boat launch, 55-foot fishing pier, and 20-foot kayak launch pad providing access to the BSC and San Martin Lake. The site includes two pavilions and solar lighting to allow for nighttime fishing (Texas General Land Office 2016). The Zapata boat launch is located off SH-48, about 4.7 miles west of the LNG Terminal site. The parking lot of the Zapata boat launch is within the path of the proposed pipeline route between MPs 133.5 and 133.6, but would be crossed by HDD concurrently with the channel to San Martin Lake. Use of the HDD crossing method would avoid direct impacts on the site, and would not impact the operation of the boat launch (i.e., there would not be any temporary closures). However, there would be increased noise and traffic from the HDD activities, which could occur up to 24 hours a day, 7 days a week, for 10 weeks. The Zapata boat launch would be about 1,500 feet from the HDD exit point and over 3,000 feet from the HDD entry point; at these distances, the sound level from HDD construction would be perceived as moderate to quiet.

Bahia Grande Coastal Corridor Project

As identified during scoping, the Bahia Coastal Corridor Project is a multi-stage project that is currently underway with the goal of acquiring land for conservation purposes. The Nature Conservancy, Conservancy Fund, FWS, and TPWD are working to identify parcels for acquisition, through purchase or easement, to connect the Lower Rio Grande Valley NWR, Laguna Atascosa NWR, Boca Chica State Park, and other privately held land to provide protection for various threatened and endangered species, as discussed in section 4.7.

An existing easement held by the FWS on BND land that is part of this overall effort would be crossed by the Pipeline System between MPs 134.5 and 135.5; however, this crossing would be conducted by HDD, therefore direct impacts would be avoided. To date, the conservation sponsors noted above have identified, and are attempting to acquire, an additional 1,852 acres of a total acquisition goal of 10,000 acres. The land currently identified for acquisition would be at least 5 miles away from the Rio Grande LNG Project. As such no direct impacts are anticipated on lands expected to be acquired.

Great Texas Coastal Birding Trails

Four Great Texas Coastal Birding Trails, as designated by the TPWD, would be within 0.25 mile of the Project: King Ranch Trail, Hawk Alley Trail, Olmos Creek Trail, and Texas 48 Scenic Drive. These recreation areas are not linear trail systems but are larger tracts of land designated by the TPWD that offer discrete locations where the public can observe birds and other wildlife. The King Ranch Trail is considered to be the entire parcel and as such, impacts on this area are included in the discussion above (King Ranch). None of these “trails” are state-designated as Texas Scenic Drives, nor under the National Scenic Byways Program (23 USC 162).

Given these trails are not discrete linear features, a variety of crossings methods would be applied, including typical upland construction and specialized construction methods such as those used for waterbody or wetland crossings, as well as HDD (between MPs 18.8 and 19.2). Noise and dust produced during construction would have a temporary impact on trail users, as well as changes in visual setting of areas where active construction occurs. However, given these trails are associated with large tracts of land, users could opt to visit areas unaffected by construction.

Conservation Reserve Programs

Lands managed by the NRCS and the FSA that would be crossed by the pipeline facilities are contracted as State Acres for Wildlife Enhancement (SAFE) as part of the CRP program. Environmentally sensitive areas are voluntarily converted from cropland and/or ranch/grazing land per the terms of a 10- or 15-year contract (U.S. Department of Agriculture 2017). The CRP SAFE contract affords financial assistance to eligible farmers and ranchers to establish the appropriate vegetation cover to support target wildlife, and the land is managed per the terms of a conservation plan developed collaboratively by the landowner and the NRCS. The pipeline facilities would cross three areas subject to CRP SAFE contracts, all of which are in Cameron County (between MPs 108.1 and 128.2). Initial consultation between the FSA and RB Pipeline has indicated that these parcels have been designated for the protection of ocelot habitat (see section 4.7.1.4).

According to correspondence with the Cameron County FSA Office, disturbance of habitat established per the conservation plan for these CRP SAFE contracts can result in cancellation of the contracts, and the contract owner would be required to repay all cost share payments received per the terms of the contract as well as 25 percent liquidated damages (U.S. Department of Agriculture 2017). Individual landowners could negotiate compensation of any anticipated fees or penalties as part of the easement agreement for each corresponding contract. RB Pipeline intends to consult with the FWS to identify the location of the parcels and determine the appropriate avoidance, minimization, or mitigation measures for the land. However, as no mitigation for these parcels is currently proposed, **we recommend that:**

- **<u>Prior to the end of the draft EIS comment period</u>, RB Pipeline should consult with the NRCS and FSA to determine the specific location of the three CRP-SAFE easements located between MPs 108.1 and 128.2 and identify appropriate measures to avoid (or minimize or mitigate for) impacts on the easements and the wildlife that they support. Results of this consultation should be filed with the Secretary.**

General Impacts and Mitigation

One of the primary concerns when recreation and special interest areas are in close proximity to a project is the impact of construction on the purpose for which the area was established (e.g., the recreational activities, public access, and resources the area aims to protect). Construction could alter visual aesthetics by removing existing vegetation and disturbing soils; these potential impacts are discussed in section 4.8.2. Construction could also generate dust and noise, which could be a nuisance to recreational users, and could generally interfere with or diminish the quality of the recreational experience by affecting wildlife movements or disturbing hikers and bikers while using trails.

During the 7-year construction period for the LNG Terminal, noise from construction would be audible at recreation areas near the site. Noise from clearing, grading, and construction would be continuous for the duration of those activities, as discussed in section 4.11.2. Alternatively, pile-driving, which would be required for the installation of the marine facilities and foundations would be louder than typical construction noise and would be most prominent for receptors in or along the BSC near the LNG Terminal site. Based upon the construction schedule provided by RG LNG (see table 2.3-1 and section 2.5.1.3), land-based, impact pile-driving operations for the first stage of construction (including LNG Train 1 and related offsite utilities) would require between 114 and 165 days; each subsequent stage of construction would require less time. Pile-driving at the MOF would only be required over a 3-month period, land- or water-based pile-driving at the Berth 2 jetty would take place for a 5-month period, and would occur over a 2-day period for the fixed aid to navigation structure. Construction of the Berth 1 jetty would be conducted prior to dredging the marine berth and would require about 4 months for land-based pile-driving.

In general, construction of the Pipeline System would result in impacts on recreational and special interest areas that would be temporary and limited to the period of active construction, which typically would last only several days to several weeks in any one area. For areas in proximity to the Pipeline System, RB Pipeline would implement the requirements and mitigation included in its Plan and Procedures. As described throughout this EIS, implementation of these requirements would generally minimize, and to some extent mitigate, potential impacts on resources and activities in recreation and special use areas.

During construction of the Rio Grande LNG Project, most non-local workers, and in some cases their families, would reside primarily in one of the five counties within the Project area, with the bulk of the workforce residing in Cameron County given the proximity to the LNG Terminal site (see section 4.9.6). RG LNG anticipates that up to 270 permanent employees would be hired to operate the LNG Terminal, and the Pipeline System would require up to 20 new permanent employees. It is likely that some workers and/or their families would visit nearby recreation areas in those counties, resulting in indirect impacts. However, given the existing inventory of recreation areas in these counties and their large geographic area with multiple access points, is it likely that these facilities would be able to accommodate use by workers and/or their families; therefore, we conclude that the overall impact on these facilities would not be significant.

4.8.2 Visual Resources

"Visual resources" refers to the composite of basic terrain features, geologic features, hydrologic features, vegetation patterns, and anthropogenic features that influence the visual appeal of an area for residents or visitors. In general, impacts on visual resources may occur during construction when large equipment, excavation activities, spoil piles, and construction materials are visible to local residents and visitors, and during operation to the extent that facilities or portions of facilities and their lighting are visible to residents and visitors. The degree of visual impact resulting from the proposed facilities would be highly variable among individuals, and would typically be determined by the general character of the existing landscape and the visually prominent features of the proposed facilities.

4.8.2.1 LNG Terminal

The existing viewshed of the proposed LNG Terminal site includes predominately open land with scrub-shrub vegetation. Land surrounding the site includes open land with scrub-shrub vegetation with the BSC and SH-48 framing the southern and northern site boundaries. As described in section 4.9.8.2, the Port of Brownsville and the BSC support the movement of domestic and foreign products, which included about 7.6 million metric tons of cargo with over 1,050 vessel-calls in 2014 (Port of Brownsville 2015). As such, the movement of these vessels contributes to the characterization of the existing viewshed. Visual receptors in the vicinity of the LNG Terminal site would include recreational and commercial users of the BSC, motorists on SH-48, and visitors to the Laguna Atascosa NWR, and other nearby recreation areas discussed in section 4.8.1.5.

Construction of the LNG Terminal would increase traffic on SH-48 and within the waters of the BSC, as described in section 4.9.8. Construction of these facilities would affect the views of those using these transportation corridors, as well as for visitors at nearby recreation areas.

There are no residences within the LNG Terminal site; the closest residential areas are about 2.2 miles away. Given the LNG Terminal site's proximity to residential areas, it would be possible to see the LNG Terminal from some vantage points in Port Isabel and Laguna Heights, in particular elevated sites such as the Port Isabel Lighthouse; however, the distance to the LNG Terminal site limits its visibility and as such it would not be a prominent feature in the viewshed for these residences.

The changes to the visual character of the area during construction that land and water-based receptors could observe include the presence of equipment and workers, the increase in construction related traffic (on land and in the BSC), and the installation of large structures at the LNG Terminal site (e.g., LNG trains, storage tanks). These receptors traveling along the highway and BSC would have a short time (i.e., until the vehicle or vessel passes the site) to view the site during construction.

To support construction of the LNG Terminal, RG LNG proposes to use two storage areas, one of which would also serve as an offsite parking location for construction work. The Port Isabel and the Port of Brownsville storage areas would be located in areas of heavy industry. As such, visual receptors in the vicinity of these storage areas would include workers and visitors at nearby industrial/commercial facilities and motorist on nearby roadways. Given the location of the storage areas at existing industrial sites, impacts on visual receptors would be minor and temporary.

While the vessel transits associated with construction and operation of the LNG Terminal would result in a moderate increase in traffic in the BSC, this increase would have a minimal impact on the viewshed because the vessels would be consistent with current use and visual character of the waterway.

Permanent changes to the visual character of the area would result from the operation of the LNG Terminal due to the presence of aboveground structures. The most prominent visual feature at the LNG Terminal site would be the four LNG storage tanks, each of which would be 275 feet wide and 175 feet in height. To help mitigate visual impacts from the LNG Terminal features, RG LNG has proposed to use ground flares that would be 6 feet in height and surrounded by a 67-foot-high vertical wall to reduce the heat and limit the visibility of flare-offs. Other visible structures within the LNG Terminal site would include six LNG trains, two marine loading berths, one turning basin, four LNG and two LNG truck loading bays, and Compressor

Station 3. In addition, the structures within the LNG Terminal site would require lighting. RG LNG has developed mitigation measures that would reduce day and night time visibility of the aboveground facilities at the LNG Terminal site, including the selection of grey tank coloring, horticultural plantings, and the construction of a levee that would obstruct most construction activities and low-to-ground operational facilities from view. Several light reduction techniques would also be implemented including limiting the amount of outdoor lighting installed, dimming lights at night, and directing lights downward.

Numerous public comments identified concerns with the visual impact of the LNG Terminal to surrounding communities, specifically including Port Isabel and South Padre Island. RG LNG developed visual simulations from several scenarios at key observation points (KOP) in the vicinity of the LNG Terminal site, as listed below. In response to concerns raised by the NPS for visual impacts on historic and architectural resources, RG LNG further conducted visual simulations for KOPs associated with the Port Isabel Lighthouse, Palo Alto Battlefield National Historical Park/National Historic Landmark, and Resaca de la Palma and Palmito Ranch Battlefields. These simulations are included in appendix N. The following summarizes the potential impacts on the viewshed based on the viewshed simulations developed by RG LNG:

- <u>Bahia Grande Channel (0.2 mile west-southwest of the property boundary)</u> – RG LNG conducted visual simulations for both daytime and nighttime visual impacts from the south side of SH-48, near the Bahia Grande Channel (see figures 1 through 3 in appendix N). Due to the proximity of the Bahia Grande Channel to the LNG Terminal site and lack of visual buffers, most of the structures within the LNG Terminal would be visible during the daytime. However, from this vantage point the most prominent feature would be the non-jurisdictional power lines that would be constructed by AEP, which would run parallel to this section of SH-48 (see section 1.4.2). In the evening, when facilities would be illuminated, the LNG Terminal site would be visible; however, individual structures within the site would be more difficult to distinguish from one another. Visual receptors familiar with the existing nighttime appearance of the channel would likely notice the change in viewscape from the terminal lighting, while those less familiar with the existing setting may not notice the change. Anglers fishing from stationary locations near the LNG Terminal site would potentially find the change in the viewscape most notable, which could result in a change in usage patterns; however, the increase in lighting may also attract fish to the local vicinity, which may benefit nighttime anglers. Impacts on fishermen at or accessing waters near Bahia Grande Channel are discussed further in section 4.9.3.2.

- <u>SH-48 (2.6 miles north-northeast of the property boundary)</u> – RG LNG conducted visual simulations for both daytime and nighttime visual impacts approaching the LNG Terminal site from the north on SH-48 (see figures 4 through 6 in appendix N). The most prominent features during the day from this vantage point would include the storage tanks, while other structures at the site would be visible but not distinguishable from one another. In the evening, when facilities would be illuminated, the LNG Terminal site would be visible, but at a distance that would make it difficult to distinguish one structure from one another.

- Jaime J. Zapata Memorial Boat Ramp, Fishing Pier, and Kayak Launch Pad (Zapata boat launch) (1.7 miles southwest of the property boundary) – RG LNG conducted visual simulations for daytime only visual impacts at the boat launch as this site, which conforms to the peak use of the site (see figures 7 and 8 in appendix N). Due to lack of visual buffers, the LNG Terminal site would be visible during the daytime; however, given the distance from the boat launch, individual structures would be difficult to see.

- Port Isabel Lighthouse (4.0 miles northeast of the property boundary) – RG LNG conducted visual simulations for daytime only visual impacts at the lighthouse to conform to the time when visual receptors would likely be present at the site (see figures 9 and 10 in appendix N). While it would be possible to see the LNG Terminal site from the lighthouse under ideal visibility conditions, the distance to the LNG Terminal site would make it difficult to see. Further, Port Isabel is used for maintenance and repairs of ships and platforms, as such infrastructure like the Noble Driller shown in figures 9 and 10 (appendix N) characterizes the existing viewshed, thereby minimizing the visual impact of the LNG Terminal.

- Shrimp Basin (4.8 miles southwest of the property boundary) – RG LNG conducted visual simulations for daytime only visual impacts at the shrimp basin to conform to the time when visual receptors would likely be present at the site (see figures 11 and 12 in appendix N). While the existing vegetation buffer would obscure much of the LNG Terminal site, the storage tanks would be visible, but would not be readily distinguishable as such.

- Isla Blanca Park Boat Ramp (4.8 miles northeast of the property boundary) – RG LNG conducted visual simulations for daytime only visual impacts at the boat ramp to conform to the time when visual receptors would likely be present at the site (see figures 13 and 14 in appendix N). The LNG Terminal site would be a visible feature on the horizon from this vantage point; however, given the distance to the site, the storage tanks, which would be the terminals most prominent feature, would not be distinguishable as such.

- Isla Grand Hotel (6.3 miles northeast of the property boundary) – RG LNG conducted visual simulations for daytime only visual impacts, from the highest vantage point (the 12th floor) at the site (see figures 15 and figures 16 in appendix N). The LNG Terminal would not be visible from this vantage point given the distance between the two sites.

- Palmetto Pilings (4.9 miles southeast of the property boundary) – RG LNG conducted visual simulations for daytime only visual impacts at the historical marker to conform to the time when visual receptors would likely be present at the site (see figures 17 and 18 in appendix N). Due to the distance from the LNG Terminal site and the existing vegetation buffer, the LNG Terminal site is partially obscured; however, the storage tanks would be visible.

- Palo Alto Battlefield (12.0 miles west of the property boundary) – RG LNG conducted visual simulations for daytime only visual impacts at the battlefield to conform to the time when visual receptors would likely be present at the site (see figures 19 and 20 in appendix N). To determine whether the LNG Terminal structures would be visible by persons of average height, a viewpoint toward the terminal site was set 6 feet above the highest ground elevation in the battlefield. The results illustrate that while the viewshed from the KOP within the battlefield would be minimally altered, the LNG Terminal would not be discernable from the Palo Alto Battlefield due to the distance, vegetation screening, and the proposed grey color of the LNG tanks.

- Fort Belknap (4.1 miles south-southwest of the property boundary) – RG LNG conducted visual simulations for daytime only visual impacts at Fort Belknap to conform to the time when visual receptors would likely be present at the site (see figures 21 and 22 in appendix N). While it would be possible to see the LNG Terminal site from Fort Belknap, the distance to the LNG Terminal site would make it difficult to detect. The presence of existing development, including several visible high-rise buildings, reduces the minor visual impact that would result from construction and operation of the terminal. In addition, visitors reading the historical marker would be facing away from the terminal.

Although not selected for the placement of a KOP, Resaca de la Palma Battlefield is approximately 2 miles further west than the Palo Alto Battlefield within the Brownsville city limits. The battlefield viewshed is surrounded by a former channel of the Rio Grande; municipal infrastructure including street lighting, traffic signals, and a public high school; residential housing; and commercial developments. At a distance of over 14 miles west of the LNG Terminal site, construction and operation of the LNG Terminal would have no impact on the viewshed of Resaca de la Palma Battlefield.

Based on our review of the visual simulations, most of the vantage points are at a distance far enough away from the LNG Terminal site that impacts on the viewshed would be permanent, but negligible or minor (i.e., at the lighthouse, hotel, shrimp basin, and historic battlegrounds/landmarks), and individual structures within the LNG Terminal site would not be discernable. Visual receptors within nearby waters north of the LNG Terminal site, such as Laguna Madre, would be at lower elevations and/or far enough away such that the nearby shoreline areas would obscure the LNG Terminal site. Visual receptors at locations closer to the LNG Terminal site (i.e., on SH-48, Bahia Grande Channel, and Zapata boat launch), would be able to discern individual structures; however, these receptors would generally not be stationary and therefore would have a short viewing time (i.e., until the vehicle or vessel passes the site). See section 4.10.2 for additional discussion of visual impacts on National Historic Landmarks.

In accordance with federal safety regulations (see section 4.12), facilities would be illuminated at night. To minimize visual impacts from lighting at the LNG Terminal site, RG LNG has stated that it would develop a lighting plan. Key components of the plan identified in the application include limited lighting that would be based on FAA regulation, use of directional controls, selection of a neutral color to mitigate impacts on wildlife, and low-light model security cameras.

Nighttime visual receptors in close proximity to the LNG Terminal would consist of motorists along SH-48 and boaters in the nearby waters of the BSC, San Martin Lake, and the Bahia Grande Channel. Based on the visual simulations from the Bahia Grande Channel, we have determined that there would be a permanent and moderate impact on visual resources for users in the immediate vicinity of the proposed LNG Terminal site.

4.8.2.2 Pipeline Facilities

The pipeline facilities would be constructed across large parcels of land consisting mostly of open land used for ranching and grazing, as well as agricultural land. This land also contains numerous easements for oil and gas pipelines, including at least 50 known foreign pipelines that would be crossed by the proposed Pipeline System. As a result, the existing viewshed is characterized, in part, by existing infrastructure associated with these systems.

RB Pipeline's right-of-way vegetation clearing would cause the primary impact on visual resources during construction and operation of the pipelines and associated facilities. To minimize visual impacts, portions of the right-of-way would be adjacent to existing permanent rights-of-way, which would minimize development of new corridor. This would also help to limit the extent of changes in the viewshed. Clearing forested land within the construction right-of-way, and maintaining the permanent right-of-way as herbaceous and scrub-shrub vegetation types would change the viewshed for visual receptors in the area; however, forest land crossed by the proposed pipeline is generally small pockets of trees, areas of where trees are not densely present, and/or areas where the pipeline is collocated with U.S. Highway 77, resulting in minimal visual impacts from tree clearing. For the portions of the right-of-way adjacent to existing rights-of-way, we have determined that the impact would not be significant because the increase in width of the rights-of-way would be difficult to discern, and given the parcels crossed are predominately large, privately owned tracts, there would be few observers of the change. RB Pipeline would allow scrub-shrub land and forested wetlands to revert to pre-construction conditions except for the maintained portion of the right-of-way, although it could require years to reach that stage, resulting in long-term visual impacts in those areas.

In addition to clearing of vegetation, construction of the pipelines 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. No planned or permitted residential or commercial developments were identified within 0.25 mile of the Pipeline System. Two residences are within 50 feet of existing roads proposed for use during construction of the Pipeline System (see section 4.8.1.3). Visual impacts in these areas due to the presence of construction equipment and personnel would be temporary; therefore, we have determined that those visual impacts would not be significant.

As described in section 2.3, RB Pipeline would complete the installation of Pipeline 1 before installing Pipeline 2. Similarly, the compressor stations would be installed in increments to correspond to the compression capacity required to support the portion of the Pipeline System in place at that time. This phased construction approach would allow RB Pipeline to utilize a smaller construction workforce. While this approach would result in a longer construction period, impacts associated with the visual presence of construction related traffic would be minimized.

Following construction, all disturbed areas would be restored, and areas outside of the permanent rights-of-way would be returned to pre-construction conditions in compliance with federal, state, and local permits; the Project-specific Plan and Procedures; landowner agreements; and RB Pipeline's lease requirements, with the exception of aboveground facility sites. As described throughout this EIS, implementation of these requirements would generally minimize, and to some extent mitigate, potential impacts on resources and as such would mitigate impacts on visual receptors.

Compressor Station 1

RB Pipeline would lease a 37-acre parcel of land within a rural area of Kleberg County to accommodate construction and operation of Compressor Station 1. As described in section 4.8.1.2, the areas that would be cleared and graded predominantly consist of open land, which would be converted to industrial/commercial land. Initial construction-related impacts, including the presence of equipment and workers, would be temporary and limited to the 12-month construction period; however, additional compression would be added during discrete periods during subsequent stages of the Project (see table 2.3-1).

Based on the proximity to Highway 281 (over 4 miles away), it is unlikely that these facilities would be visible to passing motorists. Construction and operation of Compressor Station 1 would take place on land within King Ranch, which is discussed in sections 4.8.1.4 and 4.10.1. The closest residence to the site is about 5.5 miles to the west (see table 4.11.2-12). Given the lack of visual receptors in proximity to this compressor station and existing commercial infrastructure just northwest of the site, visual impacts would be permanent, but minor.

Compressor Station 2

Construction of Compressor Station 2 would take place within a rural area of Kenedy County on a 28.6-acre parcel that RB Pipeline would lease. As with Compressor Station 1, initial construction would occur over a 12-month period with additional compressors being added in stages. As described in section 4.8.1.2, the areas that would be cleared and graded consist exclusively of open land, which would be converted to industrial/commercial land. During both construction and operation, Compressor Station 2 could be visible to passing motorists traveling along U.S. Highway 77. However, construction and operation of the compressor station would not affect any designated visual resources, and the closest residence is 2.9 miles to the south (see table 4.11.2-13). Given the limited number of visual receptors in proximity to this site, we find that visual impacts associated with this compressor station would be permanent, but minor.

Booster Station 1 and 2

The proposed interconnect booster stations would be constructed on predominately open land in Kenedy County, and each would be collocated with an associated metering site. RB Pipeline would lease two 10-acre sites (MPs 19.6 and 25.4) to accommodate these facilities. These sites would be cleared and graded, resulting in a permanent conversion to industrial/ commercial land. Passing motorists traveling along U.S. Highway 77 would be able to see the sites during both construction and operation. The closest residences to these sites are about 1.7 and 2.4 miles away, respectively (see table 4.11.2-12). Given the limited number of visual receptors in proximity to these sites, visual impacts would be permanent, but minor.

Metering Sites

Of the eight metering sites that would be constructed for the Pipeline System, four would be constructed within the footprint of an associated compressor or interconnect booster station, and are discussed above, and four would be stand-alone facilities constructed on open land. The four stand-alone metering sites would be on individual parcels, for a total of 6.9 acres of open land that would be converted to industrial/ commercial land. Vegetation cover, which could potentially minimize the visibility of these facilities, is generally limited at these locations; however, these areas include large tracts of land in a rural setting with no residences within 50 feet of any of the metering sites. Visual receptors at these sites would include motorists on nearby roadways who may be able to view construction workers and equipment as well as the stations themselves during operation; however, their view would be short in duration. Overall, the metering sites would result in short-term (during construction) or permanent (during operations) localized visual impacts during construction and a permanent but minor impact during operations.

Other Aboveground Facilities

RB Pipeline would install 12 MLVs at 6 locations along the Pipeline System (MPs 18.0, 35.1, 48.9, 83.6, 100.5, and 119.5). In general, the impacts on visual resources resulting from the construction and operation of the MLVs would be minimal as each site is small (typically less than 0.1 acre) and would be within the pipeline operational right-of-way or within an aboveground facility (e.g., compressor or metering site). MLVs along the operational right-of-way would be enclosed in a security fence. Pig launchers and pig receivers would be constructed within the compressor station boundaries.

4.8.3 Coastal Zone Management

The CZMA calls for the "effective management, beneficial use, protection, and development" of the nation's coastal zone and promotes active state involvement in achieving those goals. As a means to reach those goals, the CZMA requires participating states to develop management programs that demonstrate how those states will meet their obligations and responsibilities in managing their coastal areas. For oil and gas projects, the Texas CZMA is administered by the RRC through the Texas CZMP. Activities or development affecting land within Texas' coastal zone are evaluated by the RRC for compliance with the CZMA through a process called "federal consistency." The Rio Grande LNG Terminal and the majority of pipeline facilities in Willacy and Cameron Counties from MP 69.8 to the LNG Terminal would be within the designated coastal zone.

RG Developers have requested a CZMA determination for the Project as part of the COE Section 10/404 permitting process, and submitted a revised application for determination of consistency with the Texas CZMP to the COE March 30, 2018, and to the RRC on April 10, 2018. The applications are still under review, and a Section 10/404 permit has not been issued.

Further, the RB Pipeline has not submitted an application for water quality certification for the Pipeline System. As a result, RG Developers have not received a consistency determination from the RRC; therefore, **we recommend that:**

- **Prior to construction of the Project, RG Developers should file with the Secretary a determination from the RRC that the Project is consistent with the laws and rules of the Texas Coastal Zone Management Program.**

4.9 SOCIOECONOMICS

Construction and operation of the Rio Grande LNG Project could impact socioeconomic conditions, either adversely or positively, in the general Project vicinity. These potential impacts include alteration of population levels or local demographics, increased employment opportunities, increased demand for housing and public services, increased traffic on area roadways and waterways, and an increase in state and local government revenues associated with sales and payroll taxes.

The socioeconomic analysis for the proposed Project examines data from Cameron, Hidalgo, Willacy, Kenedy, Kleberg, and Jim Wells Counties. Of these, the greatest socioeconomic impacts would occur in Cameron County, where the Rio Grande LNG Terminal would be located. None of the Project components would be constructed in Hidalgo County, but it is included in the socioeconomic analysis because it would likely experience an influx in population from non-local workers relocating to the area due to the relatively short commute distance to the Rio Grande LNG Terminal. For the purposes of our socioeconomic analysis, Cameron, Hidalgo, and Willacy Counties make up the affected area for the Rio Grande LNG Terminal; and Cameron, Willacy, Kenedy, Kleberg, and Jim Wells Counties make up the affected area for the pipeline facilities.

4.9.1 Population

Table 4.9.1-1 provides a summary of selected population and demographic information for the affected areas.

4.9.1.1 LNG Terminal

In 2015, the total population of the three-county affected area for the LNG Terminal site was about 1.3 million, with a population density of 329 persons per square mile. Of the three-county area, Hidalgo County has the largest population, including 842,304 residents in 2015 and a population density of 493 persons per square mile (U.S. Census Bureau 2010a, 2010b 2015a). In comparison, the 2015 population of the State of Texas was about 27.5 million residents. Construction of the LNG Terminal would take place over a 7-year period; RG LNG originally anticipated beginning construction in 2018; however, the actual start of construction is dependent on the issuance of all relevant permits and authorizations.

Construction workers would be on site throughout the duration of the construction period, with an average monthly construction workforce of 2,950 workers. During a 17-month period (spanning Years 4 and 5 of construction), the construction workforce at the LNG Terminal site would exceed 5,000 workers, with a maximum workforce of about 5,225. The anticipated monthly construction workforce at the LNG Terminal site is depicted in figure 4.9.1-1. Although the estimated years are no longer completely accurate, the shape of the curve (reflecting the number of workers) would not change appreciably as the graph moves to the right to match the actual years of work.

Table 4.9.1-1
Existing Socioeconomic Conditions in the Affected Areas

State / County	2010 Population	2015 Population (est.)	2010 Population Density (per square mile)	2015 Per Capita Income	2015 Civilian Labor Force	2015 Unemployment Rate (%)	Top Industries
Texas	25,145,561	27,469,114	96	26,999	13,006,330	7.0	C, F, D
Cameron	406,220	422,156	456	15,105	164,483	10.0	C, F, B
Hidalgo	774,769	842,304	493	14,689	330,963	9.9	C, F, D
Willacy	22,134	21,903	37	44,413	6,062	11.5	C, A, E
Kenedy	416	407	<1	14,251	185	0.0	A, E, C
Kleberg	32,061	31,857	36	18,722	15,256	11.7	C, B, A
Jim Wells	40,838	41,382	47	21,798	17,859	6.6	C, A, F
LNG Terminal Affected Area[a]	1,203,123	1,286,363	329[b]	24,736[c]	501,508	10.5[d]	C, F, D, B, A, E
Pipeline Facilities Affected Area[e]	501,669	517,705	115[c]	22,858[d]	203,845	8.0[e]	C, A, F, E, B

Sources: U.S. Census Bureau 2010a, 2010b, 2015a, and 2015c.
a Includes Cameron, Willacy, and Hidalgo Counties.
b Average population density for the affected counties.
c Average per capita income for the affected counties.
d Average unemployment rate for the affected counties.
e Includes Cameron, Willacy, Kenedy, Kleberg, and Jim Wells Counties.

Industries:
A Agriculture, forestry, fishing and hunting, and mining
B Arts, entertainment, recreation, and accommodation and food services
C Educational services, health care and social assistance
D Professional, scientific, management, administrative, and waste management services
E Public administration
F Retail trade

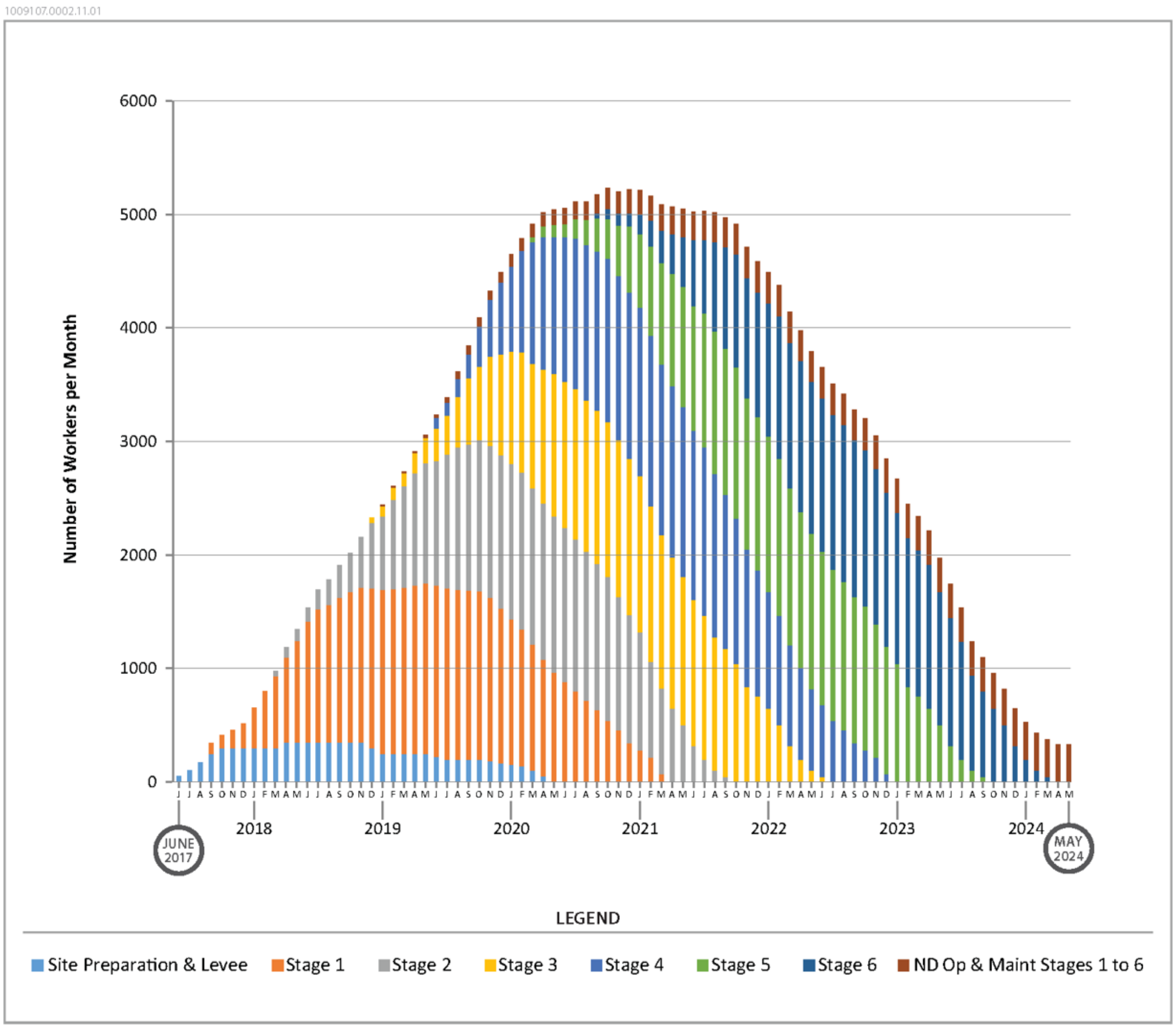


Figure 4.9.1-1 Construction Workforce Associated with the LNG Terminal Site

RG LNG estimates that about 30 percent of the workers would be hired locally, resulting in an average of 2,065 non-local workers and a maximum of 3,658 non-local workers. RG LNG assumes that about 70 percent of the non-local workers would be accompanied by family members. Based on an average family size of 3.5 persons in Texas and a peak non-local workforce of 3,658 workers, up to 10,058 non-local persons and family members could relocate to the affected area during construction of the LNG Terminal (U.S. Census Bureau 2015b). This addition would represent a 0.8 percent increase in the total population within Cameron, Willacy, and Hidalgo Counties over the 2015 census data.

After construction, RG LNG anticipates that 270 workers would be employed at the LNG Terminal site, of which 108 are expected to be non-local hires who would relocate to the Project area. The influx of these workers and their families would represent a minor but permanent increase in the population in the vicinity of the LNG Terminal site. In addition to the LNG Terminal operational staff, RG LNG anticipates hiring about 60 staff to maintain the LNG terminal site; the majority of these staff members are anticipated to be local.

4.9.1.2 Pipeline Facilities

The pipeline facilities would be constructed in Cameron, Willacy, Kenedy, Kleberg, and Jim Wells Counties. Of these, Cameron County had the highest 2010 population density of about 456 persons per square mile, while Kenedy County had the lowest, with less than one person per square mile. The 2010 population densities for Willacy, Kleberg, and Jim Wells Counties were about 37, 36, and 47 persons per square mile, respectively. As shown in table 4.9.1-1, the population in these counties ranged from 407 to 422,156 people in 2015 (U.S. Census Bureau 2015a).

Header System, Pipeline 1, and the Aboveground Facilities

RB Pipeline is proposing a multi-stage construction period for the Pipeline System (see figure 4.9.1-2). The Header System, Pipeline 1, and the aboveground facilities would be constructed during Stages 1 and 2, which would extend for a 12-month period. During this construction period, the average monthly workforce would be 1,240 workers, with a peak of 1,500 workers (see figure 4.9.1-2). The workforce would be concentrated near the compressor stations with an average monthly workforce of 160 workers each (including Compressor Station 3); the remaining workers would be separated into two construction spreads along the Header System and Pipeline 1. Spread 1, with an average monthly workforce of 380 workers, would extend from MP HS-2.4 to MP 65.2. Spread 2, with the same number of workers, would extend from MP 65.2 to MP 135.5. Workers along each spread would continue to move down the pipeline so that active construction at any given location would generally not last longer than a few weeks.

RB Pipeline anticipates that the majority of construction workers for the pipeline facilities (90 percent) would be hired from outside the Project area. Therefore, the estimated maximum non-local workforce during Stages 1 and 2 would be 810 workers for the construction of the Header System and Pipeline 1 (including both spreads) and 540 workers for the construction of the three Compressor Stations. This peak addition of 1,350 non-local workers would result in a negligible increase in the affected area’s population (0.003 percent).

RB Pipeline anticipates that 10 staff would be employed along the Pipeline System once Pipeline 1 became operational, including 3 to 4 staff at each compressor station. The operational staff would periodically visit the pipelines, booster stations, metering sites, and MLV sites to maintain the facilities. Assuming that all 10 workers are non-local, this would represent a negligible, but permanent, increase in the local population.

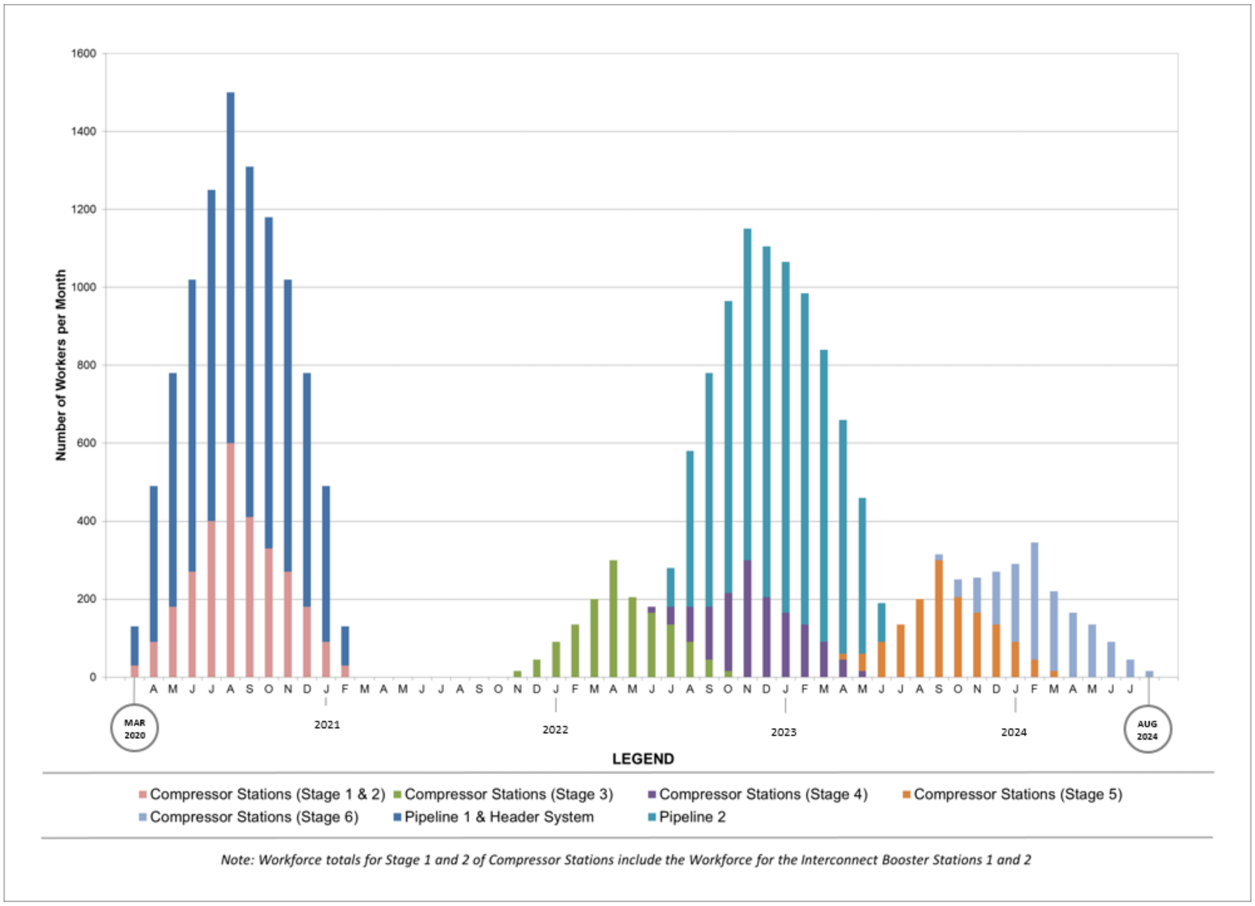


Figure 4.9.1-2 Construction Workforce Associated with the Pipeline Facilities

Pipeline 2

After the completion of Stage 2, there would be a period of no active construction for 8 months prior to the beginning of Stage 3 (see figure 4.9.1-2). Stages 3 through 6 would involve additional compression at each of the three compressor stations, which would require an average monthly workforce of 240 workers (peak of 300). However, as work related to Stages 3 through 6 of the compressor stations would be restricted to the facility footprints established for those facilities during Stages 1 and 2, the majority of active construction would take place along Pipeline 2. Construction of Pipeline 2, which would occur as part of Stage 4, would require an average workforce of 760 workers (380 per spread) over a 12-month period that would begin approximately 18 months after the completion of construction for Pipeline 1.

The estimated maximum non-local workforce during Stage 3 would be 270 workers to add additional compression at the three compressor stations. Stage 4 would require a maximum of 810 non-local workers for the construction of Pipeline 2 (including both spreads) plus 270 workers for work at the three compressor stations, for a maximum non-local workforce of 1,080 workers during this stage. Finally, Stages 5 and 6 would each require a maximum non-local workforce of 270 to complete construction on the three compressor stations. Because the construction periods associated with the two pipelines would be separated by 18 months, it is unlikely that non-local workers would be accompanied by family members. RB Pipeline anticipates that 10 additional staff would be added upon full build-out of the Pipeline System, for a total of 20 permanent operational staff. These operational staff would periodically visit the pipelines, booster stations, metering sites, and MLVs to maintain the facilities. Assuming that the 20 workers employed after full build-out are non-local, this would represent a negligible, but permanent, increase in the local population.

4.9.2 Economy and Employment

The affected areas of the LNG Terminal and the pipeline facilities are generally characterized by lower per capita income and higher unemployment rates compared to the State of Texas (see table 4.9.1-1). As further discussed in section 4.9.10, many Project area residents live in poverty, with the percentage of people living in poverty ranging from 18.0 percent in Jim Wells County to 36.3 percent in Willacy County. The top industries in the affected areas include:

- educational services, and health care and social assistance;
- retail trade;
- professional, scientific, management, and administrative and waste management services;
- arts, entertainment, and recreation, and accommodation and food services;
- agriculture, forestry, fishing and hunting, and mining; and
- public administration (U.S. Census Bureau 2015c).

The economic benefits from employment opportunities for local contractors and laborers were raised during the scoping period. Construction of the Rio Grande LNG Project would stimulate the economy through an estimated $22.4 billion in direct expenditures by RG Developers and annual operating direct expenditures of $2.1 billion. Due to the forecasted number of jobs that would be created during construction and operation of the Project, RG Developers have been coordinating with local training organizations and school districts to provide seminars and career talks to discuss future career opportunities for the Project. In addition, RG Developers have included career development guidance on their Project-specific website that provides links to various career development organizations. RG Developers anticipate hiring a number of unskilled or semi-skilled workers that would be trained on the job through the National Center for Construction Education and Research System.

4.9.2.1 LNG Terminal

The civilian labor force is defined as the sum of employed persons and those actively searching and available for work (U.S. Census Bureau 2010a). During construction of the LNG Terminal, about 30 percent of the peak workforce (up to 1,568 workers of the 5,225 total workers) is expected to be hired from Cameron, Hidalgo, and Willacy Counties. In 2015, the civilian labor force numbered 164,483 in Cameron County, 330,963 in Hidalgo County, and 6,062 in Willacy County. The average per capita income in Cameron and Hidalgo Counties

($15,105 and $14,689, respectively) was below the State of Texas' average per capita income of $26,999, while Willacy County's average per capita income is higher than the state ($44,413). All three counties had a higher unemployment rate than the State of Texas (see table 4.9.1-1).

Construction of the LNG Terminal would stimulate the economy through an estimated $20.2 billion in direct expenditures by RG LNG. Of the 20.2 billion, about $3.2 billion would be direct expenditures for materials, a portion of which may be regionally or locally sourced. Specific to the LNG Terminal, RG LNG estimates that a percentage of the $1.9 billion construction payroll (direct and indirect/support labor) would be spent locally by both local and non-local workers for the purchase of housing, food, gasoline, and other goods, services, and entertainment in the vicinity of the LNG Terminal site. Typically, construction activities increase economic activity within an 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 a project or to workers and their families; and
- an induced effect – the spending of disposable income by the construction workers at local businesses, which in turn order new inventory from their suppliers.

The increase in economic activity resulting from direct, indirect, and induced effects of the LNG Terminal would result in a positive economic impact on the local economy. RG Developers' economic consultant (The Perryman Group [TPG]), estimated that the production of goods and services associated with construction of the LNG Terminal would amount to $31.7 billion dollars in total economic impact across the United States, $22.1 billion of which would be in Texas ($5.6 billion in Cameron County) (TPG 2015).

Anticipated operational direct expenditures for the LNG Terminal would be $1.9 billion annually. RG Developers anticipate that a 270-person operational staff for the LNG Terminal would result in an annual payroll of $24.3 million. The annual direct, indirect, and induced expenditures during full operation of the Rio Grande LNG Project (including the LNG Terminal and the pipeline facilities) are estimated to result in economic impacts of about $2.3 billion across the United States, $2.1 billion of which would be in Texas ($1.4 billion in Cameron County) (TPG 2015). We conclude that the expenditures and permanent workforce associated with operation of the LNG Terminal would result in positive, permanent impacts on the local economy.

4.9.2.2 Pipeline Facilities

During construction of the pipeline facilities, RB Pipeline estimated that about 10 percent of the workers would be hired from Jim Wells, Kleberg, Kenedy, Willacy, and Cameron Counties. In 2015, the civilian labor force in these counties ranged from a low of 185 in Kenedy County to a high of 164,483 in Cameron County. Four counties (Jim Wells, Kleberg, Kenedy, and Cameron Counties) have lower per capita incomes than the state average of $26,999, while

Willacy County's average per capita income is higher than the state average ($44,413). Three counties (Kleberg, Willacy, and Cameron Counties) have higher unemployment rates (11.7, 11.5, and 10.0 percent, respectively) as compared to the state average of 7.0 percent, while Kenedy and Jim Wells Counties have lower unemployment rates (0.0 and 6.6, respectively).

About $2.2 billion in direct expenditures are anticipated during construction of the pipeline facilities. RB Pipeline anticipates that about $800 million would be spent nationally on materials, of which $60 million would be spent on local and regional construction materials specifically for the pipeline facilities. In addition, a portion of the estimated $809 million in labor, including about $165 million in payroll for pipeline facility construction workers, would be spent locally by both local and non-local workers for the purchase of housing, food, gasoline, and other goods, services, and entertainment in the Project area.

Of the estimated $69.6 billion in direct, indirect, and induced expenditures associated with construction of the full Rio Grande LNG Project, the pipeline facilities are estimated to be $7.4 billion dollars in total economic impact across the United States, $4.3 billion of which would occur in Texas ($625 million in Cameron County) (TPG 2015). The increase in economic activity resulting from construction of the pipeline facilities would result in a temporary, positive economic impact in the affected counties.

Operation of the pipeline facilities is expected to result in $179.7 million in annual operational total capital expenditures, a portion of which would be spent in the area of affect for the Pipeline System. Based on the average annual salary, about $1.3 million in annual operational payroll would be allocated to the 20 new operational staff. These expenditures would result in a minor, but positive permanent impact on the local economy.

4.9.3 Tourism and Recreational Fishing

4.9.3.1 Tourism

In an area characterized by high poverty rates and unemployment, tourism is an important source of employment and income for the local communities. Tourism was identified as a significant resource of concern in scoping comments, along with recreation-based commerce in the Project vicinity. Major tourist draws in the Rio Grande Valley (Cameron, Willacy, Hidalgo, and Starr Counties) include, but are not limited to, South Padre Island beaches, boating, recreational fishing, wildlife viewing (particularly bird watching), the Palo Alto Battlefield, and the Port Isabel Lighthouse (Rio Grande Valley Texas 2016). In 2014, visitors spent an estimated $2.2 billion in the Rio Grande Valley, with Cameron County ranking 11th out of the 254 Texas counties for visitor spending (Dean Runyan Associates 2015). That same year, the travel industry supported 24,790 jobs in the Rio Grande Valley (Dean Runyan Associates 2015).

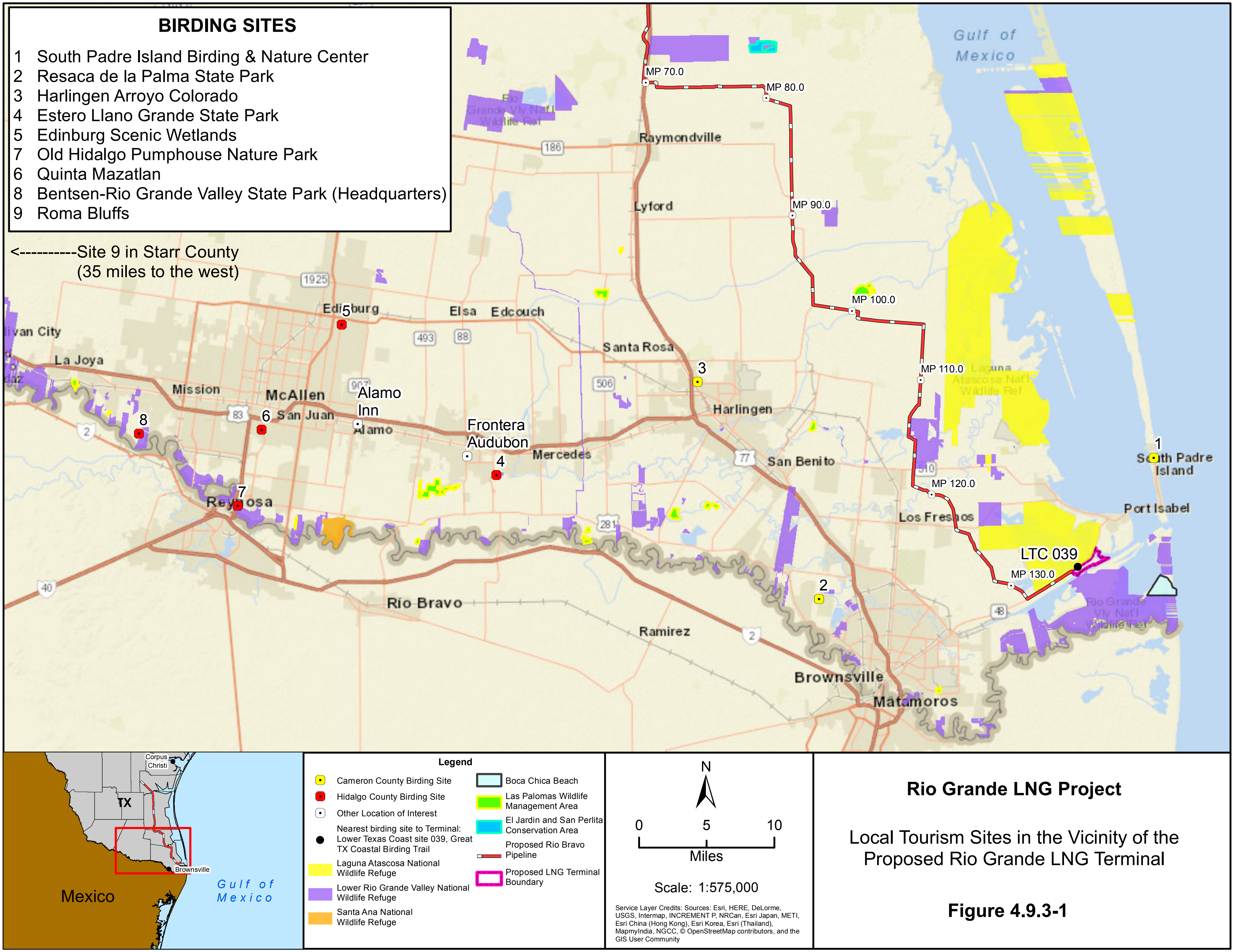
Out of 26 metropolitan statistical areas (MSAs) in Texas, the Brownsville-Harlingen MSA (which includes Cameron County) ranks seventh in the number of days tourists spent visiting (D.K. Shifflet & Associated, Ltd. 2015). In 2014, nature-oriented activities were the most popular tourist pastime, with 56.0 percent of visitors taking part in beach and waterfront activities; visiting state, local, and national parks; or wildlife viewing. About 23.6 percent of tourist trips included participation in outdoor sports, including fishing, biking, boating, and sailing (D.K. Shifflet & Associated, Ltd. 2015). In 2011, the direct, indirect, and induced impacts of nature-oriented tourism in the Rio Grande Valley spurred $463 million in revenues and supported about 6,613 jobs (Texas A&M University 2012).

The Rio Grande Valley is cited as one of the top destinations for bird watching in the country (Mathis and Matisoff 2004, Glusac 2010, Thomas 2016). Located along the Central Flyway, the region is a major bird migration corridor for an estimated 500 bird species (see section 4.6.1). Birding destinations in the region include designated birding centers, NWRs, and local roads and landmarks. The Rio Grande Valley is home to the World Birding Center, a network of nine birding sites along a 120-mile-long corridor following the Rio Grande from the city of Roma to South Padre Island (see figure 4.9.3-1). Created through a partnership among the TPWD, FWS, and local communities, the goal of the World Birding Center is to protect native habitat while strengthening eco-tourism in the Rio Grande Valley (The World Birding Center 2016). Of the nine World Birding Center sites, the South Padre Island Nature and Birding Center is the closest to the LNG Terminal site, located about 7.8 miles away.

Additional birding sites in the Rio Grande Valley are part of the Great Texas Coastal Birding Trail, a state-designated system of 43 hiking and driving trails that includes 308 birding sites along the Texas Gulf Coast. The trail system is managed by the TPWD as part of the Great Texas Wildlife Trails and includes dozens of birding sites in the Rio Grande Valley. Birding site 039 is directly across from the proposed LNG Terminal site's western end, on the southern shore of Bahia Grande (see figure 4.9.3-1). The next closest designated birding sites include the Lower Texas Coast Site 032 in Laguna Vista, Site 033 in Port Isabel, and Site 043 at Boca Chica Beach, all more than 4 miles away. Additional detail on the Great Texas Coastal Birding Trail is provided in section 4.8.1.

LNG Terminal

Construction of the LNG Terminal could impact local tourism through an increase in noise, changes in the visual landscape, and heavier traffic along SH-48. Operations would also result in increased noise and visual effects; however, the addition of 270 permanent jobs would not significantly impact local traffic. To determine the noise and visual impacts on local recreational activities, RG Developers conducted noise and visual assessments in the vicinity of the LNG Terminal site; results of those studies are discussed in detail in sections 4.11.2 and 4.8.2, respectively, and summaries of those impacts on local tourist activities are provided below. Noise and visual impacts on beachgoers, birdwatchers, tour operators, and other visitors are expected to occur only in the immediate vicinity of the LNG Terminal site. Sound from pile-driving would be louder than typical construction noise and would be most prominent for tourist sites near the LNG Terminal site. Based upon RG LNG's anticipated construction schedule, land-based pile-driving for the first stage of construction (including LNG Train 1 and related offsite facilities) would require between 114 and 165 days; each subsequent stage of construction would require less time. In addition, pile-driving operations at the MOF would take place over a period of 3 months. Land- or water-based pile-driving at the Berth 1 jetty would occur over a 5-month period, and the timeframe for construction of the Berth 2 jetty would be similar. As such, impacts from pile-driving would be temporary and limited to the period of construction (see section 4.11.2).



Rio Grande LNG Project

Local Tourism Sites in the Vicinity of the Proposed Rio Grande LNG Terminal

Figure 4.9.3-1

During ideal visibility conditions, it would be possible to see the LNG Terminal from the top of the Port Isabel Lighthouse, which is about 4.0 miles away; however, these impacts would be negligible to minor (see section 4.8.2). Similarly, no visual impacts on South Padre Island beaches and associated tourism would occur, given that the beaches face the ocean and are 5 miles away. Charter boat trips launching from the bayside of South Padre Island would largely be unaffected by construction because the Laguna Madre or the Gulf of Mexico is the destination of most trips. Alternatively, some charter boat tours are designed expressly for the purpose of viewing maritime industries along the BSC. Visitors on these tours would see and hear LNG Terminal construction activities. The availability of lodging accommodations on the island are not expected to be impacted by the LNG Terminal construction workforce (see section 4.9.6).

Tourists may experience temporary traffic delays along SH-48 at peak commute times during the 7-year construction period of the LNG Terminal. RG LNG would implement mitigation measures during the construction period to minimize these impacts (see section 4.9.8); however, tourists may choose to go to other quieter, more scenic sites away from the LNG Terminal site, so that visitation patterns may change, but the number of visits to the Project area would likely not.

Construction of the LNG Terminal would not be expected to affect the majority of designated birding and wildlife watching locations in the area. The closest World Birding Center site to the LNG Terminal site is the South Padre Island Birding and Nature Center, which is about 7.8 miles away. The only designated birding site within 4 miles of the LNG Terminal site is the Lower Texas Coast Site 039 of the Great Texas Coastal Birding Trail, located immediately across from the LNG Terminal site (see figure 4.9.3-1). Sounds from construction and operation of the LNG Terminal would be audible at this birding site, so that some bird-watchers would likely bypass this site in favor of birding sites farther from the LNG Terminal site. Given the multitude of other birding sites and trails available elsewhere in the Rio Grande Valley, neither construction nor operation would be expected to impact the birding tourism industry in Cameron County.

Aside from Lower Texas Coast Site 039 in the Bahia Grande portion of the Laguna Atascosa NWR, most nature tourism facilities at this NWR are about 9 miles north of the LNG Terminal site and would not be impacted by construction. Boca Chica Beach is a visitor-oriented NWR site located about 5.5 miles southeast of the LNG Terminal site; construction noise is not expected to be perceivable at this distance. Additionally, the viewshed of visitors to this beach would not be impacted because dunes line the landward side of the beach, blocking views of the LNG Terminal site.

The portion of South Bay closest to the LNG Terminal site would be exposed to noise from LNG Terminal construction, including pile-driving, that would be louder than ambient sound levels. As described in table 4.7.1.3, the composite construction sound level at designated piping plover critical habitat near the LNG Terminal site would be a maximum of 61.1 decibels, which is perceived as moderate. The distance from the LNG Terminal site to South Bay is similar, and that area would likely be exposed to a similar level of construction noise. Nature tourism at the southern extent of the Bahia Grande would be similarly exposed to construction noise that is louder than the background traffic on SH-48, given its distance from pile-driving at the MOF (about 2,500 feet).

Sound from operation of the LNG Terminal would be perceptible at the Zapata boat launch, within the Bahia Grande, and at Lower Texas Coast Site 039. Operations would run 24 hours a day, 7 days a week. Additional information regarding impacts on tourists engaging in recreational fishing in the Project area are discussed in section 4.9.3.2, below.

Pipeline Facilities

Recreational areas that draw nature-oriented tourists would be crossed by the pipeline, including four Great Texas Coastal Birding Trails, a National Historic Landmark (King Ranch), the Zapata boat launch, and BND land subject to a wildlife crossing conservation easement. As discussed in 4.8.1.4, the Lower Rio Grande Valley and Laguna Atascosa NWRs would be less than 0.25 mile from the Pipeline System.

Although pipeline construction would not prohibit visitors from using recreational areas, sights and sounds of pipeline construction activities may be a nuisance to visiting tourists, and could generally interfere with or diminish the quality of their experience by affecting wildlife movement. See section 4.9.8 for a discussion of potential traffic impacts for these recreational areas. Given the number of tourism opportunities in the Project area, tourists may go to other sites within the Project area, so that visitation patterns may change, but the number of visits to the Project area would likely not.

Following construction, RB Pipeline would restore land crossed by the Pipeline System to pre-construction conditions; however, as the construction of Pipeline 2 would occur about 18 months after the installation of Pipeline 1, previously vegetated areas may not fully recover between construction stages. Lands where aboveground facilities are constructed would be permanently converted to industrial/commercial use. In general, impacts of construction of the Pipeline System on nature-oriented tourism sites would be temporary and limited to the period of active construction, which typically would last several days to several weeks in any one area. Operational impacts, including the permanent conversion of aboveground facility sites to industrial/commercial land, would result in negligible impacts on tourism based on their placement outside of main tourism areas.

4.9.3.2 Recreational Fishing

In the Project area, recreational fishing is most common in the coastal bays of Cameron and Willacy Counties, which form the southernmost extent of the Lower Laguna Madre Bay System. Recreational fishing was identified as a resource of concern in scoping comments. Waterbodies in the vicinity of the Project area are further described in section 4.3. During the 2013/2014 fishing season, residents and visitors spent an estimated 461,700 hours on private fishing trips and another 41,100 hours on guided fishing trips in these bays (TPWD 2015a). About 79 percent of recreational boat fishing within the entire Lower Laguna Madre Bay System takes place in the Lower Laguna Madre Bay. Less than 1 percent of recreational boat fishing is within Brazos Santiago Pass and the BSC. The Project would not cross significant recreational fisheries in Jim Wells, Kleberg, or Kenedy Counties.

Speckled seatrout, redfish, southern flounder, and sheepshead are the most commonly caught recreational species in the local bays (TPWD 2015a). Additionally, a small number of anglers and fishing guides fish for snook specifically within the BSC, where the species is known to school (Ferguson 2015). Offshore fishing in south Texas targets red snapper, king mackerel, Spanish mackerel, gray triggerfish, tuna, and billfish, but comprises only about 5.0 percent of fishing effort compared to that spent in the bays (TPWD 2015a).

In addition to boat-fishing, recreational shore-based fishing occurs in the Project area. About 70 percent of shore-based fishing in the Lower Laguna Madre Bay System occurs along the Brazos Santiago Pass jetties; shore-based fishing also occurs along the BSC, and along the southern end of Bahia Grande. Shore-based anglers also fish along the banks of the 0.4-mile-long Bahia Grande Channel, although the land on both sides is owned by the BND and is not officially designated for fishing.

LNG Terminal

Construction and operation of the LNG Terminal could affect recreational fishing through restrictions in fishing access, an increase in noise, and changes in vessel traffic. Construction activities at the LNG Terminal site would not restrict fishing access to bays in the Project area or the Gulf of Mexico. Fishing along the eastern bank of the Bahia Grande Channel on the LNG Terminal site would be prohibited. To compensate for this loss, RG Developers, in coordination with relevant agencies, are exploring the potential to provide a parking and fishing area on the western bank of the Bahia Grande Channel.

As discussed in section 4.9.3.1, noise impacts from construction are expected in the immediate vicinity of the LNG Terminal site, potentially resulting in avoidance of the area by recreational fishermen. Construction noise would likely be audible at local fishing sites including the Bahia Grande Channel, portions of the Bahia Grande and South Bay, and the Zapata boat launch during the 7-year construction period. Construction activities would occur predominantly during the day, between 7:00 a.m. and 7:00 p.m., Monday through Friday. However, dredging may take place up to 24 hours per day, 7 days per week.

The Lower Laguna Madre, the most popular waterbody in the region for recreational fishing, is about 4.3 miles from the center of the LNG Terminal site, and typical construction noise is not expected to result in an audible increase in ambient sound at that distance. For additional information about noise impacts expected from Project construction and operation, see section 4.11.2. In addition to increased noise, barge deliveries would increase traffic in the BSC during the construction period; however, with the exception of excluding recreational fishing boats from the construction areas, boating activities, and vessel avoidance behaviors would not be significantly modified.

Operational noise could also result in anglers avoiding local fishing areas. RG Developers estimate that during typical operations, noise would only be audible at the south shore of the Bahia Grande and at the Zapata boat launch during lulls in SH-48 traffic. As boat-launching activities are short term, it is unlikely that patterns of usage for the launch itself would change based on the presence of the LNG Terminal; however, a perceived increase in ambient noise and visual impacts could result in a change in usage of the fishing pier by recreational anglers. Given the amount of recreational fishing opportunities in the Project area, anglers may visit other nearby sites, so that visitation patterns immediately adjacent to the LNG Terminal site may change, but the number of visits to the general Project area for recreational fishing would not.

During operation, up to 312 LNG carriers would call on the LNG Terminal per year, or about 6 per week. Due to potential safety/security zone exclusions, vessels would likely not be permitted to pass an LNG carrier transiting the BSC or maneuvering in the turning basin; however, the exact navigation protocol would be determined by the Coast Guard. Recreational fishing boats that begin trips from Port Isabel or South Padre Island could experience delays at Brazos Santiago Pass if they arrive during LNG carrier transit; however, RG LNG estimates that an LNG carrier's transit time through the pass would be about 30 minutes. The maximum estimated delay for fishing vessels in the BSC during inbound LNG carrier transits would be about 3 hours. The planned transit times of LNG carriers would be communicated to the Coast Guard and Port of Brownsville Harbor Master, to allow for the issuance of advisories to mariners. Impacts on marine transportation are further discussed in section 4.9.8.2, below. Overall, the Project would result in direct, minor impacts on recreational fishing resulting from delays during LNG carrier transit.

Pipeline Facilities

Sights and sounds of Pipeline System construction activities may be a nuisance to people fishing in the Project vicinity, including at the Zapata boat launch, but pipeline construction would not prohibit visitors from using these areas. In general, impacts of construction of the Pipeline System on recreational fishing would be temporary and limited to the period of active construction, which typically would last several days to several weeks in any one area, with the exception of the Zapata boat launch, which would be crossed by an HDD that could last up to 10 weeks. The Zapata boat launch would be about 1,500 feet from the HDD exit point and over 3,000 feet from the HDD entry point; at these distances, the sound level from HDD construction would be perceived as moderate to quiet. Recreational fishing is not known to occur in the inland rivers and streams that would be crossed by the pipeline facilities.

4.9.4 Commercial Industries

4.9.4.1 Commercial Fishing

In 2014, the Port of Brownsville and Port Isabel together ranked as the second largest fishing port by value along the Gulf of Mexico (National Ocean Economics Program 2016). Shrimp are the top commercial species in the region, most of which are caught offshore (Fisher 2015). About 12.1 million pounds of commercial fish were landed at the two ports in 2014, valued at $69.1 million (National Ocean Economics Program 2016b). A majority of this commercial fishery is based on offshore shrimping and fishing; however, some commercial fishing occurs in the Lower Laguna Madre System.

Commercial fishing in the Lower Laguna Madre and nearby bays is dominated by bait fisheries (including shrimp) and black drum. In addition, trawlers harvest bait shrimp from the BSC (Fisher 2016). The live weight and landed value of commercial fish caught in the Lower

Laguna Madre off the coasts of Cameron and Willacy Counties in 2013 was 724,345 pounds and $1.2 million, respectively (TPWD 2015b). None of the reported fishery catch were oysters; commercial oyster landings have not been documented in the Lower Laguna Madre since 1992 (Gulf States Marine Fisheries Commission 2012). South Bay supports an oyster population, but does not currently support a commercial fishery (Bozka 2003, Fisher 2016). The Project would not cross commercial fisheries in Jim Wells, Kleberg, or Kenedy Counties.

The Port of Brownsville Fishing Harbor, about 4.8 miles west of the LNG Terminal site, houses up to 500 fishing vessels (Port of Brownsville 2016a). The total shrimp fleet was about 350 vessels in the 1990s, but decreased to 160 by the late 2000s due, in part, to competition from imported shrimp (Nelsen 2008). A smaller number of bay shrimping vessels (about 50) dock in the Port Isabel region (Bearden 2015).

LNG Terminal

Public scoping comments expressed concern for impacts on commercial fisheries from construction and operation of the LNG Terminal. During construction, barge deliveries would increase traffic in the BSC. Fishing boats would avoid cargo ships and barges making deliveries to the LNG Terminal during construction in a manner similar to the way they currently maneuver around commercial deep-draft ships and barge traffic into and out of the Port. Dredging would occur within the boundaries of the BSC, which would temporarily reduce the area of the BSC available for vessel transit. Impacts on marine transportation due to dredging are addressed in section 4.9.8 and, because dredging would be limited to Stage 1 of construction, impacts would be temporary and minor. Therefore, vessel operators would have the ability to safely navigate and avoid construction activities. Use of dredging vessels, tugs, and barges would be coordinated with the BND, Coast Guard, and the Pilots Association. Marine traffic is further discussed in section 4.9.8.2.

During operation, up to 312 LNG carriers would call on the LNG Terminal per year, or about 6 per week. Due to potential safety/security zone exclusions, shrimping and other fishing vessels would likely not be permitted to pass an LNG carrier transiting the BSC or maneuvering in the turning basin; however, the exact navigation protocol would be determined by the Coast Guard. The estimated delay for fishing vessels during inbound LNG carrier transits would be about 3 hours. Fishing vessels could follow behind outbound LNG carriers, as long as they traveled at an approved distance from the LNG carrier. The Project would result in direct, minor impacts on commercial fishery vessel operators resulting from delays during LNG carrier transit.

Pipeline Facilities

Fish are not harvested commercially in the inland rivers and streams crossed by the RB Pipeline. No impacts on commercial fisheries are anticipated as a result of construction or operation of the pipeline facilities.

4.9.4.2 Ports

There are two active ports located along the BSC: the Port of Brownsville, about 8 miles west of the LNG Terminal site, and Port Isabel, which is 4 miles east of the terminal site on the Texas coast. The Port of Brownsville, which is managed by the BND along with the land adjacent to the BSC itself, serves as the primary marina for Gulf shrimping vessels that operate out of Cameron County. The port is one of the largest steel importers on the Gulf Coast and it supports industries related to marine cargo transport and ship and oil rig repair (BND 2013, Port of Brownsville 2013). The Port of Brownsville is one of about 256 U.S. foreign-trade zones, areas that benefit manufacturers and distributers by the legal ability to defer import duties on raw goods and materials and pay reduced duties on finished products (Foreign-Trade Zones Board 2013). In 2015, the Port of Brownsville handled about 9.1 million metric tons of cargo, the highest tonnage that had passed through the Port in 10 years (Port of Brownsville 2016).

Port Isabel's primary maritime function is to serve as a dock site for out-of-service industrial vessels until they are put back into commission, and it therefore generates far less vessel traffic when compared to Port of Brownsville-generated traffic (Bearden 2015). During 2014, Port Isabel handled about 13,000 tons of cargo (Bearden 2015).

LNG Terminal

Construction and operation of the LNG Terminal would generate increased economic activity within the Port of Brownsville and support maritime workers and businesses co-located in the BND. The BND would receive direct payments and other financial benefits from RG LNG, such as lease payments and dockage and wharf fees. A portion of capital expenditures would be paid to local maritime suppliers and service-oriented businesses that regularly do business with BND industries and are equipped to serve the needs of LNG Terminal construction and operation. For example, LNG Terminal operations would benefit tug suppliers due to its investment in tugboat services for escorting LNG carriers transiting the BSC.

Procedures developed as part of the WSA process would ensure that traffic along the BSC remains safe and efficient for all users when LNG Terminal operations begin (see section 4.9.8.1). On January 19, 2018, the Coast Guard's LOR was filed in the Project docket indicating that the BSC is suitable for Project use. RG LNG would also work with stakeholders, such as the pilots, the BND, and the Coast Guard, to ensure that clear guidance on shipping through the BSC is established and communicated.

Pipeline Facilities

A portion of the pipeline between MPs 131.6 and 135.5 would be constructed within existing right-of-way adjacent to SH-48. Potential impacts on port facilities from construction of the pipeline in this area would be limited to congestion on SH-48 and other roads in the vicinity of the ports (see section 4.9.8.1).

4.9.5 Local Taxes and Government Revenue

Public comments also express concern over loss of tax revenue from tax abatement opportunities afforded by Cameron County to LNG companies. RG Developers anticipate spending about $4.0 billion on construction materials across the nation, a portion of which would be spent in Cameron County and other Texas locations, resulting in the generation of local, state, and federal sales tax revenues. Local, state, and federal governments would also tax the $2.1 billion in workforce payroll associated with Project construction. Expenditures on goods and services by the construction workers and their families would also generate increased tax revenues through indirect and induced effects. Of the $4.0 billion spent nationwide on construction materials for the full Project, an estimated $60 million would be spent on local and regional construction materials and fuel during construction of the pipeline facilities. Due to this spending, a total of $4.6 million in sales tax revenues would be generated for the State of Texas and local taxing authorities. Tax revenues during construction would be a moderate, temporary, and positive impact on tax revenue within the Project area.

In 2018, property taxes were assessed at about 1.76 percent of the property value (Tax-Rates.org). Per Texas State tax code chapter 312, a portion or all of the increase in property value may be abated per the terms of a specific agreement between a taxpayer and the taxing unit (Comptroller.Texas.Gov 2018). During operation, RG LNG estimates that the LNG Terminal would generate about $92.9 million in property taxes in the affected counties over the first 22 years of operation. The estimated tax benefits assume the Project would receive tax abatements comparable to those recently granted for other LNG and major refining and petrochemical facilities along the Texas Gulf Coast.

To offset a portion of the forgone taxes associated with the abatement, RG LNG has committed to annual payments of $2.7 million during the first ten years of operation and will donate $10 million to aid in the funding of community projects (LNG World News 2017). Operation of the LNG Terminal would also result in minor, long-term increases in sales tax revenue from expenditures on materials, goods, and services. RB Pipeline estimates that tax revenues (general property, sales/use, and other miscellaneous taxes) in the counties crossed by the Pipeline System would range from $5.2 to $117.0 million.

4.9.6 Housing

The number of housing units (permanent and temporary) varies across the affected areas, largely based on county population and the presence or absence of a major city. Table 4.9.6-1 provides data on the rental and other temporary living options in the affected areas. Based on the 2015 American Community Survey, Hidalgo County has the greatest number of available housing units (34,105), and also has the greatest number of residents (842,304) within the affected areas (U.S. Census Bureau 2015a, 2015d). In contrast, Kenedy County has both the lowest population (407) and number of available housing units (102) within the affected areas. The median rental housing cost per month for the six Project-area counties ranges from about $498 in Willacy County to about $745 in Kleberg County (U.S. Census Bureau 2015d).

Public scoping comments expressed concern regarding impacts on the availability of housing for communities in the Project area during the construction phases. Several factors impact the feasibility of housing options for the Project construction workforce, including proximity to the work sites and seasonal fluctuations in availability. For example, a seasonal population of retired visitors migrate to the Rio Grande Valley each winter for an average of 4.4 months (University of Texas-Pan American 2014). A study conducted by the University of Texas-Pan American estimated that these "Winter Texans" occupy about 68.6 percent of recreational vehicle (RV) and mobile home parks in the Rio Grande Valley from November through February. Based on a Winter Texan occupancy rate of 68.6 percent, the number of available RV and mobile home sites would be reduced considerably during the winter months. Additionally, lodging accommodations on South Padre Island are not expected to be used by the

LNG Terminal construction workforce because they are resort destinations with higher rental rates. Table 4.9.6-1 estimates available housing for non-local Project construction workers based on these criteria.

Table 4.9.6-1
Available Housing for Non-Local Construction Workers during Construction of the Project

County	Vacant Housing Units[a]	Estimated Vacant Hotel/Motel Rooms[b]	Estimated Vacant RV and Mobile Home Park Sites[c]	Total Available Units	Average Workforce Demand of Available Units (%)	Peak Workforce Demand of Available Units (%)
Cameron[d]	24,097	1,339	4,990	30,426	--	--
Hidalgo	34,105	2,524	6,506	43,135	--	--
Willacy	1,549	108	185	1,842	--	--
Kenedy	102	256[e]	118[e]	476	--	--
Kleberg	2,089	223	412	2,724	--	--
Jim Wells	2,377	190	177	2,744	--	--
LNG Terminal Affected Area[f]	--	--	--	75,403	2.7	4.9
Pipeline Facilities Affected Area[g]	--	--	--	38,212	2.8	3.5

Sources: U.S. Census Bureau 2015d, Office of the Governor 2014, and University of Texas-Pan American 2014.

a Includes single- and multi-family units and mobile homes.

b Estimated from the hotel/motel rooms and vacancy rates for each geographic area per the Office of the Governor (2014).

c Assumes that each RV/Mobile Home park has 193 sites. Also assumes that the vacancy rates are 31.4 percent in Cameron and Willacy Counties (to account for winter Texans) and 50 percent for the remaining counties.

d Excludes vacancies on South Padre Island, which is a resort destination.

e Total includes accommodations in Encino and Falfurrias cities in neighboring Brooks County, about 20 miles from the pipeline route.

f Includes accommodations shown in this table for Willacy, Hidalgo, and Cameron Counties.

g Includes accommodations shown in this table for Jim Wells, Kleberg, Kenedy, Willacy, and Cameron Counties.

4.9.6.1 LNG Terminal

As stated previously, local residents would make up about 30 percent of the workers hired for construction of the LNG Terminal. An average workforce of 2,065 non-local residents would be expected to move to the affected area, with a peak of 3,658 workers. Within the affected area, a total of 75,403 housing units would be available for rent to the workforce, including hotel and motel rooms, vacant housing units, and RV sites. Based on this availability, the average non-local workforce and their family members would occupy about 2.7 percent of the currently available housing, up to a peak of 4.9 percent, indicating there would be sufficient lodging units to accommodate the non-resident workers and their family members.

Operation of the LNG Terminal would result in about 108 non-local workers and their families relocating to the affected area. Because an adequate number of housing units are available in the affected area, we anticipate that this would have a negligible but permanent impact on the local housing market.

4.9.6.2 Pipeline Facilities

Local residents would make up about 10 percent of the workers hired for construction of the pipeline facilities. Therefore, during the first 12 months of construction, an estimated peak of 1,350 workers would temporarily move into the affected area for construction of the pipeline facilities. Following construction of the Header System, Pipeline 1, and the aboveground facilities, there would be an 8-month period of little to no construction activity along the pipeline facilities where the non-local workers may choose to return to their homes. Upon reinitiating construction for Stages 3 through 6, a maximum of 1,080 workers would migrate into, or back into, the affected counties (see section 4.9.1.2).

Within the affected area, a total of 38,212 housing units would be available for rent to the workforce, including hotel and motel rooms, vacant housing units, and RV sites. Based on this availability, the average and peak non-local workforce would occupy about 2.8 and 3.5 percent of the currently available housing, indicating sufficient lodging units would be available to accommodate the non-resident workers, resulting in minor and temporary impacts on the availability of housing units. Following construction, RB Pipeline anticipates a permanent workforce of up to 20 workers for daily operations of the pipeline facilities. This would represent a permanent but negligible impact on the local housing market.

4.9.7 Public Services

Public scoping comments highlighted the need to assess Project impacts on public services. Table 4.9.7-1 provides an overview of public services available in the Project area, including public schools, police departments and sheriff's offices, fire departments, and hospitals.

Table 4.9.7-1
Public Services in the Affected Areas

County	Public Schools[a]	Police Departments and Sheriff's Offices	Fire Departments	Hospitals[b]	Hospital Beds
Cameron	156	11	13	8	1,314
Hidalgo	336	18	20	17	2,423
Willacy	14	2	7	0	0
Kenedy	1	1	4	1	0
Kleberg	15	2	2	1	96
Jim Wells	21	3	6	0	135
LNG Terminal Affected Area[c]	506	31	40	25	3,737
Pipeline Facilities Affected Area[d]	207	19	32	10	1,545

Sources: Texas Education Agency 2014, USA Cops 2015, Texas A&M Forest Service 2015, Texas Department of State Health Services 2015.

[a] Includes public charter schools.

[b] Only includes hospitals licensed with the Texas Department of State Health Services.

[c] Includes accommodations shown in this table for Willacy, Hidalgo, and Cameron Counties.

[d] Includes accommodations shown in this table for Jim Wells, Kleberg, Kenedy, Willacy, and Cameron Counties.

4.9.7.1 LNG Terminal

To understand potential impacts on schools, assumptions have been made based on anticipated workforce. RG LNG estimates that the maximum number of non-local hires during peak construction of the LNG Terminal is expected to be 3,658 workers. As discussed in section 4.9.1.1, should 70 percent of the non-local workers be accompanied by family members, and based on an average family size of 3.5 persons in Texas, up to 10,058 non-local persons could relocate to the affected area during the 7-year construction period. This would represent an increase of 0.8 percent in the population of the three-county affected area for the LNG Terminal.

Based on the average family size of 3.5 persons in Texas, we conservatively assumed that each of the 2,561 non-local families would bring two school-aged children to the LNG Terminal area of effect. RG LNG estimates the number of students at schools in the area of affect to be 330,102 students; the addition of up to 5,121 children during peak construction would increase the current student enrollment by 1.6 percent and change the student-to-teacher ratio from 15.7 to 15.9 students per teacher. If the peak non-local workforce with school-aged children all moved to Cameron County, they would increase the existing 103,416-person student body by 4.9 percent and change the student-to-teacher ratio from 15.4 to 16.1 students per teacher. This increase could result in a minor and temporary impact on public schools in the LNG Terminal area of effect, or a minor to moderate impact on public schools in Cameron County (if all children attended schools in Cameron County). However, these impacts could be mitigated, in part or whole, by using the increased tax revenues generated from construction of the Project to hire additional teachers during the construction period.

Construction of the LNG Terminal would have little or no short-term impact on the availability of public safety services such as police, fire, and medical because the non-local workforce would be small relative to the current population. If all non-local workers and family members moved to the three affected counties, they would represent about a 0.8 percent increase over the existing population during peak construction. Further, RG LNG would train a portion of the construction and operation workforces as emergency responders and provide access to first-aid kits. In addition, onsite security would be provided through a third-party contractor. Therefore, we conclude that impacts on public services during construction of the LNG Terminal would be temporary and minor.

In 2014, the LNG Terminal affected area had about 3,737 beds in licensed general and special hospitals. During peak construction, the non-local workers and family members could increase the ratio of residents to hospital beds from 341 to 343 residents per bed, a 0.6 percent increase. This temporary, minor increase would not have a significant adverse effect on the ability of the general and special hospitals to serve the population in the LNG Terminal affected area.

RG LNG anticipates that 108 non-local workers would be employed at the LNG Terminal during operation. This addition of 108 families would represent a negligible increase in the local population. Therefore, we conclude that local public services would not be affected during operations.

4.9.7.2 Pipeline Facilities

To understand potential impacts on local services, assumptions have been made based on anticipated workforce. RB Pipeline estimates that the maximum number of non-local hires during construction of Pipeline 1 would be 1,350 workers; Pipeline 2 would have a maximum of 1,080 non-local hires. As each pipeline would take about 12 months to complete with an 18-month gap between, it is unlikely that the non-local workers would be accompanied by family members. The addition of 1,350 non-local workers would represent a negligible increase in the population of the pipeline's affected area (0.3 percent); therefore, negligible impacts on public services (i.e., schools, police departments, fire departments, and hospitals) would also be negligible.

The 20 new permanent positions would represent a negligible increase in the local population. Therefore, we conclude that local public services would not be affected during operations.

4.9.8 Transportation

Several potential impacts on vehicular and marine traffic may result from the construction and operation of the Project. Potential impacts on vehicular traffic would generally be related to the influx of construction workers commuting to and from the LNG Terminal and pipeline facilities, as well as the transport of construction materials. Marine traffic impacts would result from the increase in large vessel movements in the BSC during construction and operation of the LNG Terminal.

4.9.8.1 Roadway Transportation

LNG Terminal

Access for transporting equipment, materials, and personnel to the LNG Terminal site would be available through the use of existing roadways. The approach to the LNG Terminal would be along SH-48, which is an asphalt, divided highway with two northbound lanes, two southbound lanes, and 4- to 8-foot shoulders. RG LNG would construct three driveways at the LNG Terminal site with a left turn lane on westbound SH-48 and temporary traffic signals at each driveway for direct vehicular access to SH-48.

Public comments expressed concern for increased traffic volume, especially during evacuations, and road degradation due to loss of tax revenue from tax abatement opportunities. Impacts on local taxes and government revenue are addressed in section 4.9.5. Impacts on local users of the roadway network due to construction of the LNG Terminal would include potential delays from increased worker traffic and reduced roadway capacity. To identify, quantify, and recommend mitigation for traffic impacts on area roadways during construction of the Project, RG Developers commissioned a *Traffic Impact Analysis* (Aldana Engineering and Traffic Design, LLC 2016). Traffic count data conducted in January indicated that about 12,000 vehicles travel along SH-48 between SH-550 and SH-100 every day. As January is considered the low season for local tourism, RG Developers also reviewed general travel trends from the peak tourism month (July) and determined that traffic counts are about 40 percent higher than that observed in January; therefore, about 17,000 vehicles per day are anticipated to travel along

SH-48 during the peak season (MS2 2016). RG LNG estimates that construction worker commutes would result in a maximum of 4,600 roundtrips (9,200 transits total) per day, based on a peak workforce of 5,225 construction workers; however, the number of roundtrips would be related to the number of workers over time, as depicted in figure 4.9.1-2. This estimate assumes that 10 percent of the workers would carpool to and from work, and 2 percent of workers would be absent on any given day.

In addition, material truck traffic would generate up to 150 roundtrips to the LNG Terminal per day. As the capacity of the roadway is 40,000 vehicles per day, and about 12,000 (winter season) to 17,000 (summer season) vehicles are estimated to travel on this roadway every day, the roadway has sufficient capacity available to accommodate the additional traffic generated for construction of the LNG Terminal. RG LNG proposed to minimize material truck traffic on SH-48 by constructing a temporary haul road to transport fill material from the Port Isabel dredge pile to the LNG Terminal site; however, we are exploring alternatives to this proposal (see section 3.4). Specifically, we have recommended that RG LNG assess the feasibility of using barges to transport fill material, or to consult with the local transit authorities regarding use of large trucks on the existing road system. If use of the existing road system is identified as the preferred alternative, an additional 124 roundtrips (247 transits) per day would occur for the first 27 months of construction.

The *Traffic Impact Analysis* revealed that improvements would be necessary to safely accommodate peak hour traffic flows at each of the three proposed driveways. Before peak construction, and in coordination with the TxDOT, RG LNG has agreed to implement the following measures recommended in the analysis:

- add an additional left-turn lane on westbound SH-48 at its intersections with SH-100 and at each LNG Terminal driveway;
- optimize traffic signal timing at the intersection of SH-48 and SH-100;
- provide an acceleration and deceleration lane at each LNG Terminal driveway intersection;
- provide temporary traffic signals at each LNG Terminal driveway;
- create median openings across from LNG Terminal driveway 1;
- create a temporary median opening on SH-48 across from any temporary offsite parking site, including the proposed Port of Brownsville temporary storage/parking area, and install a temporary traffic signal;
- schedule deliveries of construction materials to avoid the expected arrival and departure of the workforce; and
- stagger shifts to avoid all workers arriving and leaving at the same time, if congestion occurs at the LNG Terminal driveways.

In addition to the above mitigation measures recommended by the traffic analysis, RG LNG has committed to hiring off-duty police officers to direct traffic during peak commuting hours and installing roadway warning signs to notify travelers of construction activities. Additionally, RG LNG plans to provide onsiteparking for workers during peak construction months. When onsite parking becomes limited by the constructed LNG facilities, offsite parking would be provided at a 25-acre Port of Brownsville temporary storage area located on the south side of SH-48, where workers would be bused to and from the LNG Terminal site. With the implementation of the proposed measures, and considering that SH-48 would remain at about 65.9 percent capacity during peak tourist season with the addition of Project-related traffic, we have determined that impacts from construction of the LNG Terminal would have temporary and minor impacts on local users of the roadway network.

Operation of the LNG Terminal would result in an average of 300 roundtrips to the site per day associated with worker commutes and truck deliveries. The traffic impact analysis determined SH-48 would continue to provide ample capacity with this increase in traffic (Aldana Engineering and Traffic Design, LLC 2016). We have determined that operation of the Rio Grande LNG Terminal would have permanent but negligible impacts on roadway transportation. As discussed in section 4.12, RG Developers would have ERPs with the appropriate entities, which would identify emergency response routes.

Pipeline Facilities

The pipeline right-of-way is primarily routed through undeveloped land. Construction of the pipeline facilities may temporarily affect roadway traffic due to increased vehicle traffic associated with construction workforce commutes and the delivery of equipment and materials to the construction work area. Construction of the pipeline facilities is not expected to impact marine transportation. Construction-related traffic on area roads would be highest during the first year of the 4-year construction period, with an estimated 1,950 roundtrips per day. During the subsequent years, RB Pipeline estimates a maximum of 1,356 roundtrips per day, which would occur during Stage 4 with the construction of Pipeline 2.

To minimize impacts on traffic, RB Pipeline would provide adequate parking for workers to ensure that parking on the shoulders of major roads is avoided and install warning signs on roadways to notify travelers of construction activities. If traffic congestion occurs during construction, RB Pipeline would consider implementing additional measures, including, but not limited to, scheduling truck deliveries between peak commuting times, re-routing truck traffic to avoid busy roadways, and implementing temporary traffic signals. Results of the *Traffic Impact Analysis* found that each roadway assessed was operating at a Level-of-Service (LOS) B or better. Avoidance of the segment of farm to market road (FM) 106 in Cameron County that crosses the Arroyo River was recommended to avoid potential deterioration to a LOS D (Aldana Engineering and Traffic Design, LLC 2016). RB Pipeline has stated that it would use FM 106 to access the Project area; however, it would monitor use of all roadways evaluated in the *Traffic Impact Analysis,* including FM 106.

RG Developers are consulting with TxDOT on appropriate monitoring procedures to ensure these roadways do not fall below a LOS C. Since RG Developers have not identified specific protocols for determining when traffic congestion would warrant additional measures or how a change in LOS would be monitored, **we recommend that**:

- **Prior to the end of the draft EIS comment period, RG Developers should file with the Secretary traffic mitigation procedures, developed in consultation with applicable transportation authorities, to monitor LOS on roadways proposed for use during construction of the Project. These procedures should describe mitigation measures that would be implemented for a resultant LOS of C or below, including alternative routes if necessary.**

Any section of road damaged by Pipeline System construction would be repaired to pre-construction conditions or better after construction, unless otherwise agreed upon by the landowner and approved by the FERC. Given that the total number of workers would be spread out along the 137.9-mile-long Pipeline System, and the mitigation that would be implemented should traffic congestion occur, including our recommendation to develop traffic mitigation procedures, we find that construction of the pipeline facilities would result in minor and temporary impacts on local traffic. RB Pipeline anticipates that 20 workers would be hired for operation of the three compressor stations. The pipelines and metering sites would be unmanned during operation, with and only occasional site visits by operations personnel for maintenance. Given the low number of operational personnel for the pipeline facilities, impacts on traffic or roadways resulting from operation of the pipeline facilities would be negligible.

4.9.8.2 Marine Transportation

LNG Terminal

RG LNG would primarily use truck transport to deliver construction materials to the LNG Terminal site, with marine barge transportation serving in a supplementary role. Vessel traffic in the BSC averaged about 1,057 vessels per year between 2012 and 2014, which equates to about 88 vessels per month, including 61 barges (BND 2015). Over the 7-year construction period for the LNG Terminal, RG LNG anticipates about 880 barge deliveries for the LNG Terminal site. Some equipment would be transported a short distance from the Port of Brownsville or Port Isabel, while other equipment would be transported directly from the vendor. Marine deliveries would be highest during the first 5 years of construction, where deliveries would be expected 15 times per month. Although these additional trips would represent an increase of about 25 percent in current barge traffic, they would not result in significant impacts on the channel, as the barges would not block small vessel traffic, the pilots and the Brownsville Harbor Master would manage commercial vessel traffic, and the additional vessels would not result in an exceedance of the channel's traffic capacity. In addition to increased vessel traffic during construction, dredging for the marine facilities would temporarily reduce the area of the BSC available for vessel transit. RG LNG would restrict vessels from passing over areas of active dredging, and would coordinate with local authorities so that dredging activity would not restrict large vessels from transiting the BSC. Because dredging would be limited to Stage 1 of construction, impacts would be temporary and minor.

The BSC currently experiences about six large vessels per week (i.e., about two transits per day) calling at the Port of Brownsville, including cargo vessels, tankers, and ocean barges. During operations, about 312 LNG carriers would call on the LNG Terminal per year (about 6 per week). With the addition of six LNG carriers calling at the LNG Terminal per week (about two transits per day), existing large vessel traffic levels would double; however, the channel would still function at about one-third of its theoretical capacity for large vessel traffic (about 12 large vessel transits daily, assuming a 2-hour transit time). Based on RG LNG's anticipated number of port calls and its navigation simulation study, RG LNG determined that LNG carriers calling at the LNG Terminal would be transiting in the BSC for a combined duration of 30 hours per week (about 18 percent of the week). According to the Port of Brownsville Harbor Master, all large vessel traffic is one-way except for the occasional barge passing with pilot approval; therefore, a one-direction regime would be in place during LNG carrier transits.

In a letter dated December 26, 2017, the Coast Guard issued the LOR for the Project, which stated that the BSC is considered suitable for LNG marine traffic in accordance with the guidance in the Coast Guard's NVIC 01-2011. The WSA review focused on the navigation safety and maritime security aspects of LNG carrier transits along the BSC. The WSA itself is designated Sensitive Security Information as defined in 49 CFR 1520. Because any unauthorized disclosure of these details could be employed to circumvent the proposed security measures, they are not releasable to the public.

In accordance with 33 CFR 165.30, the Coast Guard has the authority to establish moving security zones for LNG carriers during. LNG carriers would reach the LNG Terminal using existing shipping channels, with the exception of the recessed turning basin at the Rio Grande LNG Terminal itself. Inbound LNG carriers would be piloted by a local pilot affiliated with the Brazos-Santiago Pilots Association; the pilot boarding station is at the Entrance Channel at BSC markers 2 and 3. To minimize impacts on other users of the BSC, it is anticipated that LNG carriers would follow required mandates put forth in the LNG Terminal Manual, including the requirement to notify LNG Terminal managers and relevant authorities of the expected arrival of an LNG carrier four days in advance to ensure that the timing of LNG carrier channel transits are aligned with other shipping schedules.

Based on the Coast Guard's LOR for the Project, the expected doubling in large vessel traffic, and the potential to preclude vessel traffic 30 hours per week, we have determined that operation of the LNG Terminal would result in a permanent and moderate increase in marine traffic within the BSC based on current conditions.

Additional detail on potential impacts on boating and fishing in the vicinity of the LNG Terminal site is provided in section 4.9.3 and 4.9.4. Additional discussion of marine traffic and transportation as it relates to marine safety, including potential cryogenic/thermal impacts along the LNG carrier transit route, is provided in section 4.12.

Pipeline Facilities

As the proposed pipelines would cross marine waterways via HDD, no impacts on marine transportation would result from construction or operation of the pipeline facilities.

4.9.9 Property Values

Potential impacts on the value of a tract of land depends on many factors, including size, the value of adjacent properties, the presence of other industrial facilities or pipelines, the current value of the land, and the extent of development and other aspects of current land use. A potential purchaser would make an offer to purchase based on his or her own values, which may or may not take the presence of the LNG Terminal or pipeline facilities into account.

4.9.9.1 LNG Terminal

The proposed location of the LNG Terminal site is just outside the city limits of Brownsville and Port Isabel on land owned by the BND that is zoned for commercial and industrial use. The nearest residences are about 2.2 miles away in Port Isabel. A literature study that compiled 25 previous investigations of industrial developments' effects on property values found that adverse impacts on property values decreased steadily with distance from the industrial development (Farber 1998). A few of the investigations in the study predicted adverse effects on property values beyond 2 miles of the industrial development, and the study concluded that housing markets are sensitive to real or perceived hazard risks from industrial development (Farber 1998). As discussed in section 4.12, the LNG Terminal would be subject to regulations that strictly control all aspects of the development's construction and operation, with risks largely confined within the LNG Terminal site property boundaries.

Visibility of the LNG Terminal site, which would include four 175-foot-high LNG storage tanks, could potentially affect values of residential properties. As discussed in section 4.8.2, it would be possible to see the LNG Terminal from some vantage points in Port Isabel and Laguna Heights, in particular at elevated sites such as the Port Isabel Lighthouse; however, the distance to the LNG Terminal site limits its visibility and as such it would not be a prominent feature in the viewshed for these residences.In summary, visibility impacts and the public's perception of risk of the LNG Terminal are factors that could affect residential property values in the Project area. These potential impacts would be attenuated by the distance of more than 2 miles between residential areas and the LNG Terminal site.

4.9.9.2 Pipeline Facilities

The pipeline facilities would be located primarily on agricultural land and open land. As shown in table 4.8.1-2, 11 structures would be within 50 feet of the construction work area; however, only two of those structures are residential, each of which would be within 50 feet of existing access roads that are proposed for use without modification. The pipeline facilities include the Header System, Pipelines 1 and 2, and associated aboveground facilities, three compressor stations, two booster stations, eight metering sites, and additional appurtenant facilities. Impacts from Compressor Station 3 are discussed above, as it would be within the boundaries of the LNG Terminal site. The remaining aboveground facilities would be constructed on open land, agricultural land, and barren land.

RB Pipeline would compensate the landowners for new easements at the aboveground facilities, as well as the temporary loss of land use associated with construction workspaces and any damages. The easement acquisition process is designed to provide fair compensation to the landowner for the right to use the property for facility construction and operation. Although not anticipated due to the rural and sparsely-populated land in the vicinity of the Pipeline System, affected landowners who believe that their property values have been negatively affected could appeal to the local tax agency for reappraisal and potential reduction of taxes. The pipeline facilities are not expected to adversely impact property values outside of the pipeline right-of-way or aboveground facility boundaries.

Property values are generally based on the actual use of the land. Construction and operation of the Pipeline System would not change the general use of the land, but would preclude the construction of aboveground structures within the permanent easements. Because the Pipeline System would be located primarily within agricultural land, we have concluded that use of the land, and the associated property value, would likely not be negatively affected by the Pipeline System.

4.9.10 Environmental Justice

For projects with major aboveground facilities, FERC regulations (18 CFR 380.12(g)(1)) direct us to consider the impacts on human health or the environment of the local populations, including impacts that would be disproportionately high and adverse for minority and low-income populations. Additionally, during Project scoping, we received comments raising concerns about the impacts of the Rio Grande LNG Project on minority and low-income populations.

The EPA's Environmental Justice Policies (which are directed, in part, by Executive Order 12898: *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations*) focus on enhancing opportunities for residents to participate in decision making. The EPA (2011) states that Environmental Justice involves meaningful involvement so that: "(1) potentially affected community residents have an appropriate opportunity to participate in decisions about a proposed activity that would affect their environment and/or health; (2) the public's contributions can influence the regulatory agency's decision; (3) the concerns of all participants involved would be considered in the decision-making process; and (4) the decision-makers seek out and facilitate the involvement of those potentially affected." CEQ also has called on federal agencies to actively scrutinize a number of important issues with respect to environmental justice (CEQ 1997a).

As part of our NEPA review, we have evaluated potential environmental justice impacts related to the Rio Grande LNG Project taking into account the following:

- the racial and economic composition of affected communities;
- health-related issues that may amplify effects to minority or low-income individuals; and
- public participation strategies, including community or tribal participation in the NEPA process (CEQ 1997a).

The EPA provides guidance on determining whether there is a minority or low-income community to be addressed in a NEPA analysis. According to this guidance, minority population issues must be addressed when they comprise over 50 percent of an affected area or when the minority population percentage of the affected area is substantially greater than the minority percentage in the larger area of the general population. According to USC 689(3), low-income populations are defined as a geographic area represented by a census tract or equivalent county division where the poverty rate is 20 percent or greater, among other indicators.

In accordance with these guidelines, we prepared an environmental justice analysis for the Project. Public scoping comments expressed concern for impacts on low-income and minority populations. To develop a more accurate understanding of the racial and ethnic characteristics of the communities in the immediate vicinity of the LNG Terminal site and pipeline facilities, data were used from census block groups that intersect a 2-mile radius around the LNG Terminal site and the pipeline facilities, as opposed to the larger geographic areas included in census tract and county level data. In this analysis, the minority and low-income population percentages in the State of Texas and the Project-area counties were compared to the respective percentages within the census blocks groups. Table 4.9.10-1 identifies the racial composition and economic status of the affected block groups, counties, and the State of Texas for the LNG Terminal and pipeline facilities.

4.9.10.1 LNG Terminal

Three of the four block groups near the LNG Terminal site have minority populations greater than the general EPA guideline of 50 percent, comprised predominately of Hispanic or Latino people. Additionally, all four block groups have poverty rates that exceed 20 percent, indicating that these are low-income communities. According to the EPA guidelines stated above, these are environmental justice populations.

The FERC and RG Developers have made documents and notices about the Project available to the public, and FERC held public scoping meetings, as described in section 1.3, where materials were provided in both English and Spanish to accommodate the local Hispanic or Latino population. In addition, during the public scoping meeting in Port Isabel, both English and Spanish-speakers were present to converse one-on-one with stakeholders in attendance. Further, RG Developers made Project information available to the public via an internet website (www.riograndelng.com), phone hotline, and via community and stakeholder meetings in the Project area. RG Developers used the FERC's Pre-filing Process (see section 1.3). One of the major goals of this process is to increase public awareness and encourage public input regarding every aspect of a project (e.g., design, siting, routing, environmental concerns and impacts) before an application is filed. As part of this process, FERC staff participated in RG Developers' open houses and hosted FERC scoping sessions to receive input from the public about the Project. Interested parties have had, and will continue to be given, opportunities to participate in the NEPA review process. To date, this included the opportunity to participate in the public scoping meetings within the Project area to identify concerns and issues that should be covered in the EIS, and the opportunity to submit written comments about the Project to the FERC. Stakeholders will also have the opportunity to review this draft EIS and provide comments directly to the FERC staff in person (during scheduled comment sessions) or in writing via mail or internet.

Table 4.9.10-1
Demographics and Economic Statistics in the Vicinity of the Rio Grande LNG Project

State/County/ Block Group/ Tract	White, not Hispanic or Latino	African-American	Hispanic or Latino	Asian	American Indian and Alaskan Native	Native Hawaiian and Pacific Islander	Two or More Races	Population Below Poverty (%)
TEXAS	43.8	11.6	38.4	4.2	0.2	0.1	1.5	13.4
LNG TERMINAL								
Cameron	11.5	0.4	88.5	0.6	0.4	0.0	0.2	29.6
Block Group 1								
Tract 123.05	74.6	0.0	25.4	0.0	0.0	0.0	0.0	26.7
Tract 142[a]	1.0	0.0	99.0	0.0	0.0	0.0	0.0	37.5
Block Group 2								
Tract 123.04[b]	30.3	0.0	66.0	0.0	0.0	0.0	0.0	22.1
Tract 127[a]	23.1	0.0	76.9	0.0	0.0	0.0	0.0	15.6
PIPELINE FACILITIES								
Cameron	11.5	0.4	88.5	0.6	0.4	0.0	0.2	29.6
Block Group 1								
Tract 101	17.0	0.0	82.5	0.0	0.5	0.0	0.0	20.0
Tract 102.01	13.1	0.0	86.9	0.0	0.0	0.0	0.0	26.7
Tract 122	16.2	0.0	83.7	0.0	0.0	0.0	0.1	16.8
Tract 123.01	37.4	1.7	54.1	4.6	0.0	0.0	0.6	23.9
Tract 142	1.0	0.0	99.0	0.0	0.0	0.0	0.0	37.5
Block Group 2								
Tract 127	23.1	0.0	76.9	0.0	0.0	0.0	0.0	15.6
Tract 142	21.1	0.7	78.2	0.0	0.0	0.0	0.0	39.2
Block Group 3								
Tract 101	4.6	0.0	95.4	0.0	0.0	0.0	0.0	47.6
Block Group 4								
Tract 101	68.5	0.0	29.9	0.0	0.0	0.0	1.6	16.8
Tract 122	11.4	0.0	88.5	0.0	0.2	0.0	0.0	35.5
Block Group 5								
Tract 122	2.2	0.8	94.7	1.1	0.0	0.0	1.3	41.0
Willacy	10.4	1.6	87.5	0.1	0.0	0.0	0.4	36.3
Block Group 1								
Tract 9506	17.0	0.0	82.0	0.0	0.9	0.0	0.0	35.4
Tract 9507	10.4	0.0	83.6	0.0	0.0	0.0	6.1	9.6
Block Group 2								
Tract 9505	10.5	0.0	89.5	0.0	0.0	0.0	0.0	18.3
Tract 9507	11.7	0.0	87.6	0.0	0.1	0.2	0.0	26.4
Kenedy	33.6	0.0	66.2	0.2	0.0	0.0	0.0	20.0
Block Group 1								
Tract 9501	33.6	0.0	66.2	0.2	0.0	0.0	0.0	20.0

Table 4.9.10-1 (continued) Demographics and Economic Statistics in the Vicinity of the Rio Grande LNG Project								
State/County/ Block Group/ Tract	**White, not Hispanic or Latino**	**African-American**	**Hispanic or Latino**	**Asian**	**American Indian and Alaskan Native**	**Native Hawaiian and Pacific Islander**	**Two or More Races**	**Population Below Poverty (%)**
Kleberg	21.9	3.9	71.3	2.0	0.1	0.0	0.6	19.7
Block Group 1								
Tract 201	39.5	0.0	58.2	1.1	0.0	0.0	0.3	4.2
Block Group 2								
Tract 201	26.4	2.1	70.2	1.3	0.0	0.0	0.0	10.6
Jim Wells	19.0	0.5	79.5	0.4	0.1	0.1	0.4	18.0
Block Group 1								
Tract 9504	11.7	2.5	85.9	0.0	0.0	0.0	0.0	5.2
Block Group 3								
Tract 9502	35.9	0.0	63.3	0.8	0.0	0.0	0.0	10.0
Block Group 4								
Tract 9507	25.8	0.0	74.2	0.0	0.0	0.0	0.0	5.3

Sources: Sources: U.S. Census Bureau 2015e, 2015f, 2015g, EPA 2016c.

[a] The block group is within 1 mile of the LNG Terminal site and pipeline facilities.

[b] About 3.7 percent reported their race as "Some other race alone."

Contractors working on the Project would be required to comply with applicable equal opportunity and non-discrimination laws and policies. The criteria for all positions would be based upon qualifications and in accordance with applicable, federal, state, and local employment laws and policies. The impacts of constructing and operating the LNG Terminal on the natural and human environments are identified and discussed throughout section 4.0 of this document. The nearest residential areas are about 2.2 miles from the proposed LNG Terminal site. Potential pollution emissions from the LNG Terminal site, when considered with background concentrations, would be below the National Ambient Air Quality Standards (NAAQS), which are designated to protect public health. Therefore, the Project would not have significant adverse air quality impacts on the low-income or minority populations in the Project area. Air quality impacts are discussed in more detail within section 4.11.1.

Area residents may be impacted by traffic delays during construction on SH-48. However, as shown in the traffic analysis (see section 4.9.8), impacts would be minor and short-term, and RG LNG has committed to implementing mitigation measures to alleviate any potential road congestion during peak construction months (see section 4.9.8). Another potential impact to area residents pertains to subsistence fishing that could occur along the BSC. About 1.5 miles of the 17-mile-long shoreline of the channel would be developed for the LNG Terminal site. However, fishing opportunities would still exist along the remainder of the undeveloped channel shoreline, as well as in nearby public areas, including the Zapata boat launch and pier over San Martin Lake and the south end of Bahia Grande. Also, as discussed above RG Developers, in coordination with relevant agencies, are exploring the potential to provide a parking and fishing area on the western bank of the Bahia Grande Channel to compensate for the lost fishing area near the LNG Terminal.

If all of the peak non-local construction workers and their families including school-aged children, temporarily relocated to Cameron County, this would result in an increase to the existing student enrollment by 4.9 percent and would change the student-to-teacher ratio from 15.4 to 16.1 students per teacher. This increase could result in a minor, temporary impact on public schools in the LNG Terminal affected area, and a minor to moderate impact on public schools in Cameron County. However, these impacts could be mitigated, in part or whole, by using the increased tax revenues generated from construction of the Project to hire additional teachers during the construction period.

The LNG Terminal site was chosen to be at least 1.5 miles from populated areas. Furthermore, the LNG Terminal is expected to generate economic benefits to local residences by stimulating economic growth and employment (see section 4.9.2.1) and by increasing the local tax base (see section 4.9.5), which may in turn benefit public services. There would be minor and temporary traffic delays and potential impacts on public schools during construction, but these impacts would apply to everyone and not be focused on or targeted to any particular demographic group. We conclude that the LNG Terminal would not have disproportionate adverse effects on minority and low-income residents in the area.

4.9.10.2 Pipeline Facilities

Similar to the block groups surrounding the LNG Terminal site, all block groups and counties near the pipeline facilities, with the exception of two block groups (block group 1, tract 123.05 and block group 4, tract 101) in Cameron County, have predominantly Hispanic or Latino minority populations greater than the general EPA guideline of 50 percent. Also, the majority of the block groups have poverty rates higher than 20 percent, indicating that they are low-income communities. All five counties in the study area have higher poverty rates than the State of Texas overall.

The entire Header System and the majority of the Pipeline System are routed through agricultural land or grassland with few residences, and no existing residences are located closer than 50 feet from the pipeline right-of-way. As described above, FERC and RG Developers have made documents and notices about the Project available to the public. The impacts of constructing and operating the pipeline facilities on the natural and human environments are identified and discussed throughout section 4 of this document. Aside from temporary, minor traffic delays during peak construction times, the pipeline facilities are not expected to have disproportionate, adverse effects on minority and low-income residents in the area. Overall, construction of the Rio Grande LNG Project would result in temporary, minor to moderate impacts on socioeconomic factors. Although the increase in construction activities and workers would result in an overall increase in road-way traffic, and possibly school-aged children, in the area surrounding the LNG Terminal, these increases would be within planned and sustainable levels of usage on roads and local schools. Similarly, operation of the Project would result in mostly minor, but permanent, impacts on socioeconomic factors. However, the introduction of increased tax revenues from the Project would result in monetary benefits for the affected counties. As the number of non-local workers and family members would decrease as operation of the LNG Terminal progresses, any increase in usage of local services that may have resulted from the presence of the construction workforce would return to near pre-construction levels.

4.10 CULTURAL RESOURCES

Section 106 of the NHPA requires the FERC to take into account the effects of its undertakings on properties listed, or eligible for listing, on the NRHP, and to afford the ACHP an opportunity to comment. RG Developers, as non-federal parties, are assisting the 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). Section 800.10 of 36 CFR 800 provides special requirements for protecting National Historic Landmarks.

Construction and operation of the Rio Grande LNG Project could have the potential to affect historic properties (i.e., cultural resources listed, or eligible for listing, on the NRHP). Cultural resources include archaeological sites, districts, buildings, structures, and objects that are at least 50 years old, as well as locations with traditional value to Native Americans or other groups. Historic properties are cultural resources that possess one or more criteria specified in 36 CFR 60.4, and generally must possess integrity of location, design, setting, workmanship, feeling, and association.

4.10.1 Cultural Resources Surveys

4.10.1.1 LNG Terminal Site

RG LNG completed archaeological surveys of a 1,000-acre parcel for the LNG Terminal site, including the natural landforms (lomas) that are considered to have a high potential for containing archaeological sites, the locations of proposed geotechnical bore holes, and the locations of previously recorded archaeological sites. The survey included surface inspection and the excavation of 144 shovel test units. Many areas within the LNG Terminal site are comprised of dredged materials that were deposited during the channelization of the BSC; these areas possess little to no potential for containing cultural resources and were therefore not subject to shovel testing. The study area for indirect effects was defined as a 0.5-mile buffer around above-ground proposed structures, extended to a distance of up to 12 miles depending on topography and vegetation. The resulting report (Stotts and Carpenter, June 1, 2015) was provided to the FERC and the Texas SHPO. On March 30, 2016, the SHPO indicated a submerged survey was not necessary for the Project.

No new cultural resources were identified within the surveyed 1,000-acre area. Three previously recorded archaeological sites (41CF8, 41CF135, and 41CF191) were revisited during surveys. Site 41CF8 had previously been listed on the NRHP; however, no intact deposits were identified in the Project area, and therefore this portion of the site was recommended as non-contributing to NRHP eligibility. Sites 41CF135 and 41CF191 had no previous NRHP eligibility recommendations. No cultural materials were encountered at the locations of either site, and both sites were recommended as not eligible for the NRHP. RG LNG recommended no further work within the surveyed area. In a May 15, 2015 letter, the SHPO concurred with the survey results. We also concur.

Research identified no known architectural resources located within 0.5 mile of the LNG Terminal facility; however, two National Historic Landmarks are within or near the extended 12-mile study area. The Palmito Ranch Battlefield is approximately 4.1 miles from the LNG

Terminal site boundary (about 5.4 miles from the LNG Terminal site center). The Palo Alto Battlefield is approximately 12 miles from the boundary of the LNG Terminal site (about 14 miles from the LNG Terminal site center). RG Developers conducted viewshed and noise impacts assessments for these two National Historic Landmarks. RG Developers concluded that due to distance and topography, visual impacts to the battlefields would be moderate and minor, respectively, and noise impacts from construction and operation would not be audible. See sections 4.8.2 and 4.11.1 for further discussion of the viewshed and noise, respectively. On March 19, 2018, the SHPO commented that visibility of the Project from identified historic resources in the area is limited, and that proposed lighting design should help limit the Project impact on the Palmito Ranch Battlefield. No comments have yet been received from the NPS on the assessments.

Subsequently, RG Developers completed supplemental surveys of 4.5 miles of the non-jurisdictional Brownsville Navigation District Utility Corridor, 2.9 miles of SH-48 turning lanes, the two offsite storage/parking areas, and the 1.3-mile-long section of the proposed 1.8-mile-long temporary haul road that extends outside the LNG Terminal site. The resulting addendum report (Neilson, August 17, 2016) was provided to the FERC and SHPO. No new archaeological sites or architectural resources were identified. Two previously recorded archaeological sites (41CF99 and 41CF159) were revisited. No evidence of the sites was identified; therefore, the sites were recommended as not eligible for the NRHP in the Project area. No survey of the Port Isabel dredge pile was recommended due to its disturbed nature. In a December 1, 2016 letter, the SHPO concurred with these recommendations, and indicated no further work was required. We concur with the SHPO.

4.10.1.2 Pipeline Facilities

RB Pipeline conducted archaeological resources surveys for a 200-foot-wide corridor for the pipelines, a 100-foot-wide corridor for access roads, as well as ATWS, aboveground and temporary facilities, and off-site facilities. The survey included surface inspection and the excavation of 1,778 shovel test units. The study area for architectural resources included the area located within 0.5 mile of proposed aboveground facilities. Surveys conducted through 2016 cover about 56 percent of the current pipeline facilities (including the pipeline route, access roads, aboveground facilities, and contractor/pipe yards). Surveys for the remaining areas will be conducted once access is available; this includes approximately 30 miles of the Project which crosses the King Ranch National Historic Landmark. Further, some ATWS, aboveground and temporary facilities, and access roads remain to be surveyed. The resulting report (Nielsen et al., June 29, 2016) was provided to the FERC and SHPO.

As a result of the surveys, 15 cultural resources were identified. These included one newly recorded archaeological site (41WY152), a newly recorded historic railroad bed (41CF224), three previously recorded archaeological sites (41KN1, 41WY2, and 41WY73), one historic ranch (Armstrong Ranch), one historic architectural resource (Bell Airfield), three historic drainage districts (Cameron County Drainage Districts 1, 3, and 4), three historic irrigation districts (Cameron County Irrigation Districts 2 and 6, and Bayview 11), one historic water improvement district (Cameron County Water Improvement District 10), and one historic drainage system (Rio Grande Floodway). In addition, one previously recorded archaeological site (41CF195) could not be inspected due to denied access.

Sites 41CF224, 41WY152, and the Bell Airfield were recommended as not eligible for the NRHP. No cultural materials were encountered at the locations of previously recorded sites 41WY2, 41WY73, and 41KN1; therefore, these sites were recommended as not eligible for the NRHP. Further assessment of site 41CF195 was recommended as access becomes available. The Armstrong Ranch has been previously determined eligible for the NRHP, and avoidance of any contributing components was recommended. RG Developers indicated that as currently designed, the Project would not impact any contributing portions. Cameron County Irrigation Districts 2 and 6 have been previously determined eligible for the NRHP. The remaining irrigation resources have not been fully evaluated and remain undetermined for NRHP eligibility. Avoidance of any contributing components was recommended. RB Pipeline indicated it was evaluating avoidance of the larger historic waterways by HDD, but design details had not yet been finalized. On September 6, 2016, the SHPO concurred with the recommendations in the report. RB Pipeline has since modified its Project to include HDD crossings of drainage canals, where practicable.

In addition, the Port of Brownsville and BSC was identified as a potential historic district that has been unevaluated, but upon recommendation of the SHPO, is treated as eligible for the NRHP. The Project parallels the shipping channel, but does not impact the channel. RG Developers provided information regarding the channel to the SHPO on August 16, 2017. RG Developers have not yet filed the SHPO's comments on the information.

Subsequently, RB Pipeline completed supplemental surveys of 6.7 miles of pipeline corridor; Contractor/Pipe Yard 2; a booster station; and 35.2 miles of access roads. The resulting addendum report (Carter, September 12, 2016) was provided to the FERC and SHPO. No new archaeological sites were identified. Two previously recorded archaeological sites (41CF195 and 41WY74) were revisited. No evidence of the sites was identified; therefore, the sites were recommended as not eligible for the NRHP in the Project area. One previously recorded architectural resource (Armstrong Ranch, noted above), and one new resource (an isolated, weathered iron cross) were identified. Components of the Armstrong Ranch identified during the survey consist of a corral complex within the boundaries of a contractor yard. The iron cross could possibly indicate a burial or memorial marker. Avoidance was recommended for both resources. In a November 30, 2016 letter, the SHPO concurred with these recommendations. RB Pipeline indicated it would avoid the corral complex and install signage to clearly mark the contractor yard, and maintain a 75-foot buffer to protect the iron cross. Since surveys were completed, RB Pipeline re-located proposed Compressor Station 2; survey results for the currently proposed location will be provided when available.

4.10.2 Unanticipated Discovery Plan

RG Developers provided a plan addressing the unanticipated discovery of cultural resources or human remains during construction to the FERC and SHPO. We and the SHPO requested revisions to the plan. RG Developers submitted a revised plan which we find acceptable. The SHPO concurred with the plan on November 10, 2016.

4.10.3 Native American Consultation

Between March 2015 and February 2016, RG Developers submitted requests for Native American tribal consultations to the following seven federally recognized Native American tribes, and also conducted letter and email follow-ups: the Alabama-Coushatta Tribe of Texas; the Comanche Nation of Oklahoma; the Tonkawa Tribe of Oklahoma; the Kickapoo Tribe of Oklahoma; the Kickapoo Traditional Tribe of Texas; the Apache Tribe of Oklahoma; and the Fort Sill Apache Tribe of Oklahoma. Additionally, two state-recognized tribes, the Lipan Apache Tribe of Texas and the Tap Pilam Coahuiltecan Nation, were also contacted in 2015.

Four of the tribes contacted responded. On April 2, 2015, the Comanche Nation of Oklahoma inquired whether the state site files had been reviewed. RG Developers provided the tribe with the results of the site files review. On July 21, 2015, the tribe was also furnished with a copy of the final survey report for the LNG Terminal. On July 22, 2015, the Comanche Nation of Oklahoma indicated that the Project would have “no effect.” On April 15, 2015, the Tonkawa Tribe of Texas indicated there were no designated historical or cultural sites identified in the Project area, but requested notification should construction activities identify unanticipated cultural or human remains; RG Developers confirmed consultations would continue, as requested.

On July 9, 2015, the Lipan Apache Tribe of Texas indicated it had no sacred sites in the Project area that it knew of, but requested to be contacted in the event that human remains are discovered during construction activities. On October 22, 2016, the Alabama-Coushatta Tribe of Texas indicated that “no known impacts to cultural assets of the Alabama-Coushatta Tribe of Texas are anticipated” from the Project. No other responses have been received.

We sent our NOI and follow-up letters to the same seven federally recognized tribes. No responses to our NOI or letters have been received.

4.10.4 Other Parties Contacted

RG Developers also contacted and followed-up with historical commissions and local museums to determine the potential presence of cultural resources or areas of historical significance. Groups contacted included the Brownsville Historical Association; Cameron County Historical Commission; Jim Wells County Historical Commission; John E. Conner Museum; Kenedy Ranch Museum; King Ranch Museum; King Ranch Corporate Office; Kleberg County Historical Commission; Port Isabel Historical Museum; Preservation Texas; Southern Texas Archaeological Association; Texas Historical Foundation; and Willacy County Historical Museum. The John E. Conner Museum responded and provided additional contact information. The Texas Historical Foundation indicated it did not comment on Section 106 compliance review. The Kleberg County Historical Commission indicated it did not know of any historical sites along the pipeline route in Kleberg County. No other responses have been received and no areas of concern were expressed as a result of these contacts.

4.10.5 Compliance with the National Historic Preservation Act

RG Developers have not yet completed cultural resources surveys for the Project. Once cultural resources surveys are complete, if any historic properties would be adversely affected by the Project, a treatment plan would be prepared. To ensure that cultural resources studies and consultation are completed and the FERC's responsibilities under Section 106 of the NHPA are met, **we recommend that:**

- **RG Developers should not begin construction of facilities or use of staging, storage, or temporary work areas and new or to-be-improved access roads until:**

  a. RG Developers file with the Secretary:

  i. outstanding SHPO comments on reports, plans, special studies, or information provided to date, as well as any NPS comments, as applicable;

  ii. any outstanding updates, reports, plans, or special studies, and the SHPO's comments on these, as well as any NPS comments, as applicable; and

  iii. any necessary treatment plans or site-specific avoidance/ protection plans, and the SHPO's comments on the plans.

  b. The ACHP is afforded an opportunity to comment if historic properties would be adversely affected; and

  c. The FERC staff reviews and the Director of OEP approves all cultural resources survey reports and plans, and notifies RG Developers in writing that construction may proceed.

  All material 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: "<u>CUI/PRIV – DO NOT RELEASE</u>."

4.11 AIR QUALITY AND NOISE

4.11.1 Air Quality

Construction and operation of the proposed Project would result in impacts on local and regional air quality. Public scoping comments expressed concern regarding impacts on air quality due to construction and operation emissions associated with the Project. This section summarizes federal and state air quality regulations that are applicable to the proposed facilities. The section also characterizes the existing air quality and describes potential impacts the facilities may have on air quality regionally and locally.The term *air quality* refers to relative concentrations of pollutants in the ambient air. The subsections below describe well-established concepts that are applied to characterize air quality and to determine the significance of increases in air pollution.

This includes metrics for specific air pollutants known as criteria pollutants; Ambient Air Quality Standards (AAQS), regional designations to manage air quality known as Air Quality Control Regions (AQCR); and efforts to monitor ambient air concentrations. Combustion of natural gas would produce criteria air pollutants such as ozone, carbon monoxide (CO), sulfur dioxide (SO_2), and inhalable particulate matter (PM [$PM_{2.5}$ and PM_{10}]). $PM_{2.5}$ includes particles with an aerodynamic diameter less than or equal to 2.5 micrometers, and PM_{10} includes particles with an aerodynamic diameter less than or equal to 10 micrometers. Combustion of fossil fuels also produces volatile organic compounds (VOC), a large group of organic chemicals that have a high vapor pressure at room temperature; and oxides of nitrogen (NO_x). VOCs react with nitrogen oxides, typically on warm summer days, to form ozone. Other byproducts of combustion are greenhouse gases (GHG) and hazardous air pollutants (HAP). HAPs are chemicals known to cause cancer and other serious health impacts.

GHGs produced by fossil-fuel combustion are CO_2, methane (CH_4), and nitrous oxide (N_2O). The status of GHGs as a pollutant is not related to toxicity. GHGs are non-toxic and non-hazardous at normal ambient concentrations. GHG emissions due to human activity are the primary cause of increased levels of all GHG since the industrial age. These elevated levels of GHGs are the primary cause of warming of the global climate system since the 1950s. These existing and future emissions of GHGs, unless significantly curtailed, will cause further warming and changes to the local, regional, and global climate systems. Emissions of GHGs are typically expressed in terms of CO_2 equivalents (CO_2e).

Other pollutants, not produced by combustion, are fugitive dust and fugitive emissions. Fugitive dust is a mix of $PM_{2.5}$, PM_{10}, and larger particles thrown up by vehicles, earth movement, or wind erosion. Fugitive emissions, in the context of this EIS, would be fugitive emissions of methane from operational pipelines and aboveground facilities.

4.11.1.1 Regional Climate

The Project area climate – humid subtropical – is significantly influenced by its location in the Texas Coastal Zone (i.e., proximity to the Gulf of Mexico). In general, the Port Isabel area has very short, mild winters and long, hot summers, although the sea breeze can help moderate peak temperatures. Climate data obtained from NOAA for the period 1981 to 2010 show an annual average temperature of 74 °F. Daily average high temperatures range from 68 °F during January to 91 °F during August. Daily average low temperatures range from 52 °F during January to 77 °F during July and August. The record minimum and maximum temperatures are 17 °F and 103 °F, respectively (NOAA 2018a).

The region experiences relatively high dew point values (about 75 °F in summer), resulting in higher relative humidity for the June through September period (NOAA 2018b). Near the northern extent of the pipeline facilities in Corpus Christi, monthly temperature trends are similar; however, the daily average high temperatures range from 67 °F during January to 94 °F in August, and daily average low temperatures range from 57 °F during January to 85 °F in August (NOAA 2018a).

Monthly total rainfall tends to be highest (greater than 2 inches) during the early summer and autumn months across the Project area. The annual average precipitation in Port Isabel amounts to approximately 29 inches, with a monthly maximum of 6.3 inches in September (NOAA 2018). In Corpus Christi, the annual average precipitation is about 30 inches, with a monthly maximum of 5.0 inches in September. Much of this precipitation comes from thunderstorm activity, although the majority of days that receive precipitation experience light rain. Tropical storms or hurricanes, although uncommon, can also enhance summer and autumn rainfall in this region.

The overall predominant wind pattern for the year in the extreme southern Texas Coastal Zone is southeasterly winds, with northwesterly winds dominating at times in the cooler part of the year, particularly December. The annual average wind speed is approximately 10 miles per hour (mph), with the highest average monthly wind speeds occurring during spring (NOAA 2018b). The prevailing southeast wind is further enhanced during spring and early summer by thermal winds which develop when the air over the heated land further west from the coast is warmer than the air over the relatively cooler waters of the Gulf of Mexico.

4.11.1.2 Existing Air Quality

Ambient Air Quality Standards

The EPA has established NAAQS for six criteria pollutants: SO_2, CO, ozone, nitrogen dioxide (NO_2), PM_{10}, $PM_{2.5}$, and lead. There are two classifications of NAAQS, primary and secondary standards. Primary standards set limits the EPA believes are necessary to protect human health including sensitive populations such as children, the elderly, and asthmatics. Secondary standards are set to protect public welfare from detriments such as reduced visibility and damage to crops, vegetation, animals, and buildings.

Individual state air quality standards cannot be less stringent than the NAAQS. The federal NAAQS for criteria pollutants are the same as the state standards established by the TCEQ in accordance with Section 30 of the TAC (30 TAC), Part 101.21. The TCEQ has also established 30-minute average property line standards for SO_2 and H_2S in 30 TAC Part 112. The federal NAAQS and Texas-specific standards (referenced as net ground-level concentrations) are summarized in table 4.11.1-1.

As with any activity that involves combustion of fossil fuels and processing of natural gas, the Project would contribute GHG emissions. The principle GHGs that would be produced by the Project are CO_2, CH_4, and N_2O. The GHG CO_2e unit of measure takes into account the global warming potential (GWP) of each GHG. The GWP is a ratio relative to CO_2 that is based on the particular GHG's ability to absorb solar radiation as well its residence time within the atmosphere. Based on this definition, CO_2 has a GWP of 1, CH_4 has a GWP of 25, and N_2O has a GWP of 298. To obtain the CO_2e quantity, the mass of the particular GHG compound is multiplied by the corresponding GWP, the product of which is the CO_2e for that compound. The CO_2e value for each of the GHG compounds is summed to obtain the total CO_2e GHG emissions.

Table 4.11.1-1 Ambient Air Quality Standards				
Pollutant	**Averaging Period**	**Primary NAAQS**	**Secondary NAAQS**	**Texas Net Ground-Level Concentration**
Ozone	8-hour (2015)[a]	0.070 ppm	0.070 ppm	-
CO	1-hour[b]	35 ppm	-	-
	8-hour[b]	9 ppm	-	-
NO_2	1-hour[c]	100 ppb	-	-
	Annual[d]	53 ppb	53 ppb	-
$PM_{2.5}$	24-hour[e]	35 μg/m^3	35 μg/m^3	-
	Annual[f]	12 μg/m^3	15 μg/m^3	-
PM_{10}	24-hour[g]	150 μg/m^3	150 μg/m^3	-
Lead	3-month[h]	0.15 μg/m^3	0.15 μg/m^3	-
SO_2	1-hour[i, j]	75 ppb	-	-
	3-hour[b]	-	0.5 ppm	-
	30-minute	-	-	0.4 ppm[k]
H_2S	30-minute	-	-	0.08/0.12 ppm[l]

ppb = parts per billion; µg/m3 = micrograms per cubic meter.

a Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years.
b Not to be exceeded more than once per year.
c The 98th percentile of daily maximum 1-hour average concentrations, averaged over 3 years.
d Annual arithmetic mean.
e The 98th percentile of 24-hour concentrations, averaged over 3 years.
f Annual arithmetic mean, averaged over 3 years.
g Not be exceeded more than once per year on average over 3 years.
h Not to be exceeded.
i The 99th percentile of daily maximum 1-hour concentrations, averaged over 3 years.
j The 24-hour and annual SO_2 NAAQS were revoked in 2010 (75 Federal Register 35520); however, standards remain in effect until 1 year after an area is designated attainment or nonattainment for the 1-hour standard, except in areas designated nonattainment for the 1971 standard, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.
k Net ground-level concentration not to be exceeded at the property boundary.
l Net ground-level concentration of 0.08 ppm not to be exceeded on property normally occupied by people and net ground-level concentration of 0.12 ppm not to be exceeded on property that are not normally occupied by people.

Existing Air Quality

AQCRs are established by the EPA and local agencies for air quality planning purposes, in which State Implementation Plans describe how the NAAQS would be achieved and maintained. Each AQCR, or portion(s) of an AQCR, is classified as either attainment, nonattainment, or maintenance with respect to the NAAQS. The LNG Terminal site would be located in Cameron County, which is within the Brownsville-Laredo Intrastate AQCR. Vessel transit along the BSC would occur within the same AQCR. The pipeline facilities would be within the Corpus Christi-Victoria Intrastate AQCR (Jim Wells, Kenedy, and Kleberg Counties) and the Brownsville-Laredo Intrastate AQCR (Cameron and Willacy Counties). Areas where air quality data are not available are considered to be unclassifiable and are treated as attainment areas. All components of the Rio Grande LNG Project would be in areas classified as in attainment for all criteria pollutants.

In addition, there are no nonattainment or maintenance areas through which LNG carriers would transit en route to the LNG Terminal site. Although the EPA maintains jurisdiction over portions of the outer continental shelf within the Gulf of Mexico (40 CFR 55), attainment status does not apply in offshore areas. Therefore, LNG carriers transiting the Gulf of Mexico would not pass through nonattainment or maintenance areas.

Transport of construction materials associated with the Project could occur within the Houston-Galveston-Brazoria (HGB) area, which is a marginal nonattainment area for the 2015 8-hour ozone standard. Construction emissions from Project elements within the HGB area would not be expected to result in an exceedance of applicable general conformity thresholds for the HGB area.

Air Quality Monitoring and Background Concentrations

Ambient air monitoring operations in Texas are the responsibility of the TCEQ, which has developed a statewide network of stationary monitoring stations to collect direct measurements of air pollutant concentrations. Data from these air monitoring sites are available through the EPA's AIRDATA database, which collects air monitoring data from all over the country.

Ambient air quality monitoring data from the 3-year period of 2012 to 2014 and, for some pollutants, 2014 to 2016, are summarized in table 4.11.1-2 for those monitors that were nearest or most representative of the proposed Project facilities. Because not all pollutants are monitored at all stations, multiple monitor locations were used and are representative of conditions at the Rio Grande LNG Terminal and along the pipeline route; ambient air quality monitor locations were identified in coordination with the TCEQ, as provided in RG Developers' Air Quality Modeling Protocol and Air Quality Modeling Analysis Report for the LNG Terminal and Compressor Station 3.[36]

The concentrations listed in table 4.11.1-2 are maximum or near maximum values for the identified monitors. As such, they are not necessarily representative of current actual air quality in the immediate vicinity of the proposed facilities. For each monitor, table 4.11.1-2 lists the applicable concentrations such as annual mean concentration in each year and/or a near maximum short-term concentration, which are comparable to the applicable NAAQS. As shown in the table, each of the measured concentrations are below or equivalent to the applicable NAAQS for the pollutant and averaging period, thus indicating attainment with the standard.

---

[36] RG Developers' Air Quality Modeling Protocol and Air Quality Modeling Analysis Report are available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession numbers 20161202-5213 and 20180301-5019.

Table 4.11.1-2 Ambient Air Quality Concentrations for Areas Near the Rio Grande LNG Terminal and Pipeline Facilities							
Pollutant	**Averaging Time**	**Monitor Location**	**Year**	**Rank**	**Monitor Value**	**NAAQS**	**Unit**
CO	1-hour	Brownsville[a]	2014	2nd high	1.6	35	ppm
	8-hour		2014	2nd high	0.8	9	
NO_2	1-hour	Lake Jackson[b]	2014-2016	98th percentile	18.8	100	ppb
	Annual		2016	Mean	2.0	53	
$PM_{2.5}$	24-hour	Isla Blanca[c]	2014-2016	98th percentile	25.7	35	μg/m^3
	Annual		2014-2016	Mean	9.5	12	
PM_{10}	24-hour	Brownsville[a]	2012-2014	2nd high	49	150	μg/m^3
Ozone	8-hour	Brownsville[a]	2014-2016	4th high	57.3	70	ppb
Lead	Quarterly	N/A	N/A	Maximum	N/A	0.15	μg/m^3
SO_2	1-hour	Corpus Christi West[d]	2012-2014	99th percentile	5.3	75	ppb
	3-hour		2014	2nd high	3.2	500	

a 344 Porter Drive, Brownsville, Texas (monitor no. 48-061-0006).
b 109B Brazoria Hwy 322 West, Lake Jackson, Texas (monitor no. 48-039-1016).
c Lot B 69 ½, South Padre, Texas (monitor no. 48-061-2004).
d 902 Airport Blvd., Corpus Christi, Texas (monitor no. 48-355-0025).

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 TCEQ has the primary jurisdiction over air emissions produced by stationary sources associated with the Project. The TCEQ's air quality regulations are codified in the 30 TAC. The regulations incorporate federal program requirements listed in 40 CFR 50-99 and establish permit review procedures for all facilities that can emit pollutants to the ambient air. New facilities are required to obtain an air permit prior to construction. For larger facilities subject to major New Source Review (NSR) review, and approval at the federal level may be required.

<u>Federal Air Quality Requirements</u>

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. We have determined that the following NSPS would be applicable to one or more of the proposed facilities.

Subpart A – General Provisions. The general provisions listed in Subpart A include broader definitions of applicability and various methods for maintaining compliance with requirements listed in subsequent subparts of 40 CFR 60. Subpart A also specifies the state agencies to which the EPA has delegated authority to implement and enforce standards of performance. The TCEQ has been delegated authority for all 40 CFR 60 standards promulgated by the EPA. Equipment at the LNG Terminal, compressor stations, or booster stations subject to any of the NSPS subparts listed below would all be subject to Subpart A.

Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines. Subpart IIII applies to owners and operators of stationary compression ignition internal combustion engines (CI ICE) that commence construction after July 11, 2005 where the stationary CI ICE are: 1) manufactured after April 1, 2006, and are not fire pump engines, or 2) are manufactured as a certified NFPA fire pump engine after July 1, 2006. 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. CI ICE in the form of essential generators and firewater pumps at the LNG Terminal would be subject to NSPS Subpart IIII.

Subpart JJJJ – Standards of Performance for Spark Ignition Internal Combustion Engines. Subpart JJJJ provides requirements for stationary spark ignition internal combustion engines that are constructed, modified, or reconstructed after June 12, 2006. The two natural gas back-up generators located at Compressor Stations 1, 2, and 3 and the interconnect booster stations would be subject to the requirements of Subpart JJJJ for emergency natural gas-fired engines greater than or equal to 130 hp.

Subpart KKKK – Standards of Performance for Stationary Combustion Turbines. Subpart KKKK applies to owners and operators of stationary combustion turbines with a heat input peak load equal to or greater than 10 British thermal units per 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. The turbines at the LNG Terminal, Compressor Stations 1 and 2, and two booster stations would be subject to NSPS KKKK.

Subpart OOOO – Standards of Performance for Crude Oil and Natural Gas Industry. Subpart OOOO applies to owners and operators of crude oil and natural gas production, transmission, and distribution facilities. Subpart OOOO regulates emissions of VOCs and SO_2 from affected facilities that commenced construction, modification, or reconstruction after August 23, 2011, and on or before September 18, 2015. Therefore, NSPS OOOO is not applicable to the Project.

Subpart OOOOa – Standards of Performance for Crude Oil and Natural Gas Industry. Subpart OOOOa applies to owners and operators of crude oil and natural gas production, transmission, and distribution facilities. Subpart OOOO regulates emissions of VOCs and methane. RG Developers anticipate that NSPS OOOOa would apply to the compressor stations. The LNG units and fugitive emissions at Compressor Station 3 within the

LNG Terminal site would be subject to NSPS OOOOa. In addition, fugitive emissions at Compressor Station 1, Compressor Station 2, and the two booster stations would be subject to NSPS OOOOa. RG Developers would monitor fugitive emissions at these facilities.

Subpart Kb – Standards of Performance for Volatile Organic Liquid Storage Vessels. Subpart Kb applies to owners and operators of storage vessels with a capacity greater than or equal to 75 m^3 and that are used to store volatile organic liquids for which construction, reconstruction, or modification is commenced after July 23, 1984. The condensate tanks at the LNG Terminal site would be subject to NSPS Kb, and would follow all monitoring, recordkeeping, and reporting requirements of this subpart.

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. Eight hazardous substances are regulated per 40 CFR 61, including asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride. NESHAP can apply to major and/or area (minor) sources of HAPs. The EPA develops national priorities for NESHAPs that focus on significant environmental risks and noncompliance patterns.

The 1990 CAA Amendments established a list of 189 HAPs, resulting in the promulgation of Part 63, also known as the Maximum Achievable Control Technology standards. Part 63 regulates HAPs from major sources of HAPs and specific source categories emitting HAPs. Some NESHAPs may apply to area (minor) sources of HAPs. Major source thresholds for NESHAPs are 10 tons per year (tpy) of any single HAP or 25 tpy of total HAPs. The LNG Terminal, including Compressor Station 3, would be a major source of HAPs, as potential total emissions of HAPs would be greater than 25 tpy, and emissions of individual HAPs would have the potential to exceed 10 tpy. Total potential HAPs emissions at Compressor Station 1, Compressor Station 2, and the two booster stations are all less than 10 tpy, and would therefore be considered area sources of HAPs. The following NESHAPs would be applicable to one or more of the proposed facilities.

Subpart A – NESHAP General Provisions. The general provisions listed in Subpart A include broader definitions of applicability and various methods for maintaining compliance with requirements listed in subsequent subparts of 40 CFR 63. This subpart also addresses the delegation of NESHAP authority to the states.

Subpart YYYY – NESHAP for Stationary Combustion Turbines. Subpart YYYY regulates HAP emissions from stationary combustion turbines located at major sources of HAP emissions. The gas-fired stationary combustion turbines proposed with the LNG Terminal would be required to comply with the requirements for initial notification established in 40 CFR 63.6145(d), but no further requirements from this subpart.

Subpart ZZZZ – NESHAP for Stationary Reciprocating Internal Combustion Engines. Subpart ZZZZ regulates HAP emissions from reciprocating internal combustion engines. Based on the potential to emit for HAPs, the LNG Terminal would be a major source. The reciprocating internal combustion engines proposed for the LNG Terminal include the engines used for the essential generators, the fire water pumps, and the natural gas generator at Compressor Station 3. Although area sources based on their potential to emit for HAPs, Subpart ZZZZ would also apply to the backup generators at Compressor Stations 1 and 2, and the two booster stations. In accordance with Subpart ZZZZ, compliance with would be achieved through compliance with NSPS IIII and JJJJ.

Mandatory Greenhouse Gas Reporting

Subpart W of 40 CFR 98 requires petroleum and natural gas facilities 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 facility. LNG storage and LNG import and export equipment are considered part of the source category regulated by Subpart W. The LNG Terminal (including Compressor Station 3) would be required to report GHG emissions because estimated annual emissions of GHGs would be above 25,000 metric tpy.

Compressor stations are also subject to GHG reporting requirements under Subpart W. Reporting is required for CO_2e from reciprocating compressor rod packing venting, centrifugal compressor venting, transmission storage tanks, blowdown vent stacks, natural gas pneumatic device venting, and equipment leaks from valves, connectors, open ended lines, pressure relief valves, and meters. Because the estimated annual emissions of GHGs for Compressor Stations 1 and 2 and Booster Stations 1 and 2 would be above 25,000 metric tpy, these facilities would be included in the GHG reporting.

General Conformity

A General Conformity applicability analysis is required for any part of the Project occurring in nonattainment or maintenance areas for criteria pollutants. Section 176(c) of the CAA requires federal agencies to ensure that federally approved or funded projects conform to the applicable approved State Implementation Plan. Such activities must not:

- cause or contribute to any new violation of any standard in any area;
- increase the frequency or severity of any existing violation of any standard in any area; or
- delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

All counties that would be affected by the Project are classified as in attainment or unclassifiable for all NAAQS; therefore, General Conformity requirements do not apply. However, barges traveling to the LNG Terminal site for the delivery of Prefabricated Electrical Substations would originate from the HGB area, which is classified as marginal nonattainment for the 2015 8-hour ozone standard. As described in section 4.11.1.3, below, construction emissions from the Project occurring within the HGB area are not expected to result in an exceedance of applicable general conformity thresholds.

New Source Review – Prevention of Significant Deterioration

Congress established the NSR pre-construction permitting program as part of the 1977 CAA Amendments. Federal pre-construction review under NSR is conducted under separate procedures for sources in attainment areas and sources in nonattainment areas. Nonattainment New Source Review applies to sources in nonattainment areas. Because no Project components would be in nonattainment areas, this process does not apply and is not discussed further.

PSD permitting applies to new major sources or major modifications at existing sources located in attainment areas or in areas that are unclassifiable. PSD is intended to keep 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)). Table 4.11.1-3 lists the major source emission thresholds applicable to the LNG Terminal and pipeline facilities.

The aggregated emissions of the LNG Terminal and Compressor Station 3 would exceed PSD major source thresholds for NO_x, CO, $PM_{2.5}$, PM_{10}, SO_2, and GHG; thus RG Developers would be required to obtain a PSD major source permit. RG Developers submitted a PSD Air Permit Application[37] for the LNG Terminal and Compressor Station 3 to the TCEQ in May, 2016; revised applications were submitted on November 30, 2016, and March 21, 2017. Compressor Stations 1 and 2 and the booster stations would all require minor source permits, which were submitted to the TCEQ on March 24, 2017. RB Pipeline also plans to obtain a minor source Permit by Rule for Compressor Station 3, so that it has a permit addressing only those emissions sources for which it is responsible.

Once a facility is subject to PSD, the following requirements apply:

- installation of Best Available Control Technology (BACT);
- air quality monitoring and modeling analyses to ensure that a Project's incremental increase of emissions would not cause or contribute to a violation of any NAAQS or PSD air quality increment;
- notification to the federal land manager of nearby Class I areas and modeling if applicable;
- a growth, soil and vegetation, and visibility analysis; and
- public comment on the permit.

---

[37] RG LNG's PSD Air Permit Applications are available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession numbers 20170403-5621 and 20170407-5193.

Table 4.11.1-3 Major Stationary Source and Prevention of Significant Deterioration Emission Thresholds		
Air Pollutant	**Major Stationary Source Threshold (tpy)**	**PSD Significant Emission Rates (tpy)**
NO_x	250	40
CO	250	100
VOCs	250	40
PM	250	25
PM_{10}	250	15
$PM_{2.5}$	250	10
SO_2	250	40
GHG (as CO_2e)	75,000	N/A

BACT is an emissions limitation that is based on the maximum degree of control that can be achieved. It is a case-by-case decision that considers energy, environmental, and economic impact. BACT can be add-on control equipment or modification of the production processes or methods. This includes fuel cleaning or treatment and innovative fuel combustion techniques. BACT may be a design, equipment, work practice, or operational standard if imposition of an emissions standard is infeasible (TCEQ 2011). RG Developers completed a BACT assessment for the LNG Terminal, including Compressor Station 3, as part of a PSD application for CO, NO_x, VOC, PM_{10}, $PM_{2.5}$, and GHGs, the results of which were incorporated into subsequent facility emission calculations.

The air quality monitoring and modeling analysis involves an assessment of existing air quality, which may include ambient monitoring data and air quality dispersion modeling results, and predictions, using dispersion modeling, of ambient concentrations that would result from the proposed LNG Terminal and associated future growth (TCEQ 2015b).

There are three air quality classifications within an attainment area for purposes of PSD permitting review: Class I areas are designated as pristine natural areas or areas of natural significance and receive special protections under the CAA based on good air quality. Class III areas are heavily industrialized zones that are established only on request and must meet all requirements outlined in 40 CFR 51.166. The remainder of the United States is designated as Class II. The LNG Terminal site and pipeline facilities would be located in Class II areas (40 CFR 81).

If a new source or major modification of an existing source is subject to the PSD permitting requirements and is within 62 miles of a Class I area, the facility is required to notify appropriate federal officials and assess the impacts of the proposed Project on the Class I area. The closest Class I area to the LNG Terminal site is Big Bend National Park, which is more than 400 miles from the site.

Air quality monitoring includes additional evaluations of the LNG Terminal impacts (including Compressor Station 3), including a growth, soil and vegetation, and visibility analysis. RG Developers filed a final air quality modeling report developed as part of the TCEQ permitting process that includes these additional evaluations. The final report was submitted to the TCEQ in January 2018. The visibility analysis for the LNG Terminal site includes an assessment of the visual air quality impacts of emissions from the terminal on Palo Alto Battlefield, 12 miles northwest of the LNG Terminal site.

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 TCEQ, which has incorporated the program in 30 TAC Chapter 122.

The 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.

Estimated potential emissions of CO, NO_x, VOC, PM_{10}, and $PM_{2.5}$ during operation of the LNG Terminal and Compressor Station 3 would be greater than 100 tpy. Additionally, the 10 tpy threshold for individual HAPs and 25 tpy threshold for aggregate HAPs would be exceeded. Therefore, the LNG Terminal and Compressor Station 3 would be subject to the Title V Operating Permit Program.

For new sources (such as the ones proposed here), applications for Title V permits are due prior to commencing operation. RG Developers plan to submit the Title V permit application for the LNG Terminal and Compressor Station 3 prior to beginning construction.

Estimated potential emissions for both Compressor Stations 1 and 2 would also be expected to exceed the 100 tpy threshold for both NO_x and CO. These facilities would also be subject to the Title V Operating Permit program. RG Developers plan to submit the Title V permit applications for Compressor Stations 1 and 2 prior to commencing operations. Operation of the booster stations would not require a Title V Operating Permit.

<u>Texas Air Quality Requirements</u>

The Project would be subject to state standards, codified in Title 30 of the TAC. The regulations listed below would apply to the new facilities associated with the Project, including turbines, thermal oxidizers, flares, generators, fire water pumps, and fugitive emissions:

- 30 TAC Chapter 101, Subchapter A – *General Rules*. This chapter includes provisions related to circumvention, nuisance, traffic hazards, sampling and sampling ports, emissions inventory requirements, sampling procedures and terminology, compliance with EPA standards, inspection and emission fees, and emission events and scheduled maintenance, startup, and shutdown activities.

- 30 TAC Chapter 106 – *Permits by Rule*. This chapter outlines the permitting requirements for facilities that meet specific emissions limits, and that do not quality as major sources (see 30 TAC Chapter 116, below). RB Pipeline plans to obtain a minor source Permit by Rule for Compressor Station 3, so that it has a permit addressing only those emissions sources for which it is responsible. The booster stations would also require minor source permits authorized as Permits by Rule.

- 30 TAC Chapter 111 – *Control of Air Pollution from Visible Emissions and Particulate Matter*. This chapter outlines the allowable visible emission (i.e., opacity) requirements and total suspended particulate emission limits based on calculated emission rates.

- 30 TAC Chapter 112 – *Control of Air Pollution from Sulfur Compounds*. This chapter outlines emission limits and monitoring, reporting, and recordkeeping requirements. This chapter also lists net ground-level concentration standards at the property line for certain sulfur compounds.

- 30 TAC Chapter 113 – *Standards of Performance for Hazardous Air Pollutants and for Designated Facilities and Pollutants*. Chapter 113 incorporates by reference the NESHAP source categories (40 CFR 63).

- 30 TAC Chapter 114 – *Control of Air Pollution from Motor Vehicles*. This chapter addresses inspection requirements and maintenance and operation of air pollution control systems/devices for motor vehicles owned and/or operated at the Project facilities. This chapter applies to use of construction- and operations-related vehicles.

- 30 TAC Chapter 116, Subchapter B – *Control of Air Pollution by Permits for New Construction or Modification*. This chapter outlines the permitting requirements for the construction of new sources. As described above under Federal Air Quality Requirements, the aggregated emissions of the LNG Terminal and Compressor Station 3 would exceed PSD major source thresholds for NO_x, CO, $PM_{2.5}$, PM_{10}, and SO_2; and RG Developers would be required to obtain a PSD major source permit. Compressor Stations 1 and 2 would require minor source permits authorized under the TCEQ *Standard Permits* regulations (30 TAC Chapter 116, Subchapter F).

- 30 TAC Chapter 118 – *Control of Air Pollution Episodes*. This chapter outlines the requirements relating to generalized and localized air pollution episodes.

- 30 TAC Chapter 122 – *Federal Operating Permits Program*. This chapter outlines the requirements for complying with the Federal operating permits program.

RG Developers have outlined the methods and measures by which they would comply with the requirements of each applicable TCEQ air quality regulation in their permit applications. It is expected that the TCEQ would include permit conditions in the respective permits to ensure compliance with these regulations.

4.11.1.3 Impacts and Mitigation

During construction, a reduction in ambient air quality would result from emissions and fugitive dust generated by construction equipment. 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. Air pollutant emissions during construction of the LNG Terminal would result from the operation of construction vehicles, marine traffic, and vehicles driven by construction workers commuting to and from work sites. Emissions during construction of the pipeline facilities would also result from the operation of construction vehicles and vehicles driven by construction workers. In addition, particulate emissions would result from fugitive dust generated by construction-related activities, the quantity of which would depend on several factors, including:

- the size of area disturbed;
- the nature and intensity of construction activity;
- surface properties (such as the silt and moisture content of the soil);
- the wind speed; and
- the speed, weight, and volume of vehicular traffic.

The Project would result in emissions from operation of the LNG Terminal, compressor stations, and booster stations, as well as fugitive emissions from pipe flanges, valves, and valve stems. Emissions estimates for each facility are included below.

LNG Terminal

Construction

Construction of the LNG Terminal would be continuous over a 78-month period, beginning upon receipt of all applicable permits. The first LNG train is expected to be completed by Year 4, with construction of the final LNG train expected to be complete in Year 7. In addition, emissions from worker commutes associated with commissioning the Project would occur in Year 8. Construction of Compressor Station 3 would also begin the first quarter of Year 3, with additional compression installed periodically through Year 7, as subsequent LNG trains are brought on-line. The construction emissions estimate includes emissions from operation of construction equipment, operation of the onsite concrete batch plants, deliveries of supplies, worker commutes, and land disturbance. Annual emissions estimates for activities associated with construction of the LNG Terminal and Compressor Station 3 are summarized in table 4.11.1-4. To estimate construction emissions, RG LNG 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) that would be used during construction at the LNG Terminal 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.

Two concrete batch plants would be established at the site, mixing a total of about 200,000 tons of cement, 400,000 tons of sand, and 600,000 tons of aggregate to produce concrete for construction of the LNG Terminal. On site batching facilities would implement fugitive dust suppression equipment and filters as required by the TCEQ.

Table 4.11.1-4
Estimated Construction Emissions for the Rio Grande LNG Terminal and Compressor Station 3 (tpy)[a,b]

Facility and Year	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	Total HAPs	CO_2e
Rio Grande LNG Terminal								
Year 1	12.0	18.6	2.0	589.4	60.0	0.7	0.2	653.8
Year 2	69.7	111.4	11.8	1,199.5	125.8	4.2	1.2	9,711.0
Year 3	127.8	174.3	23.5	1,146.6	125.8	6.4	1.7	15,835.2
Year 4	59.3	118.5	10.6	91.4	14.2	3.6	1.0	9,046.0
Year 5	45.0	106.7	8.0	56.1	9.2	2.9	0.8	7,532.0
Year 6	39.0	70.2	7.1	26.9	5.8	2.1	0.5	6,310.0
Year 7	1.2	10.4	0.0	13.9	1.4	0.1	<0.1	1,054.0
Year 8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	13.8
Compressor Station 3								
Year 3	1.3	10.3	<0.1	10.6	1.1	0.3	<0.1	1,371.5
Year 4	0.1	0.7	<0.1	0.7	<0.1	<0.1	<0.1	114.8
Year 5	0.7	6.5	<0.1	0.2	<0.1	<0.1	<0.1	933.9
Year 6	0.7	5.8	<0.1	0.4	<0.1	<0.1	<0.1	831.5
Year 7	0.4	4.4	<0.1	0.5	<0.1	<0.1	<0.1	642.8

[a] Emission estimates include construction emissions from on- and off-road vehicle activity, truck deliveries, vessel activity, worker commutes, and fugitive dust. HAPs were not estimated by RG LNG for vessel activity; however, they were estimated using emission factors for commercial marine vessels identified by the EPA in the 2014 National Emissions Inventory.

[b] RG LNG estimated annual fugitive emissions from use of the temporary haul road; to estimate annual construction emissions, the total fugitive emissions were included for the first 3 years of construction. In Year 1, given that construction would not commence until about 6 months into the year, annual estimated fugitive emissions from the haul road were assumed to be half of those estimated for Years 2 and 3. We note that we are exploring alternatives to the construction and use of the proposed temporary haul road.

Construction materials would be delivered to the site by barge and by truck. Tugboats would be used for barge deliveries of construction material and equipment. RG LNG estimates that 878 marine deliveries would occur over a 5-year period during construction. Emissions associated with transportation of construction material would be expected to continue until Year 7. Other vessel emissions during LNG Terminal construction would result from dredging of the marine facilities and surveys to map underwater topography.

Fugitive dust emissions would be generated throughout the construction period and are included in the annual emissions estimates. Fugitive dust emissions would include contributions from general site construction work (acreage impacted), earth-moving fugitive dust emissions (quantity of soil moved), and unpaved road travel (distance of travel and weight of vehicles). Fugitive dust would be produced primarily during the site preparation activities, when the site would be cleared of debris, leveled, and graded, including at proposed offsite facilities.

RG LNG would minimize vehicular exhaust from construction worker commutes by providing bus transportation during construction of Stages 4, 5, and 6 of the LNG Terminal when offsite parking areas are in use. RG LNG would use recent models of construction equipment, conduct regular inspections and emissions testing of construction vehicles, and limit idling of heavy equipment to less than 5 minutes to the extent practicable. In addition, RG LNG would implement the measures in its Terminal Construction Fugitive Dust Control Plan to minimize fugitive dust, including the following:

- a water truck would be available at all times during construction. Based on weather and site conditions, the water truck would spray Project areas as needed, including designated site entrances, access roads, staging areas, material stockpiles, laydown areas, construction workspace, and parking areas. Once available, the permanent water supply for the LNG Terminal may be used for dust control near the LNG trains and tanks;
- crushed rock would be placed on high traffic temporary roads, and sprayed with asphalt binding material to mitigate fugitive dust emissions. Roadways would be regularly monitored and cleaned or watered as necessary;
- parking areas would be paved to reduce fugitive dust generation;
- speed limits would be enforced in construction work areas, including restricting speed limits to 20 miles per hour on unsurfaced roads;
- dump trucks and off-road trucks would be covered while traveling; and
- tire washing pools would be used to remove material clinging to tires.

The EI and RG LNG's Site Construction Management would be responsible for ensuring that dust control measures are implemented. To ensure that the fugitive dust plan is adequate to minimize fugitive dust during the 78-month construction period of the LNG Terminal, and per our recommendation in section 4.2.2.1, RG LNG would submit a final Terminal Construction

Fugitive Dust Control Plan to FERC prior to construction. Because construction emissions would be limited to the construction period, standard EPA emission permitting thresholds do not apply. General Conformity applicability thresholds do not apply at the LNG Terminal site because the Project area is in attainment for all the NAAQS. We conducted a General Conformity applicability determination for marine emissions associated with barge traffic in the HGB area, which is a marginal nonattainment area for the 2015 8-hour ozone standard. As shown in table 4.11.1-5, these emissions would not exceed the NO_x and VOC emissions conformity determination thresholds of 100 tpy for marginal nonattainment areas; NO_x and VOCs are precursors to ozone. Therefore, a General Conformity determination does not apply to the Project.

The construction activities proposed in association with the LNG Terminal are comparable to other types of infrastructure projects or industrial facilities. As indicated in table 4.11.1-4, there may be localized minor to moderate elevated levels of fugitive dust and tailpipe emissions near construction areas during the 78-month construction period associated with the LNG Terminal site.

The construction emissions' impact on ambient air quality would vary with time due to the construction schedule, the mobility of the sources, and the variety of emission sources. Fugitive dust and other emissions due to construction activities generally do not pose a significant increase in regional pollutant levels; however, local pollutant levels would increase during the construction period. Considering these factors, we determine that construction of the Project would impact local air quality. However, construction emissions would not have a long-term, permanent effect on air quality in the area.

Table 4.11.1-5
Estimated Marine Vessel VOC and NO_x Emissions in the Houston-Galveston-Brazoria Area (tpy)

Year	NO_x	VOC
Year 2	6.99	0.28
Year 3	8.21	0.33
Year 4	7.30	0.29
Year 5	6.69	0.27
Year 6	0.91	0.04

Operation

Commissioning and Start-up Emissions

Commissioning of the LNG trains and startup of the LNG Terminal is expected to result in emissions between Year 4 and Year 7, during start-up of each train. Ground flares would be used to control start-up emissions. These emissions would be staged in conjunction with construction at the LNG Terminal site, and would begin in Year 4 with LNG Train 1 commissioning, emissions from LNG Tanks 1 and 2 cooldown, and cooldown at Marine Jetty 1 and associated LNG loading lines. Train 2 commissioning and startup emissions would begin in

Year 5. Emissions from commissioning of Trains 3 and 4, cooldown of LNG Tank 3, Jetty 2, and the loading lines would begin in Year 6. Finally, emissions from startup and commissioning of LNG Trains 5 and 6 and cooldown of LNG Tank 4 would begin in Year 7. A summary of these additional emissions is provided in table 4.11.1-6.

Table 4.11.1-6
Estimated Emissions from LNG Train Commissioning and Start-Up (tpy)

Year	NO_x	CO	SO_2	H_2SO_4	PM_{10}	$PM_{2.5}$	VOC	Total HAPs	CO_2e
Year 4	332	674	0.2	0.01	4.4	4.4	1,087	0.1	462,041
Year 5	236	485	0.1	0.01	3.0	3.0	782	0.1	358,314
Year 6	467	940	0.3	0.02	6.0	6.0	1,538	0.2	708,882
Year 7	463	910	0.3	0.02	6.0	6.0	1,512	0.2	701,271

H_2SO_4 = Sulfuric acid

Routine Operation

Air emissions for routine operation and maintenance at the LNG Terminal site include those associated with the LNG Terminal and Compressor Station 3. The emission sources associated with the LNG Terminal are expected to operate continuously following commissioning. The six LNG trains would include the following continuous emissions sources:

- 12 gas turbines (2 per LNG train; 1 per LNG train would be equipment with a waste heat recovery unit);
- six thermal oxidizers (one per LNG train);
- two condensate tanks; and
  - fugitive emissions from pipe flanges, valves, and valve stems.

The LNG Terminal would also contain the following emission sources, which would operate on an intermittent or as-needed basis:

- six diesel fired emergency generators;
- two emergency diesel drive firewater pumps;
- one LNG tank and BOG low-pressure vent;
- three wet/dry ground flares to control emissions during maintenance, startup, and shutdown events;
- up to 312 LNG carriers per year (about 6 per week), and their attendant tugs, pilot boats, and security escort vessels;

- trucking facilities for LNG and condensate transport; and
- miscellaneous mobile sources.

Once fully built, Compressor Station 3 would have six electric compressor units which would operate on a continuous basis and would not contribute to operating emissions. One condensate tank would be kept on site. Two backup natural gas fueled generator sets would be constructed in order to temporarily provide electricity in the event of a power outage. Additionally, intermittent emissions would be generated from maintenance activities such as pigging, blowdowns, flaring, and from startup/shutdown. Emissions from both Compressor Station 3 and the LNG Terminal would also result from fugitive emissions from piping components, such as valves and seals. Power for the LNG Terminal and Compressor Station 3 would be provided via a connection to a local public electrical network, and (with the exception of back-up generators), power generation would not contribute to operation emissions at the LNG Terminal site (see section 2.2.1).

Annual emissions by source for the LNG Terminal and Compressor Station 3 and a summary of total annual emissions are provided in table 4.11.1-7. In addition to the stationary sources at the LNG Terminal, table 4.11.1-7 shows the mobile emissions from worker commutes, truck LNG distribution, and LNG carriers and tugboats associated with LNG Terminal operations. Emission estimates include proposed control technologies, based on the completion of RG Developers' BACT assessment for CO, NO_x, VOC, PM_{10}, $PM_{2.5}$, and GHGs. In addition to total HAPs, the individual HAPs with the greatest contribution to total HAPs emitted by the Project are presented in table in table 4.11-7. These include formaldehyde and the group of VOCs known collectively as BTEX (benzene, toluene, ethylbenzene, and xylene). The estimates represent emissions associated with full build-out of the Project, and with all six LNG trains operating at maximum capacity. Operation emissions would be lower in Year 4, when the first LNG train and associated facilities would be commissioned, and would reach the values in table 4.11.1-7 after completion of the final stage of construction and commissioning Train 6 and associated facilities in Year 7.

The LNG Terminal and Compressor Station 3 would be a PSD major source for NO_x, CO, PM_{10}, $PM_{2.5}$, VOCs, and GHG (as CO_2e). The facility would be considered a major source of HAP emissions. As described in section 4.11.1.3, because emissions at the LNG Terminal site would be above the PSD significant emission rates (see table 4.11.1-3) for NO_x, CO, PM_{10}, $PM_{2.5}$, VOC, and CO_2e, these pollutants would be subject to both federal and state permitting and compliance requirements. RG Developers would be required to show compliance with the NAAQS and PSD increment requirements for NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$. In addition, RG Developers would be required to show compliance with the ozone NAAQS and to comply with the federal requirements for major sources of CO_2e. Compliance with these requirements are discussed below.

Table 4.11.1-7
Summary of Estimated Emissions from Routine Operation of the LNG Terminal and Compressor Station 3 (tpy)[a,b]

Equipment	NO_x	CO	SO_2	H_2SO_4	PM_{10}	$PM_{2.5}$	VOC	HAPs						CO_2e
								Formal-dehyde	Benzene	Toluene	Ethyl-benzene	Xylene	Total HAPs	
LNG TERMINAL														
Stationary Emissions Sources from the LNG Terminal														
Gas turbines (12)	1,702.9	2,628.0	1.7	0.1	367.9	367.9	94.6	36.1	0.6	6.6	1.6	3.3	50.8	6,080,096.0
Thermal oxidizers (6)	213.2	149.2	28.2	2.2	13.5	13.5	9.8	0.1	<0.1	0.0	<0.1	0.0	3.3	1,924,414.0
Ground flare system (2)	14.0	120.0	<0.1	<0.1	0.0	0.0	102.5	0.0	0.0	0.0	0.0	0.0	0.0	30,446.0
Ground flare system (use during maintenance / startup / shutdown)	114.0	228.0	0.3	0.0	0.0	0.0	390.0	0.0	0.0	0.0	0.0	0.0	0.0	102,662.0
Essential generators (6)	12.7	7.0	<0.1	-	0.4	0.4	-	<0.1	<0.1	<0.1	0.0	<0.1	<0.1	1,428.0
Emergency firewater pumps (2)	0.7	0.4	<0.1	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	0.0	<0.1	<0.1	76.0
LNG tank and BOG low-pressure vent with ignition package	1.1	9.4	0.0	0.0	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	4,650.0
Fugitives	-	-	-	-	-	-	3.1	0.0	<0.1	<0.1	<0.1	<0.1	0.1	5,626.0
Subtotal	***2,058.6***	***3,142.0***	***30.2***	***2.3***	***381.8***	***381.8***	***604.4***	***36.2***	***0.6***	***6.6***	***1.6***	***3.3***	***54.2***	***8,149,398.0***
Mobile Emissions Sources from the LNG Terminal														
Worker commute[c]	<0.1	0.3	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	47.0
Truck LNG distribution and NGL export[c]	1.6	0.7	<0.1	-	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1,287.0
LNG carriers and tugboats[d]	927.3	88.0	13.9	-	28.5	27.7	38.5	1.7	0.2	<0.1	<0.1	0.1	5.7	44,034.0

Table 4.11.1-7 (continued)
Summary of Estimated Emissions from Routine Operation of the LNG Terminal and Compressor Station 3 (tpy)[a,b]

Equipment	NO_x	CO	SO_2	H_2SO_4	PM_{10}	$PM_{2.5}$	VOC	HAPs						CO_2e
								Formal-dehyde	Benzene	Toluene	Ethyl-benzene	Xylene	Total HAPs	
Subtotal	***928.9***	***89.0***	***13.9***	***-***	***28.6***	***27.8***	***38.6***	***1.7***	***0.2***	***<0.1***	***<0.1***	***<0.1***	***<0.1***	***45,368.0***
LNG Terminal Total	**2,987.5**	**3,231.0**	**44.1**	**2.3**	**410.4**	**409.6**	**643.0**	**37.9**	**0.8**	**6.6**	**1.6**	**3.4**	**59.9**	**8,194,766.0**
COMPRESSOR STATION 3														
Backup generators (2)	0.1	0.3	0.0	0.0	0.0	0.0	0.1	<0.1	<0.1	<0.1	0.0	0.0	<0.1	45.0
Condensate tank (1)	-	-	-	-	-	-	3.7	0.0	<0.1	<0.1	<0.1	<0.1	0.2	52.0
Pigging activities	-	-	-	-	-	-	0.2	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	392.0
Fugitives[e]	-	-	-	-	-	-	0.7	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	63.0
Subtotal	***0.1***	***0.3***	***0.0***	***0.0***	***0.0***	***0.0***	***4.7***	***<0.1***	***<0.1***	***<0.1***	***<0.1***	***<0.1***	***0.3***	***552.0***
Total	**2,987.6**	**3,231.3**	**44.1**	**2.3**	**410.4**	**409.6**	**647.7**	**38.0**	**0.8**	**6.6**	**1.6**	**3.4**	**60.2**	**8,195,318.0**

[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] Project estimates are for the LNG Terminal and Compressor Station 3 after all stages of construction are completed. Estimates are for routine operation.
[c] Speciated HAPs were not provided by RG LNG for worker commutes, or truck LNG distribution and NGL export for the LNG Terminal. Because total HAPs for these sources are <0.1 tpy, a conservative assumption that each individual HAP would be emitted at a rate of <0.1 tpy was included.
[d] HAPs were not estimated by RG LNG for LNG carrier and tugboat emissions; however, they were estimated using emission factors for commercial marine vessels identified by the EPA in the 2014 National Emissions Inventory.
[e] Speciated HAPs were not provided by RG LNG for fugitive compressor station emissions; the emissions were estimated based on the ration of individual HAP weight percentage to the total VOC weight percentage for the gas analysis for the King Ranch Gas Plant provided by RG LNG.

Ambient Impacts

Several public scoping comments expressed concern regarding the dispersion of pollutants during operation of the LNG Terminal, and requested that RG Developers mitigate potential impacts. RG Developers conducted a PSD Screening Analysis, NAAQS Analysis, and PSD Increment Analysis for stationary sources at the LNG Terminal and Compressor Station 3 in accordance with the TCEQ's permitting requirements. In addition to the modeling required by the TCEQ, FERC requested that RG Developers conduct the requisite modeling for the LNG Terminal to include the mobile LNG carrier and support vessel emissions in order to fully assess the impacts of the LNG Terminal operations. The modeling presented herein includes the mobile LNG carriers and support vessels. The PSD Screening Analysis included a Significance Analysis, Area of Impact Analysis, and Pre-construction Monitoring Analysis. The Significance Analysis considers the emissions associated with only the proposed LNG Terminal, LNG mobile emissions, and Compressor Station 3 to determine if operation of these facilities would have a significant impact on the surrounding area. The modeled ground-level concentrations are compared to the corresponding significant impact levels (SIL), also known as modeling significance levels, to determine if any predicted concentrations at any receptor locations would be "significant." If the Significance Analysis reveals that modeled ground-level concentrations for a particular pollutant and averaging period are greater than the applicable SIL, a full impact analysis, which considers emissions from regional sources within the Area of Impact Analysis, is performed at the significant receptors.

The Area of Impact Analysis is defined as the area in which a particular pollutant and averaging time are greater than the applicable SIL. If the predicted Significance Analysis impacts for a particular pollutant are below the applicable SIL(s), then no further analyses (e.g., NAAQS Analysis and PSD Increment Analysis) are required for that pollutant. Results from the significance analysis also dictate if pre-construction ambient monitoring is required.

In accordance with the modeling requirements outlined above, RG Developers performed a PSD Significance Analyses for those pollutants that exceeded the PSD significant emission rates. These included NO_2, CO, PM_{10}, $PM_{2.5}$, VOCs, and CO_2e. The results of these analyses for stationary sources are summarized in table 4.11.1-8, along with the associated SIL for each pollutant. As stated above, FERC requested that RG Developers conduct modeling to include the mobile LNG carrier and support vessel emissions; the results of the PSD Significance Analysis for stationary and mobile sources are presented in table 4.11.1-9.

The results of RG Developers' PSD Significance Analyses conducted for the TCEQ indicate that the associated emissions of NO_2 for stationary sources (1-hr and annual) would exceed the SIL. Because the results of RG Developers' PSD Significance Analyses indicated an exceedance of the SIL for NO_2 a NAAQS analysis was required by the TCEQ for each averaging period. A cumulative modeling assessment of NO_2 emissions of nearby stationary sources (within 31 miles) is also required for the Project. RG LNG completed modeling in coordination with the TCEQ and the cumulative modeling did not indicate any exceedances of relevant thresholds. The TCEQ modeling results do not include mobile sources; therefore, we conducted a cumulative analysis including the emissions for the three LNG terminals proposed along the BSC (see section 4.13.2).

Table 4.11.1-8
Summary of Air Dispersion Modeling of Stationary Sources at the Rio Grande LNG Terminal, Significant Impact Levels for Air Quality Impacts in Class II Areas

Air Pollutant	Averaging Period	Modeled Impact (ug/m^3)[a]	SIL (ug/m^3)	Full Impact Analysis Required? (Yes / No)
NO_2	1-hour	13.89	7.5	Yes
	Annual	1.2	1	Yes
CO	1-hour	364.6	2,000	No
	8-hour	228.8	500	No
$PM_{2.5}$	24-hour	1.05	1.2	No
	Annual	0.26	0.3	No
PM_{10}	24-hour	1.05	5	No
SO_2	1-hour	1.53	7.8	No
	24-hour	0.38	5	No
	Annual	0.09	1	No

[a] Modeled impacts include the maximum predicted ground level concentration for stationary sources only as required by the TCEQ, as included in RG LNG's air quality analysis modeling report.

Table 4.11.1-9
Summary of Air Dispersion Modeling of Stationary and Mobile Sources at the Rio Grande LNG Terminal, Significant Impact Levels for Air Quality Impacts in Class II Areas

Air Pollutant	Averaging Period	Modeled Impact (ug/m^3)[a]	SIL (ug/m^3)	SIL Exceedance (Yes / No)
NO_2	1-hour	212.42	7.5	Yes
	Annual	4.03	1	Yes
CO	1- hour	658.8	2,000	No
	8- hour	236.2	500	No
$PM_{2.5}$	24- hour	2.59	1.2	Yes
	Annual	0.30	0.3	Yes
PM_{10}	24- hour	3.24	5	No
SO_2	1- hour	3.85	7.8	No
	24- hour	1.11	5	No
	Annual	0.11	1	No

[a] Modeled impacts include stationary sources and LNG carriers at the LNG Terminal.

In the event that a potential NAAQS violation is identified, a source is not considered to have caused or contributed to the violation if its own impact from the modeling significance analysis is not significant (e.g., modeled impact is less than the SIL) at the violating receptor at the time of the predicted violation. If no simultaneous exceedance of the SIL and the NAAQS is found in this process, the modeling analysis demonstrates that the proposed LNG Terminal would not cause or contribute to the potential NAAQS exceedance.

In addition to NO_2, the analysis of air dispersion modeling for stationary sources and LNG carriers indicated that emissions of $PM_{2.5}$ would meet or exceed the SIL. Table 4.11.1-10 shows the results of this NAAQS assessment for stationary and mobile (LNG carrier) sources for pollutants with a SIL exceedance (see tables 4.11.1-8 and 4.11.1-9). The modeled concentrations at the LNG Terminal and mobile sources with the inclusion of background concentrations would not exceed the NAAQS.

Because the emissions from stationary and mobile sources would not exceed the NAAQS, the results of the NAAQS analysis required by the TCEQ (which only includes stationary sources at the LNG Terminal site, resulting in lower emissions estimates, and only addresses NO_2 emissions) are not included herein. Therefore, we conclude that the LNG Terminal and Compressor Station 3 would not cause or significantly contribute to an exceedance of the NAAQS.

Table 4.11.1-10
Summary of National Ambient Air Quality Standards Full Impact Analysis

Air Pollutant	Averaging Period	Maximum Impact (ug/m^3)[a]	Background + Modeled Impact (ug/m^3)[a,b]	SIL (ug/m^3)	NAAQS (ug/m^3)	NAAQS Exceedance? (Yes / No)
NO_2	1-hour	136.5	171.8	7.5	188	No
	Annual	4.03	7.83	1	100	No
$PM_{2.5}$	24-hour	1.98	27.68	1.2	35	No
	Annual	0.30	9.80	0.3	12	No

[a] Modeled impacts include stationary sources and LNG carriers at the LNG Terminal site. The pollutants included are those that exceed the SIL as presented in tables 4.11.1-8 and 4.11.1-9.

[b] Background concentrations based upon available background levels presented in table 4.11.1-2.

Secondary air quality standards are set under the CAA for the protection of public welfare, including protection against decreased visibility and damage to animals and vegetation, including crops. The NAAQS analysis demonstrated that the LNG Terminal would comply with applicable secondary NAAQS; therefore, any impacts on vegetation, animals, and other public welfare concerns would not be significant.In Texas, if a facility complies with visibility and opacity requirements specified in 30 TAC Chapter 111, no additional visibility impact analyses are required. RG LNG would comply with visibility and opacity requirements specified in 30 TAC Chapter 111.

Given the close proximity of the LNG Terminal site to the Palo Alto Battlefield, about 14.0 miles west of the LNG Terminal site, and Padre Island National Seashore, about 36.0 miles northeast of the LNG Terminal site, RG LNG prepared an assessment demonstrating maximum modeled ground-level concentrations for pollutants in relation to the NAAQS at the Palo Alto Battlefield at the request of the NPS. The results of this comparison are provided in table 4.11.1-11. Based on the NAAQS analysis in table 4.11.1-10 above, it is anticipated that no NAAQS exceedance would occur at Padre Island National Seashore from operation of the Project.

An additional visibility screening model was prepared using VISCREEN to assess potential visibility impacts on the Palo Alto Battlefield, since sources of air pollution can cause visible plumes if PM and NO_x emissions are large enough. The VISCREEN model was run using site-specific meteorological data and background visibility conditions from the Galveston Airport in Galveston County due to a similar location on the coast of the Gulf of Mexico with nearby industrial sites.

The results of the model are compared to criteria established for Class I areas (see section 4.11.1.2) to assess the visibility of a plume due to contrast with the viewing background. The results of the VISCREEN analysis indicate that Class I area thresholds would not be exceeded at the Palo Alto Battlefield during the day when the park is open for visitors.

Table 4.11.1-11
Summary of NAAQS Full Impact Analysis, Palo Alto Battlefield Receptors

Air Pollutant	Averaging Period	Maximum Modeled Result (ug/m^3) [a]	Background Value (ug/m^3) [b]	Modeled Result + background concentration (ug/m^3)	NAAQS (ug/m^3)
NO_2	1-hr	5.16	35.3	40.46	188
	Annual	0.05	3.8	3.85	100
CO	1-hr	41.77	1,257.6	1,299.37	40,000
	8-hr	13.08	800.3	813.38	10,000
$PM_{2.5}$	24-hr	0.09	25.7	25.79	35
	Annual	0.01	9.5	9.51	12
PM_{10}	24-hr	0.66	49.0	49.66	150
SO_2	1-hr	0.24	13.2	13.44	196
	24-hr	0.06	3.7	3.76	365
	Annual	0.002	0.08	0.08	80

[a] Modeled impacts include stationary sources and LNG carriers at the LNG Terminal site.
[b] Background concentrations based upon available background levels presented in table 4.11.1-2.

The State of Texas also requires a State Property Line Analysis for major sources and listed minor sources to demonstrate compliance with state standards for net ground-level concentrations of SO_2. Results of this analysis are provided in table 4.11.1-12, and show that operation of the Project would not result in the exceedance of any relevant standards. Public scoping comments expressed concern regarding impacts of operational emissions from the LNG Terminal on public health. The State of Texas requires a State Health Effects air quality analysis comparing predicted emissions with effects screening levels, which are used to evaluate potential effects as a result of exposure to air emissions. The results of RG LNG's State Health Effects modeling evaluation indicate that the Project emissions are below applicable effects screening levels, and therefore adverse health effects are not expected.

Table 4.11.1-12
SO_2 NAAQS Analysis Modeling Results for the Rio Grande LNG Terminal

Averaging Period	Maximum Concentration (ug/m^3)[b]	State Property Line Standard (ug/m^3)
30-minute SO_2	5.1	1,021
1-hour H_2SO_4	0.16	50
24-hour H_2SO_4	0.04	15

[a] Modeled results include stationary sources and LNG carriers.

Regional Ozone Impacts

Because the Rio Grande LNG Terminal is a major source of NO_x and VOC emissions, which are precursors to ozone, the potential ozone impact of the LNG Terminal and Compressor Station 3 was analyzed. RG LNG conducted photochemical modeling to determine the potential 8-hour ozone impact from LNG Terminal operations using the Comprehensive Air Quality Model with Extensions (CAMx) in accordance with the EPA's July 2015 Draft Single Source Ozone Guidance. RG LNG also assessed potential ozone impacts in accordance with the two-step screening process established by the TCEQ.

The CAMx model was run using a "base case" scenario of emissions; a "future year" scenario that would be representative of baseline conditions in Year 7, the year before the LNG Terminal would be fully operational; and an emissions scenario that included the Project (added to the future year scenario), thus allowing for a comparison of ozone levels before and after the Project is permitted and at full build-out. In accordance with the TCEQ screening process, RG LNG used national emissions inventory data to determine the ratio of NO_x to VOC in Cameron County, and found that the ambient air surrounding the LNG Terminal is NO_x limited for creation of ozone. Based on TCEQ guidance, RG LNG performed NO_x modeling to estimate the maximum predicted 8-hour concentration of ozone resulting from Project operations and found that the maximum 8-hour ozone impacts of the LNG Terminal and Compressor Station 3 were estimated to be 2.3 parts per billion (ppb) of ozone, which, when considered with the background ozone concentration of 57 ppb, would not result in an exceedance of 8-hour ozone standard of 70 ppb. Cameron County is currently in attainment for the ozone standard, and the Project is not expected to result a violation of the ozone standard or re-designation.

Staged Emissions Impacts

As described in section 2.3, the Project has been proposed in six staged construction phases where the LNG Terminal site would be developed over the course of about 7 years, with the first LNG train becoming operational in Year 4 of construction. Therefore, construction, commissioning and start-up, and operations would take place simultaneously and result in concurrent emissions of air pollutants. Using the air emissions estimates provided by RG Developers for routine operation of all six LNG Trains and Compressor Station 3 compressor units, we have estimated the staged operational emissions during each year that commissioning and construction would also take place. Table 4.11.1-13 summarizes the combined construction, commissioning, and operational emissions for the Rio Grande LNG Terminal, by year.

Table 4.11.1-13
Combined Construction, Commissioning and Start-up, and Operational Emissions for the Rio Grande LNG Terminal and Compressor Station 3 (tpy)[a,b]

Year	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	Total HAPs	CO_2e
Rio Grande LNG Terminal								
Year1[c]	12.0	18.6	2.0	589.4	60.0	0.7	0.2	653.8
Year 2[c]	69.7	111.4	11.8	1,199.5	125.8	4.2	1.2	9,711.0
Year 3[c]	129.1	184.6	23.5	1,157.2	126.9	6.7	1.7	17,206.7
Year 4	519.8	928.1	12.6	113.6	35.7	1,117.6	3.6	813,988.2
Year 5	1,430.3	1,811.6	24.5	213.4	166.0	1,027.9	23.5	3,449,204.0
Year 6	2,391.3	3,036.7	34.7	290.0	268.0	1,944.9	38.3	5,843,844.5
Year 7	3,207.2	3,887.1	40.4	396.7	383.0	2,105.8	55.4	8,216,659.2
Year 8[d]	2,987.7	3,231.2	43.7	410.5	409.7	647.6	60.2	8,195,333.8

[a] Annual construction emissions are presented in table 4.11.1-4; annual commissioning and start-up emissions are presented in table 4.11.1-6.

[b] Annual operations emissions for full build-out are presented in table 4.11.1-7, and annual operations emissions were estimated based on the schedule presented in table 2.3-1. We have assumed the following timeframes for full operations of each stage: Stage 1 in Q4 of Year 4; Stage 2 in Q1 of Year 5; Stage 3 in Q4 of Year 5; Stage 4 in Q2 of Year 6; Stage 5 in Q1 of Year 7; Stage 6 in Q3 of Year 7.

[c] Construction emissions only; no commissioning, start-up, or operations would take place.

[d] Full build-out operations emissions and emissions from worker commutes associated with commissioning the Project would occur in Year 8.

Based on the schedule provided by RG Developers, the emissions for Years 1 through 3 would be construction only with commissioning activities for the first LNG train beginning in Year 4. Each subsequent year (Years 5 through 7) results in emissions for construction, and commissioning and start-up, of each stage. Concurrent construction and commissioning and start-up emissions would be greater than full build-out operational emissions of NOx and CO in Year 7, during which construction would be ongoing for Stage 6, while Stages 1 through 5 would be operational beginning in the first quarter of the year. Similarly, concurrent VOC emissions, primarily due to commissioning and start-up emissions, would be greatest during Years 4 through 7. These concurrent emissions would temporarily impact local air quality during the staged construction, commissioning and start-up, and operations of the LNG Terminal, and could result in exceedances of the NAAQS in the immediate vicinity of the LNG Terminal during these construction years. However, 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. Therefore, these concurrent emissions would not have a long-term, permanent effect on air quality in the area. Further, the full build-out operational emissions from the LNG Terminal, as described above, would not result in an exceedance of the NAAQS.

Greenhouse Gas Emissions

Based upon the emission estimates summarized in table 4.11.1-7, the LNG Terminal and Compressor Station 3 would be a PSD major source of GHG emissions; therefore, RG Developers' PSD permit application included a BACT assessment for GHG emissions from the facility. RG Developers have committed to complying with the GHG BACT requirements, which would mitigate GHG emissions to the extent practicable. Public comments expressed concern over the level of GHGs that would be emitted by the Project, as well as impacts on climate change. Climate change is addressed in section 4.13.2.

Operational LNG Emissions Impact Conclusion

Based upon the entirety of our analysis, we conclude that operation of the LNG Terminal would not cause, or significantly contribute to, an exceedance of the NAAQS. During operation, we have determined that the Project would have minor impacts on the local and regional air quality, but would not result in regionally significant impacts on air quality. Concurrent emissions would temporarily impact local air quality during the staged construction, commissioning and start-up, and operations of the LNG Terminal, and could result in exceedances of the NAAQS in the immediate vicinity of the LNG Terminal during these construction years. These exceedances would not be persistent at any one time during these years due to the dynamic and fluctuating nature of construction activities within a day, week, or month.

Pipeline Facilities

Pipeline System

Construction

Construction of the Pipeline System would result in a temporary increase in emissions due to the combustion of fuel in vehicles and equipment, dust generated from excavation, grading and fill activities, and general construction activities (e.g., painting and welding). Construction emissions associated with pipeline construction would be minimal and localized to the construction area, which would predominantly occur in sparsely populated areas. Construction for Pipelines 1 and 2 would be expected to occur between Years 3 and 6. There would be an 18-month period between the end of construction on Pipeline 1 (expected to be complete in Year 4), and the start of construction on Pipeline 2 in Year 5. The Header System would be constructed at the same time as Pipeline 1. Construction emissions are summarized in table 4.11.1-14.

Table 4.11.1-14 Estimated Construction Emissions for the Pipeline System (tpy)[a]								
Facility and Year	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	Total HAPs	CO_2e
Pipeline 1 and Header System[b]								
Year 3	9.2	38.1	<0.1	804.7	80.6	0.9	0.4	4,600.4
Year 4	4.2	11.8	<0.1	637.9	63.9	0.5	0.2	2,628.4
Pipeline 2								
Year 5	5.6	18.6	<0.1	717.2	71.9	0.6	0.3	4,048.8
Year 6	3.8	16.7	<0.1	717.1	71.7	0.4	0.2	3,482.5

a Emissions estimates include construction emissions from on- and off-road vehicle activity, truck deliveries, worker commutes, and fugitive dust.

b The MLV sites and metering sites are included in the emission calculations for Pipelines 1 and 2 and the Header System.

To minimize construction air emissions, RB Pipeline would use the most fuel-efficient construction equipment available, and would use buses where feasible to minimize emissions from worker commutes. Further, RB Pipeline would use recent models of construction equipment, conduct regular inspections and emissions testing of construction vehicles, and limit idling of heavy equipment to less than 5 minutes to the extent practicable. To minimize fugitive dust emissions associated with construction of the pipeline facilities, RB Pipeline would implement the measures described in its draft Pipeline System Fugitive Dust Control Plan, including the following:

- applying water and/or a non-toxic chemical dust suppressant, alone or in combination with mulches, to areas of disturbance;
- using wind fences, berms, or covering material (e.g., gravel or textiles) on disturbed areas;
- using existing public and private roads and pipeline right-of-way for access during construction wherever possible;
- restricting speed in construction work areas, including restricting speed limits to 20 miles per hour on unsurfaced roads; and
- washing, wetting down, treating, or covering hauling equipment when necessary.

To ensure that the fugitive dust plan is adequate to minimize fugitive dust during the construction of both pipelines, and per our recommendation in section 4.2.2.1, RB Pipeline would provide its final Pipeline System Fugitive Dust Control Plan prior to commencing construction of the Pipeline System. Fugitive dust emissions would occur during the construction period and would subside once construction activities for any given Project component are complete. With the implementation of the measures described above and our recommendation, we have determined that fugitive dust emissions associated with construction of the Pipeline System are not expected to contribute to degradation of the NAAQS. Construction of the Pipeline System would occur over a much shorter duration than the LNG Terminal. While elevated emissions may occur near construction areas, impacts would be short-term and minor.

Operation

Fugitive emissions in the form of minor leaks from flanges, valves, and connectors could occur along the length of the pipeline route during operation. Fugitive emissions would be staged and increase over time as construction of the Project and equipment progressed. At full build-out, the Pipeline System would emit 2.7 tpy of VOC and 337.6 tpy of CO_2e. Emissions from the pipelines would be minor and dispersed over the entirety of the pipeline length. Therefore, we conclude that operation of the pipelines would not cause or significantly contribute to an exceedance of the NAAQs.

Aboveground Facilities

Construction

Construction of Compressor Stations 1 and 2 and Booster Stations 1 and 2 would result in a temporary increase in emissions due to combustion of fuel in vehicles and equipment, dust generated from excavation, grading and fill activities, and general construction activities (e.g., painting and welding). Emissions associated with construction of the metering sites and MLVs are included in emissions estimates for the pipeline facilities. All ground disturbance, grading, and fill activities associated with construction of the compressor stations and booster stations would be completed during Stage 1 of construction. Therefore, the highest construction emissions for the aboveground facilities would occur during Year 3.

Construction of Compressor Stations 1 and 2 would be expected to take place between the first quarter of Year 3 and the third quarter of Year 7. Construction of the compressor stations would occur intermittently, with compressor units being added at each station in coordination with the staged construction at the LNG Terminal site. Booster Stations 1 and 2 would be constructed between the first quarter of Year 3 and the first quarter of Year 4. Estimated emissions associated with the construction of each compressor station and booster station are summarized in table 4.11.1-15.

As previously referenced, standard EPA emission thresholds do not apply to construction emissions, and General Conformity applicability thresholds do not apply at the aboveground facility sites because the area is in attainment for all the NAAQS. The construction activities proposed in association with the facilities are comparable to 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 in the vicinity of active construction.

Table 4.11.1-15 Estimated Construction Emissions for the Aboveground Facilities (tpy)[a]								
Facility and Year	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	Total HAPs	CO_2e
Compressor Station 1								
Year 3	1.3	10.3	<0.1	3.8	0.4	0.3	<0.1	1,371.5
Year 4	0.1	0.7	<0.1	0.1	<0.1	<0.1	<0.1	114.8
Year 5	0.7	6.5	<0.1	0.4	<0.1	<0.1	<0.1	933.9
Year 6	0.7	5.8	<0.1	1.9	0.2	<0.1	<0.1	831.5
Year 7	0.4	4.4	<0.1	0.7	<0.1	<0.1	<0.1	642.8
Compressor Station 2								
Year 3	1.3	10.3	<0.1	3.5	0.4	0.3	<0.1	1,371.5
Year 4	0.1	0.7	<0.1	0.1	<0.1	<0.1	<0.1	114.8
Year 5	0.7	6.5	<0.1	0.4	<0.1	<0.1	<0.1	933.9
Year 6	0.7	5.8	<0.1	2.3	0.2	<0.1	<0.1	831.5
Year 7	0.4	4.4	<0.1	0.8	<0.1	<0.1	<0.1	642.8
Booster Station 1								
Year 3	1.3	10.3	<0.1	2.5	0.2	0.3	<0.1	1,371.5
Year 4	0.1	0.7	<0.1	0.1	<0.1	<0.1	<0.1	98.5
Booster Station 2								
Year 3	1.3	10.3	<0.1	2.5	0.2	0.3	<0.1	1,371.5
Year 4	0.1	0.7	<0.1	0.1	<0.1	<0.1	<0.1	98.5

[a] Emissions estimates include construction emissions from on- and off-road vehicle activity, truck deliveries, worker commutes, and fugitive dust.

Operation

Compressor Stations 1 and 2 would be constructed in stages, with additional compressor units being brought online over time in conjunction with development at the LNG Terminal. Once fully built, Compressor Stations 1 and 2 would each include six, 30,000-hp gas-fired compressor units with low NO_x burners which would operate on a continuous basis. One condensate tank would be kept on each site. Two backup natural gas fueled generator sets would be constructed at both facilities in order to temporarily provide electricity in the event of a power outage. Emissions would also result from fugitive losses associated with piping components, such as valves and seals.

Additionally, intermittent emissions would be generated from maintenance activities at the facilities such as pigging, blowdowns, and startup/shutdowns. Fugitive emissions would be staged and increase over time as construction of the Project and equipment progressed. Potential fugitive emissions that would be emitted for full build-out of each of the compressor stations would be 7.1 tpy of VOCs and 15,811 tpy of CO_2e.

Based on the emission estimates provided in table 4.11.1-16, Compressor Stations 1 and 2 would each be Title V major sources for CO and NO_x, with both exceeding the major source threshold of 100 tpy. The facilities would be considered a minor source of all other criteria pollutants, as well as HAP emissions. The individual HAPs with the greatest contribution to total HAPs emitted by the Project are presented in table in table 4.11-16 for reference; these include formaldehyde and the group of VOCs known collectively as BTEX (benzene, toluene, ethylbenzene, and xylene). Though Title V major sources for CO and NO_x, emissions would be below the NSR major source thresholds (see table 4.11.1-3). An ambient full impact analysis was performed for CO, NO_x, PM_{10}, $PM_{2.5}$, and SO_2 in comparison to the NAAQS for Compressor Stations 1 and 2. As identified in table 4.11.1-17, the modeled impacts with included background concentrations would not cause a NAAQS exceedance.

Booster Stations 1 and 2 would each include a single 30,000-hp natural gas turbine-driven compressor. One condensate tank would be constructed on each site. Emissions would also result from fugitive losses associated with piping components, such as valves and seals. Additionally, intermittent emissions would be generated from intermittent sources in the form of a backup natural gas fired generator and blowdown vent at each facility. Based on the emission estimates provided in table 4.11.1-18, Booster Stations 1 and 2 would not be Title V major sources, and all emissions at each facility would be below the PSD significant emission rates (see table 4.11.1-3). An ambient full impact analysis was performed for CO, NO_x, PM_{10}, $PM_{2.5}$, and SO_2 in comparison to the NAAQS at Booster Stations 1 and 2. As identified in table 4.11.1-19, the modeled impacts with included background concentrations would not cause an exceedance of the NAAQS. Therefore, we conclude that neither booster station would cause or significantly contribute to an exceedance of the NAAQS.

Elevated levels of air pollutants would occur during the period of construction, primarily from fugitive dust. However, through implementation of construction work practices and our recommendation in section 4.2.2.1 to finalize the Pipeline System Fugitive Dust Control Plan prior to construction, analysis of the estimated emissions from construction and operation, and an analysis of the modeled air quality impacts from operation of the pipeline facilities, we find there would be no significant impacts on air quality.

While construction of the Rio Grande LNG Project would result in localized minor to moderate elevated levels of fugitive dust and combustion emissions near the construction areas, impacts related to construction of the facilities would be limited to the construction period for the Project. Based upon the entirety of our analysis, we conclude that operation of the Rio Grande LNG Project would not cause, or significantly contribute to, an exceedance of the NAAQS. During operation, we have determined that the Project would have minor impacts on the local and regional air quality, but would not result in regionally significant impacts on air quality.

Table 4.11.1-16
Compressor Stations 1 and 2 Estimated Annual Emission Rates (tpy)[a]

Equipment	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	HAPs						CO_2e
							Formald-ehyde	Benzene	Toluene	Ethyl-benzene	Xylene	Total HAPs	
Compressor Station 1													
Gas turbines (6)	190.6	193.8	20.5	11.5	11.5	12.7	4.3	0.1	0.8	0.2	0.4	6.0	669,784
Backup generators (2)	0.6	0.6	0.0	<0.1	<0.1	0.1	0.1	0.0	<0.1	0.0	0.0	0.1	225
Condensate tank (1)	-	-	-	-	-	3.7	0.0	<0.1	<0.1	<0.1	<0.1	0.2	52
Fugitive emissions[b]	-	-	-	-	-	7.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	15,811
Pig receiving	-	-	-	-	-	-	-	-	-	-	-	-	-
Startup / shutdown (including blowdowns)	1.7	13.6	-	-	-	33.1	0.0	<0.1	<0.1	<0.1	<0.1	0.49	75,532
Compressor Station 1 Total	**192.9**	**208.0**	**20.5**	**11.5**	**11.5**	**56.7**	**4.4**	**0.1**	**0.8**	**0.2**	**0.4**	**6.8**	**761,404**
Compressor Station 2													
Gas turbines (6)	190.6	193.8	20.5	11.5	11.5	12.7	4.3	0.1	0.8	0.2	0.4	6.0	669,784
Backup generators (2)	0.6	0.6	0.0	<0.1	<0.1	0.1	0.1	0.0	<0.1	0.0	0.0	0.1	225
Condensate tank (1)	-	-	-	-	-	3.7	0.0	<0.1	<0.1	<0.1	<0.1	0.2	52
Fugitive emissions[b]	-	-	-	-	-	6.7	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	15,779
Pig receiving	-	-	-	-	-	0.2	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	392.0
Startup / shutdown (including blowdowns)	1.7	13.6	-	-	-	33.1	0.0	<0.1	<0.1	<0.1	<0.1	0.5	75,532
Compressor Station 2 Total	**192.9**	**208.0**	**20.5**	**11.5**	**11.5**	**56.5**	**4.4**	**0.1**	**0.8**	**0.2**	**0.4**	**6.8**	**761,764**

[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] Speciated HAPs were not provided by RG LNG for fugitive compressor station emissions; the emissions were estimated based on the ration of individual HAP weight percentage to the total VOC weight percentage for the gas analysis for the King Ranch Gas Plant provided by RG LNG

Table 4.11.1-17
Summary of Air Dispersion Modeling at Compressor Stations 1 and 2 and Comparison to NAAQS

Equipment	Averaging Time	Maximum Modeled Result (µg/m³)	Background Value[a] (µg/m³)	Modeled Result + Background Concentration (µg/m³)	NAAQS (µg/m³)
Compressor Station 1					
NO_2	1-hour	38.71	35.3	74.0	188.7
	Annual	2.74	3.8	6.5	100
CO	1-hour	49.71	1,257.6	1,307.3	40,000
	8-hour	38.91	800.3	839.2	10,000
$PM_{2.5}$	24-hour	2.28	25.7	28.0	35
	Annual	0.40	9.5	9.9	12
PM_{10}	24-hour	3.36	49.0	52.4	150
SO_2	1-hour	4.16	13.2	17.4	196
	24-hour	2.90	3.7	6.6	365
	Annual	0.29	0.08	0.4	80
Compressor Station 2					
NO_2	1-hour	10.0	35.3	45.3	188.7
	Annual	1.25	3.8	5.1	100
CO	1-hour	96.69	1,257.6	1,354.3	40,000
	8-hour	68.32	800.3	868.6	10,000
$PM_{2.5}$	24-hour	0.52	25.7	26.2	35
	Annual	0.18	9.5	9.7	12
PM_{10}	24-hour	0.67	49.0	49.67	150
SO_2	1-hour	1.08	13.2	14.3	196
	24-hour	0.51	3.7	4.2	365
	Annual	0.13	0.08	0.2	80

[a] Background concentrations are based upon available background levels presented in table 4.11.1-2.

.

Table 4.11.1-18
Booster Stations 1 and 2 Estimated Annual Emission Rates (tpy)[a]

Equipment	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	HAPs						CO_2e
							Formald-ehyde	Benzene	Toluene	Ethyl-benzene	Xylene	Total HAPs	
Booster Station 1													
Gas turbine (1)	31.8	32.3	3.4	1.9	1.9	2.1	0.7	<0.1	0.1	<0.1	0.1	1.0	111,631
Backup generators (1)	0.3	0.3	0.0	<0.1	<0.1	0.1	0.1	0.0	<0.1	0.0	0.0	0.1	112
Condensate tank (1)	-	-	-	-	-	3.7	0.0	<0.1	<0.1	<0.1	<0.1	0.2	52
Fugitive emissions [b]	-	-	-	-	-	7.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	15,811
Startup/shutdown (including blowdowns)	0.3	2.3	-	-	-	5.5	0.0	<0.1	<0.1	<0.1	<0.1	0.1	12,589
Booster Station 1 Total	**32.4**	**34.9**	**3.4**	**1.9**	**1.9**	**18.4**	**0.8**	**<0.1**	**0.1**	**<0.1**	**0.1**	**1.3**	**140,195**
Booster Station 2													
Gas turbine (1)	31.8	32.3	3.4	1.9	1.9	2.1	0.7	<0.1	0.1	<0.1	0.1	1.0	111,631
Backup generators (1)	0.3	0.3	0.0	<0.1	<0.1	0.1	0.1	0.0	<0.1	0.0	0.0	0.1	112
Condensate tank (1)	-	-	-	-	-	3.7	0.0	<0.1	<0.1	<0.1	<0.1	0.2	52
Fugitive emissions [b]	-	-	-	-	-	7.1	0.0	<0.1	<0.1	<0.1	<0.1	<0.1	15,811
Startup/shutdown (including blowdowns)	0.3	2.3	-	-	-	5.5	0.0	<0.1	<0.1	<0.1	<0.1	0.1	12,589
Booster Station 2 Total	**32.4**	**34.9**	**3.4**	**1.9**	**1.9**	**18.4**	**0.8**	**<0.1**	**0.1**	**<0.1**	**0.1**	**1.3**	**140,195**

[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] Speciated HAPs were not provided by RG LNG for fugitive compressor station emissions; the emissions were estimated based on the ration of individual HAP weight percentage to the total VOC weight percentage for the gas analysis for the King Ranch Gas Plant provided by RG LNG.

Table 4.11.1-19 Summary of Air Dispersion Modeling at Booster Stations 1 and 2 and Comparison to NAAQS					
Equipment	**Averaging Time**	**Maximum Modeled Result ($\mu g/m^3$)**	**Background Value[a] ($\mu g/m^3$)**	**Modeled Result + Background Concentration ($\mu g/m^3$)**	**NAAQS ($\mu g/m^3$)**
Booster Station 1					
NO_2	1-hr	2.35	35.3	37.7	188
	Annual	0.20	3.8	4.0	100
CO	1-hr	31.84	1,257.6	1,289.4	40,000
	8-hr	26.27	800.3	826.6	10,000
$PM_{2.5}$	24-hr	0.14	25.7	25.8	35
	Annual	0.08	9.5	9.6	12
PM_{10}	24-hr	0.18	49.0	49.2	150
SO_2	1-hr	0.36	13.2	13.6	196
	24-hr	0.14	3.7	3.8	365
	Annual	0.026	0.08	0.1	80
Booster Station 2					
NO_2	1-hr	2.39	35.3	37.7	188
	Annual	0.20	3.8	4.0	100
CO	1-hr	28.40	1,257.6	1,286.0	40,000
	8-hr	24.80	800.3	825.1	10,000
$PM_{2.5}$	24-hr	0.25	25.7	26.0	35
	Annual	0.08	9.5	9.6	12
PM_{10}	24-hr	0.35	49.0	49.4	150
SO_2	1-hr	0.37	13.2	13.6	196
	24-hr	0.14	3.7	3.8	365
	Annual	0.026	0.08	0.1	80
[a] Background concentrations based upon available background levels presented in table 4.11.1-2.					

4.11.2 Noise

The noise environment can be affected during both construction and operation of a project. The magnitude and frequency of environmental noise may vary considerably over the course of the day, throughout the week, and across seasons, in part due to changing weather conditions and the effects of seasonal vegetation cover. This section identifies the potential Project-related sources and magnitude of noise, and discusses the change in noise attributable to construction and operation of the Project.

Sound is a sequence of waves of pressure that propagates through compressible media such as air or water. When sound becomes excessive, annoying, or unwanted, it is referred to as noise. Public scoping comments expressed concern regarding noise associated with the Project, including potential disruptions to wildlife (see sections 4.6.1 and 4.7) and residences (see section

4.11.2.3). The ambient sound level of a region is defined by the total noise generated within the specific environment and usually comprises natural and man-made sounds.

Two measurements used by some federal agencies to relate the time-varying quality of environmental noise to its known effects on people are the equivalent sound level (L_{eq}) and the day-night sound level (L_{dn}). The preferred single value figure to describe sound levels that vary over time is L_{eq}, which is defined as the sound pressure level of a noise fluctuating over a period of time, expressed as the amount of average energy. L_{dn} is defined as the 24-hour average of the equivalent average of the sound levels during the daytime (from 7:00 a.m. to 10:00 p.m.) and the equivalent average of the sound levels during the nighttime (10:00 p.m. to 7:00 a.m.). Specifically, in the calculation of the L_{dn}, late night and early morning (10:00 p.m. to 7:00 a.m.) noise exposures are increased by 10 dB to account for people's greater sensitivity to sound during nighttime hours. In general, if the sound energy does not vary over the given time period, the L_{dn} level will be equal to the L_{eq} level plus 6.4 dB. The 6.4 dB difference between the L_{dn} and the L_{eq} is a result of the 10 dB nighttime addition for the L_{dn} calculation. In addition, the maximum sound level observed during a measurement period or noise event (L_{max}) is used to describe sound levels associated with pile-driving.

Decibels are the units of measurement used to quantify the intensity of noise. To account for the human ear's sensitivity to low level noises the decibel values are corrected to weighted values known as decibels on the A-weighted scale (dBA). The A-weighted scale is used because human hearing is less sensitive to low and high frequencies than mid-range frequencies. Table 4.11.2-1 demonstrates the relative dBA noise levels of common sounds measured in the environment and industry. A 3 dB change of sound level is considered to be barely perceivable by the human ear, a 5 or 6 dB change of sound level is considered noticeable, and a 10 dB increase is perceived as if the sound intensity has doubled.

4.11.2.1 Noise Regulations

Federal Regulations

In 1974, the EPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (EPA 1974). This publication evaluated the effects of environmental noise with respect to health and safety. The document provides information for state and local governments to use in developing their own ambient noise standards. The EPA has determined that, to protect the public from activity interference and annoyance outdoors in residential areas, noise levels should not exceed an L_{dn} of 55 dBA. We have adopted this criterion (18 CFR 157.206(b)(5)) for new compression and associated pipeline facilities, and it is used here to evaluate the potential noise effects from construction and operation of the LNG Terminal and pipeline facilities. An L_{dn} of 55 dBA is equivalent to a continuous noise level of 48.6 dBA for facilities that operate at a constant level of noise. Additionally, Section 380.12(k)(4)(v)(B) of FERC's regulations indicates new compressor stations or modifications of existing stations shall not result in a perceptible increase in vibration at any noise sensitive area (NSA).

Table 4.11.2-1 Sound Levels and Relative Loudness			
Noise Source or Activity	**Sound Level (dBA)**	**Subjective Impression**	**Relative Loudness (perception of different sound levels)**
Jet aircraft takeoff from carrier (50 feet)	140	Threshold of pain	64 times as loud
Loud rock concert near stage	120	Uncomfortably loud	16 times as loud
Jet takeoff (2,000 feet)	100	Very loud	4 times as loud
Garbage disposal / food blender (2 feet)	80	Loud	Reference loudness
Vacuum cleaner (10 feet)	70	Moderate	1/2 as loud
Light auto traffic (100 feet)	50	Quiet	1/8 as loud
Quiet library, soft whisper (15 feet)	30	Very quiet	1/32 as loud
Wilderness with no wind or animal activity	25	Extremely quiet	--
	0	Threshold of hearing	--
Source: Barnes et al. 1977, EPA 1971.			

State and Local Regulations

The State of Texas does not have any state regulations that apply to noise. Additionally, no towns near the LNG Terminal site or in counties crossed by the Pipeline System were identified to have any restricting regulations. The Project is located outside the city of Brownsville; therefore, the Brownsville Noise Ordinance (Chapter 46, Article III, Brownsville, Texas, Code of Ordinances n.d.) is not applicable to the Project.

4.11.2.2 Existing Sound Levels and Noise Sensitive Areas

RG Developers estimated baseline sound levels near the proposed LNG Terminal site, compressor stations, booster stations, and HDD entry and exit sites by conducting acoustical assessments. As Compressor Station 3 would be within the footprint of the LNG Terminal, sound produced during its construction and operation are included in the estimates for the terminal. Nearby NSAs, which include residences, hospitals, and schools, were identified to determine the Project's potential sound contribution during construction and operation. RG LNG also assessed ambient sound levels at "check point" locations that do not meet the definition of an NSA, but are potentially sensitive to sound level impacts, such as cultural sites and important wildlife areas in the Project vicinity (i.e., Palmito Ranch Battlefield, Palo Alto Battlefield, piping plover critical habitat, the wildlife corridor crossing SH-48, and the Laguna Atascosa NWR).

LNG Terminal

RG LNG conducted noise surveys in July 2015 and September 2016 to characterize the existing noise environment at the NSAs and other sensitive sites nearest to the LNG Terminal site. During surveys, two 10- to15-minute measurements of L_{eq} were taken at each survey site: one during the daytime and one at night. The results of the ambient noise survey, as well as the distance and direction of each identified NSA from the center of the LNG Terminal site, are provided in table 4.11.2-2.

Table 4.11.2-2
Existing Sound Levels at Noise Sensitive Areas Near the Rio Grande LNG Terminal

NSA	Distance from LNG Terminal Site (Miles)[a]	Direction from LNG Terminal Site	Average Daytime L_{eq} (dBA)[b]	Average Nighttime L_{eq} (dBA)[c]	Calculated L_{dn} (dBA)
NSA 1	4.3	South	46.9	55.5	61.3
NSA 2	3.7	Northeast	52.4	50.1	56.9
NSA 3	3.7	Northeast	45.8	44.4	51.0
NSA 4	3.9	Northeast	50.2	52.8	58.9
Palmito Ranch Battlefield[d]	5.4	Southwest	44.2	41.2	48.2
Palo Alto Battlefield[e]	14.0	West	50.0	41.0	50.4
Laguna Atascosa NWR	0.5	West	56.7	52.5	59.8
Piping Plover Critical Habitat	0.5	South	54.9	45.2	55.0
Wildlife Corridor	2.4	Southwest	67.8	60.2	68.9

a Measurements were taken at multiple locations; the nearest to the LNG Terminal site center is presented here.
b The L_{eq} is the average of measured daytime hourly noise levels between 7:00 a.m. and 10:00 p.m.
c The L_{eq} is the average of measured nighttime hourly noise levels between 10:00 p.m. and 7:00 a.m.
d The measurement location for the Palmito Ranch Battlefield is the observation area within the National Historic Landmark.
e Due to restricted nighttime access, daytime measurements were collected at the Palo Alto Battlefield observation area, and nighttime measurements were collected at the entrance to the site.

NSA 1 is a residence about 4.3 miles southeast of the center of the LNG Terminal site. NSA 2 is Port Isabel High School, which is adjacent to the Laguna Heights residential area, located about 3.7 miles northeast of the center of the LNG Terminal site. NSA 3 includes residences in Port Isabel, about 3.7 miles northeast of the Terminal site, and NSA 4 includes residences on Long Island, about 3.8 miles east of the center of the LNG Terminal site. The observation platform at the Palmito Ranch Battlefield, located about 5.4 miles southwest of the LNG Terminal site, and the observation area at the Palo Alto Battlefield, about 14.0 miles west of the LNG Terminal site center, were calculation point locations also considered for the analysis. These sites are described in more detail in section 4.10.2. RG LNG also assessed noise impacts for calculation point locations that provide wildlife and threatened and endangered species habitat, including the Laguna Atascosa NWR, the wildlife corridor, and designated critical habitat; impacts on wildlife and threatened and endangered species, including noise impacts, are further addressed in sections 4.6.1 and section 4.7, respectively. NSA and calculation point locations are depicted on figure 4.11.2-1.

Pipeline Facilities

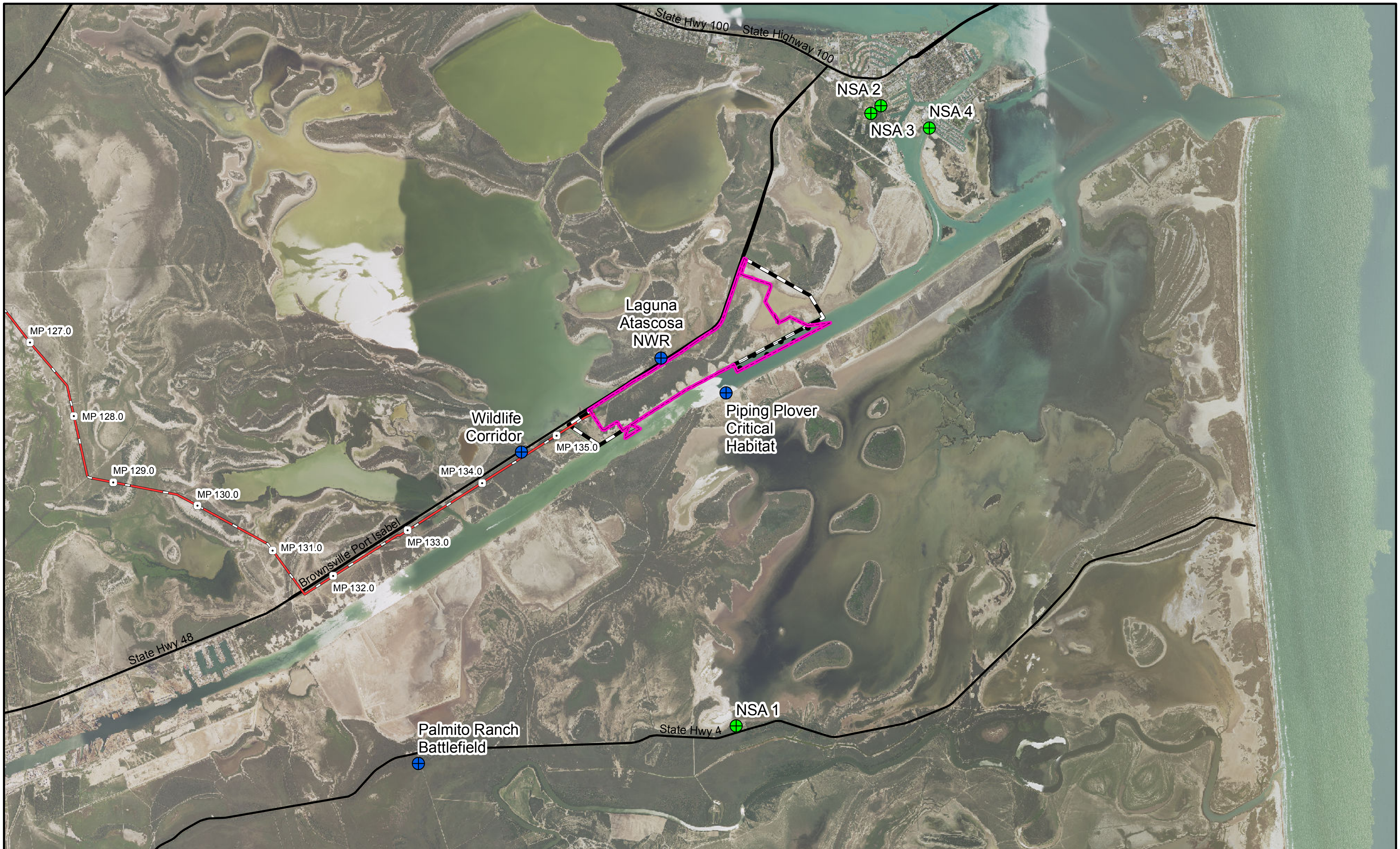
RB Pipeline conducted noise surveys in September 2016 and January 2018 to characterize the existing noise environment at the NSAs nearest to each compressor station and booster station site. Ambient sound levels measured at the NSAs identified near the compressor and booster stations are provided in table 4.11.2-3.

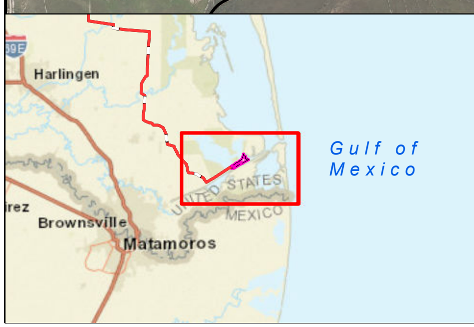
Table 4.11.2-3
Existing Sound Levels at Noise Sensitive Areas Near Compressor Stations and Booster Stations

NSA	Distance from Station (miles)	Direction from Station	Average Daytime L_{eq} (dBA)[a]	Average Nighttime L_{eq} (dBA)[b]	Existing Ambient L_{dn} (dBA)
Compressor Station 1[c]					
NSA 2	5.5	West	38.3	46.4	52.3
Compressor Station 2					
NSA 1	2.9	South	63.3	60.8	67.7
Booster Station 1					
NSA 1	1.7	East	60.0	61.3	67.5
Booster Station 2					
NSA 1	2.4	North	31.9	50.1	55.9

[a] The L_{eq} is the average of measured daytime hourly noise levels between 7:00 a.m. and 10:00 p.m.
[b] The L_{eq} is the average of measured nighttime hourly noise levels between 10:00 p.m. and 7:00 a.m.
[c] NSA 1 is identified in the vicinity of Compressor Station 1. During initial assessments, a site was identified as NSA 1; however, the site is a hunting lodge and is not a permanent residence; therefore, the site does not meet the definition of an NSA and was removed from analysis.

Similarly, RB Pipeline conducted noise surveys in September 2016 and January and February 2018 to measure ambient sound levels at the NSAs nearest to each proposed HDD. Table 4.11.2-4 includes the ambient sound levels at the nearest NSAs to each HDD entry and exit site. Several HDDs have no NSAs within 0.5 mile; at those locations, ambient sound levels are estimated at the nearest NSAs.





Legend

- Noise Sensitive Areas
- Check Points
- Proposed LNG Terminal Boundary
- BSC Dredge Areas
- LNG Terminal Site
- Proposed Rio Bravo Pipeline

AERIAL IMAGERY: NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP) 2014 - http://datagateway.nrcs.usda.gov/.

N

0 1 2
Miles

Scale: 1:100,000

Rio Grande LNG Project

Noise Sensitive Areas Near
the Rio Grande LNG Terminal

Figure 4.11.2-1

Table 4.11.2-4 Existing Sound Levels at Noise Sensitive Areas Near HDD Construction					
NSA	**Distance from HDD Entry Point (miles)**	**Direction from HDD Entry Point**	**Average Daytime L_{eq} (dBA)[a]**	**Average Nighttime L_{eq} (dBA)[b]**	**Existing Ambient L_{dn} (dBA)[c]**
Los Olmos Creek HDD (MP 18.8)					
NSA 1	1.5	Northwest	60.0	61.3	67.5
Unnamed waterbody SS-T10-011 HDD (MP 77.6)					
NSA 1	0.8	Southeast	47.6	50.7	56.8
NSA 2	0.9	Southwest	60.0	40.7	58.3
Unnamed waterbody SS-T10-010 HDD (MP 79.0)					
NSA 1	1.0	Southwest	47.6	50.7	56.8
NSA 2	1.1	Southwest	44.8	45.8	52.1
East Main Drain SS-T10-003 HDD (MP 82.0)					
NSA 1	1.0	South	56.6	44.1	55.8
NSA 2	1.4	Southwest	56.4	42.6	55.3
Donna Drain HDD (MP 86.5)					
NSA 1	1.1	West	49.3	44.4	51.9
NSA 2	1.5	Southwest	49.1	55.0	60.9
Unnamed waterbody SS-T04-005 HDD (MP 92.0)					
NSA 1	0.8	Southeast	67.8	55.1	67.0
NSA 2	0.9	Southeast	55.0	32.7	53.1
North Floodway SS-T02-004 HDD (MP 93.0)					
NSA 1	0.2	Northwest	59.4	57.1	63.9
NSA 2	0.2	Northeast	62.9	40.3	61.0
Unnamed waterbody SS-T04-008 HDD (MP 94.6)					
NSA 1	1.1	Southwest	43.7	49.1	55.0
NSA 2	1.8	Northwest	53.4	48.9	56.3
Unnamed waterbody SS-T04-006 HDD (MP 98.7)					
NSA 1	1.2	Southeast	51.2	43.8	52.4
Arroyo Colorado HDD (MP 99.8)					
NSA 1	0.5	Northeast	50.5	38.5	49.9
NSA 2	0.6	South	38.7	36.8	43.5
Unnamed waterbody SS-T14-004 HDD (MP 101.2)					
NSA 1	0.2	West	69.4	55.1	68.2
NSA 2	0.5	North	47.1	29.9	45.5
San Vincente Drainage SS-T08-001 Ditch HDD (MP 102.0)					
NSA 1	0.5	Northeast	47.3	47.1	53.5
NSA 2	0.9	Southwest	41.1	36.6	44.0

Table 4.11.2-4 (continued) Existing Sound Levels at Noise Sensitive Areas Near HDD Construction					
NSA	**Distance from HDD Entry Point (miles)**	**Direction from HDD Entry Point**	**Average Daytime L_{eq} (dBA)[a]**	**Average Nighttime L_{eq} (dBA)[b]**	**Existing Ambient L_{dn} (dBA)[c]**
Unnamed waterbody SS-T04-007 HDD (MP 115.6)					
NSA 1	0.9	Southwest	74.0	58.2	72.6
NSA 2	1.0	Southwest	69.1	61.0	69.9
Unnamed waterbody SS-T05-003 HDD (MP 116.4)					
NSA 1	0.8	West	69.1	36.7	67.1
NSA 2	0.9	West	67.0	58.0	67.4
Resaca de los Cuates HDD (MP 118.7)					
NSA 1	0.7	East	46.9	45.2	51.9
NSA 2	0.8	Southwest	38.0	38.0	44.4
Unnamed waterbody SS-T09-008 HDD (MP 124.0)					
NSA 1	0.6	North	47.1	52.4	58.3
NSA 2	1.2	Northwest	61.4	59.3	66.1
Unnamed waterbody SS-T09-001 HDD (MP 130.5), Channel to San Martin Lake HDD (MP 132.9), Channel to Bahia Grande HDD (MP 134.5)[c]					
NSA 1 (Palmito Ranch Battlefield)[c]	2.6	South	44.2	41.2	48.2

[a] The L_{eq} is the average of measured daytime hourly noise levels between 7:00 a.m. and 10:00 p.m.
[b] The L_{eq} is the average of measured nighttime hourly noise levels between 10:00 p.m. and 7:00 a.m.
[c] The exit point for the Channel to San Martin Lake HDD is the nearest HDD entry or exit point to the NSA.

4.11.2.3 Impacts and Mitigation

LNG Terminal

Construction

RG LNG anticipates that construction activities at the LNG Terminal site would be staggered, occurring over the course of 7 years. Construction would take place predominantly during the day, between 7:00 a.m. and 7:00 p.m., Monday through Friday, and site preparation and some other activities (including pile-driving) would be limited to daytime hours. However, dredging may take place up to 24 hours per day, 7 days per week. Construction activities at the LNG Terminal site would include clearing and grading associated with site preparation; materials and equipment delivery; installation of the facility foundations (e.g., pile-driving) and LNG trains; construction of the loading and ship berthing facilities, LNG storage tanks and processing facilities, and LNG truck loading facilities; and site restoration, as described in detail in section 2.5.1. In addition, activities associated with the construction of Compressor Station 3 are included in the sound level impacts at the LNG Terminal site.

The most prevalent noise-generating equipment and activity during construction of the LNG Terminal is anticipated to be pile-driving, although internal combustion engines associated with general construction equipment and dredging would also produce sound that would be perceptible in the vicinity of the site. The various types of construction activities proposed at the LNG Terminal site and associated noise levels are described below.

Dredging Activities

Dredging activities would occur in two different phases. Prior to construction of the LNG Terminal, the MOF would be dredged using a single, small-sized cutter suction dredge attached to one tugboat. Dredging during this phase would be expected to last about 2 weeks, and would be conducted 24 hours per day, 7 days a week. RG LNG has estimated that sound levels associated with dredging activities at the MOF would be about 83.5 dBA at a distance of 50 feet. Predicted sound levels at the nearest NSA to the MOF (NSA 3) would be about 34.3 dBA, which is below existing ambient sound levels. Given the predicted noise levels and the distance to the nearest NSAs, we do not expect that noise associated with dredging of the MOF would be perceptible at the nearest NSAs.

For construction of Berths 1 and 2 and the Turning Basin, RG LNG plans to use one large cutter suction dredge and two tugboats; however, if conditions require, RG LNG may utilize clamshell mechanical dredges. RG LNG's Dredged Material Management Plan is being developed, and the proposed dredging methods would be finalized in consultation with the BND and federal and state agencies. These dredging activities would be conducted over a period of 14 months. RG LNG has estimated sound levels associated with use of one large size cutter suction dredge and two associated tugboats to be 90.5 dBA at 50 feet, and about 36.8 dBA at the nearest NSA to the marine berths and turning basin (NSA 1). The sound level associated with two tugboats and clamshell mechanical dredges operating simultaneously would be about 85.8 dBA at 50 feet, and 34.1 dBA at NSA 1. Given the predicted noise levels and the distance to the nearest NSAs, and because the estimated sound level at the nearest NSAs would be below existing ambient sound levels, noise associated with dredging activities is not expected to be perceptible. The sound contributions from hydraulic dredging are included in the facility construction activity estimates provided in table 4.11.2-6.

Pile-driving Activities

RG LNG anticipates conducting pile-driving operations to support the land-based structures (liquefaction trains and related facilities), as well as during construction of the MOF, Berth 1 jetty and associated fixed aid to navigation, and Berth 2 jetty. The majority of pile-driving would be conducted on land; however, the sheet piling associated with the MOF and a total of four piles would be driven in water (two at the MOF and two for the fixed aid to navigation at the Berth 1 jetty). Steel pipe piles and concrete piles would be driven with impact hammers; however, RG LNG has committed to using vibratory hammers to reduce noise attenuation in the water and air for driving sheet pilings at the MOF. Impact hammers produce an impulsive (short, intense) noise source, while vibratory hammers produce continuous noise, but typically lower levels. Pile-driving would take place primarily on dry land, with only the MOF and fixed aid to navigation structure requiring minimal aquatic operations (see section 2.5.1.3).

Table 4.11.2-5
Pile-driving Noise Estimates for Impact-driven Piles During Construction of the Rio Grande LNG Terminal

Location	Existing Average Daytime L_{eq} (dBA)	Pile-driving at the Marine Berths and Turning Basin			Pile-driving at the MOF			Pile-driving for Foundations at the LNG Terminal Site		
		Distance (miles)[a]	Sound Level (dBA L_{max}[b])	Expected Increase over Ambient (dB)	Distance (miles)[a]	Sound Level (dBA L_{max}[b])	Expected Increase over Ambient (dB)	Distance (miles)[a]	Sound Level (dBA L_{max}[b])	Expected Increase over Ambient (dBA)
NSA 1	46.9	4.3	52.6	6.7	3.6	54.0	7.9	4.1	53.0	7.0
NSA 2	52.4	3.7	53.9	3.8	4.5	52.3	2.9	3.6	54.0	3.9
NSA 3	45.8	2.8	56.4	11.0	4.7	51.8	7.0	3.7	53.8	8.6
NSA 4	50.2	2.9	56	6.8	4.9	51.4	3.7	3.9	53.4	4.9

[a] Distance to the NSA is based on the distance from the proposed pile-driving for each facility, and therefore differs from the distance between the NSA and the LNG Terminal site center presented in table 4.11.2-2.

[b] L_{max} has been calculated assuming three simultaneous pile-driving operations, the maximum available.

RG LNG estimates that L_{max} for three pile drivers operating simultaneously would be 99 dBA at 50 feet; this value is adjusted by a usage factor to account for the intermittent use of equipment during construction. Based upon the construction schedule provided by RG LNG (see table 2.3-1 and section 2.5.1.3), land-based, impact pile-driving operations for the first stage of construction (including LNG Train 1 and related offsite utilities) would require between 114 and 165 days; each subsequent stage of construction would require less time. In addition, impact pile-driving at the MOF would occur over a period of 3 months. Construction of the Berth 1 jetty would require about 35 days of pile-driving that would take place over a 5-month period; the timeframe for pile-driving at the Berth 2 jetty would be similar. RG LNG anticipates that in-water pile-driving at the MOF and fixed aid to navigation structure would take 2 days each. Table 4.11.2-5 provides estimates of pile-driving noise based upon the various proposed pile-driving scenarios using an impact pile-driver.

All pile-driving operations are scheduled to occur over 8- to 10-hour shifts, during the daytime, 5 days a week. During pile-driving at the Berth 1 jetty, and later at the Berth 2 jetty, the highest expected sound level would occur at nearby NSA 3 when three impact pile-driving platforms are simultaneously in use (56.4 dBA L_{max}). This level corresponds to a quiet-to-moderate sound level (similar to light auto traffic at 100 feet) on the Relative Loudness Scale presented in table 4.11.2-1, and would result in an 11 dB increase over ambient sound levels at NSA 3, a perceived doubling of noise. However, this level is a conservative estimate, since it is unlikely that the strikes from three pile-drivers would be simultaneous, and it is not adjusted for a usage factor. Construction equipment, particularly impact activities such as pile-driving, also generates vibrations that can pass through the ground and cause damage to structures. Vibration levels detectable to humans generally do not extend beyond about 500 feet from pile-driving activities (Maekawa 1994). As described above, the nearest NSAs range is from about 2.8 miles to 4.9 miles from the proposed pile-driving locations. No structures are present within 500 feet of the proposed pile-driving sites, and structural effects are not anticipated from vibration during construction.

Construction of the LNG Terminal, particularly pile-driving, would also result in the generation and propagation of underwater sound energy. Pile-driving impacts on aquatic organisms and monitoring and mitigation for underwater sound are discussed in section 4.6.2; impacts on marine mammals and associated mitigation are addressed in section 4.7.2.2. To ensure that actual noise from pile-driving is not significantly greater than predicted noise, and because sound from pile driving is expected to result in an increase of more than 10 dBA over daytime L_{eq} ambient levels at NSA 3, **we recommend that:**

- **RG LNG should monitor pile-driving activities, and file <u>weekly</u> noise data with the Secretary <u>following the start of pile-driving activities</u> that identify the noise impact on the nearest NSAs. If any measured noise impacts (L_{max}) at the nearest NSAs are greater than 10 dBA over the L_{eq} ambient levels, RG LNG should:**

  a. cease pile-driving activities and implement noise mitigation measures;

  b. file with the Secretary evidence of noise mitigation installation; and

c. **file with the Secretary documentation that the noise mitigation measures reduced the noise levels at the nearest NSA to less than 10 dBA over L_{eq} background levels.**

RG LNG should not resume pile-driving activities until receipt of written notification from the Director of OEP that pile-driving may resume.

Site Preparation and Building Construction Activities

Noise levels resulting from construction would vary over time and would depend upon the number and type of equipment operating, the level of operation, and the distance between sources and receptors. RG LNG estimated the composite noise levels for site preparation (clearing and grading) and facility construction (which would occur after clearing and grading) based on construction equipment needs for these two activities. A composite noise level is typically used to describe the overall noise generated by multiple noise-generating units operating at the same time. Table 4.11.2-6 estimates the calculated combined ambient and construction-related sound levels at each NSA and in the vicinity of the LNG Terminal site. Sound pressure levels are measured on a logarithmic scale; therefore, although the construction noise would, at times, be perceptible at the NSAs, it would not be substantially above existing daytime noise levels. Further, a usage factor was used for each planned activity (including pile-driving) to account for the intermittent use of equipment during construction.

The nearest NSAs to the LNG Terminal site, NSAs 2 and 3, are about 3.7 miles to the northeast. During site preparation activities, the composite noise level at the NSAs 2 and 3 are estimated to be 50.2 dBA and 46.1 dBA, respectively; during facility construction, the composite noise level at the NSAs 2 and 3 are estimated to be 52.2 dBA and 37.1 dBA. The current daytime noise level at NSAs 2 and 3, respectively, are 52.4 dBA and 45.8 dBA (see table 4.11.2-2). As stated above, site preparation and construction activities would be limited to daytime hours.

RG LNG also evaluated the potential for noise effects on the Palmito Ranch Battlefield and the Palo Alto Battlefield resulting from the construction of the LNG Terminal. Results indicate that construction and operational sound would not be audible at the Palo Alto Battlefield, given the distance from the terminal site (about 14.0 miles). However, a minor increase above the ambient sound level (0.2 dB or less) during construction would occur at the Palmito Ranch Battlefield, which is about 5.4 miles from the terminal site. The sound level increase at the Palmito Ranch Battlefield would be below 3 dB and would not likely be perceptible.

Based upon the construction noise estimates provided by RG LNG, the maximum noise levels generated by construction activities would increase the existing daytime noise at the nearest NSAs; however, with the exception of construction at NSA 2, combined ambient and construction sound levels would not exceed the 55 dBA L_{dn} threshold. The increased sound from construction at NSA 2 would be less than 3 dB, and therefore would not be perceptible. We have included a recommendation to address the potential for pile-driving activities to exceed the 55 dBA L_{dn} threshold at the NSAs. However, due to the predicted 0.2- to 5.4-dB increases estimated during construction, we conclude that impacts on residents and the surrounding communities would be minor to moderate during construction of the LNG Terminal.

Table 4.11.2-6
Estimated Noise Level Contributions for Site Preparation and Construction of the Rio Grande LNG Terminal at Nearby Noise Sensitive Areas

Location	Distance from LNG Terminal Site (miles)	Direction from LNG Terminal Site	Existing Daytime Ambient (dBA)	Contribution L_{max} (dBA)		Combined Existing and Construction Noise Level L_{max} (dBA)		Expected Increase (dBA)	
				Site Preparation	Construction	Site Preparation	Construction	Site Preparation	Construction
NSA 1	4.3	South	46.9	48.9	50.9	51.0	52.3	4.1	5.4
NSA 2	3.7	Northeast	52.4	50.2	52.2	54.4	55.3	2.0	2.9
NSA 3	3.7	Northeast	45.8	46.1	37.1	48.9	46.3	3.1	0.5
NSA 4	3.9	Northeast	50.2	45.7	36.7	51.5	50.4	1.3	0.2
Palmito Ranch Battlefield	5.4	Southwest	44.2	42.9	33.9	46.6	44.6	2.4	0.4
Palo Alto Battlefield	14.0	West	50.0	34.7	25.7	50.1	50.0	0.1	0.0

Operation

Operation of the LNG Terminal would produce noise on a continual basis. RG Developers modeled sound levels that would be generated by operation of the LNG Terminal using sound level data for the proposed equipment that were obtained through vendors or from measurements at other LNG facilities. Major noise producing sources include air cooled heat exchangers, compressors and associated components, pumps, and aboveground piping. Intermittent noise could also occur due to flaring.

A list of estimated equipment quantities and sound power levels used in the modeling is provided in table 4.11.2-7. Table 4.11.2-8 presents the results of the modeling, along with a comparison with the existing ambient sound level, the expected sound level during operation of the LNG Terminal and Compressor Station 3 compared to the ambient sound level, and the resulting increase in ambient sound level due to operation of the LNG Terminal. Based on these estimates, the noise generated by the operation of the LNG Terminal is likely to be imperceptible at nearby NSAs and the Palmito Ranch and Palo Alto Battlefield calculation points, with noise level increases ranging between 0.1 and 0.4 dB. Figure 4.11.2-2 depicts sound contours for operation of the LNG Terminal.

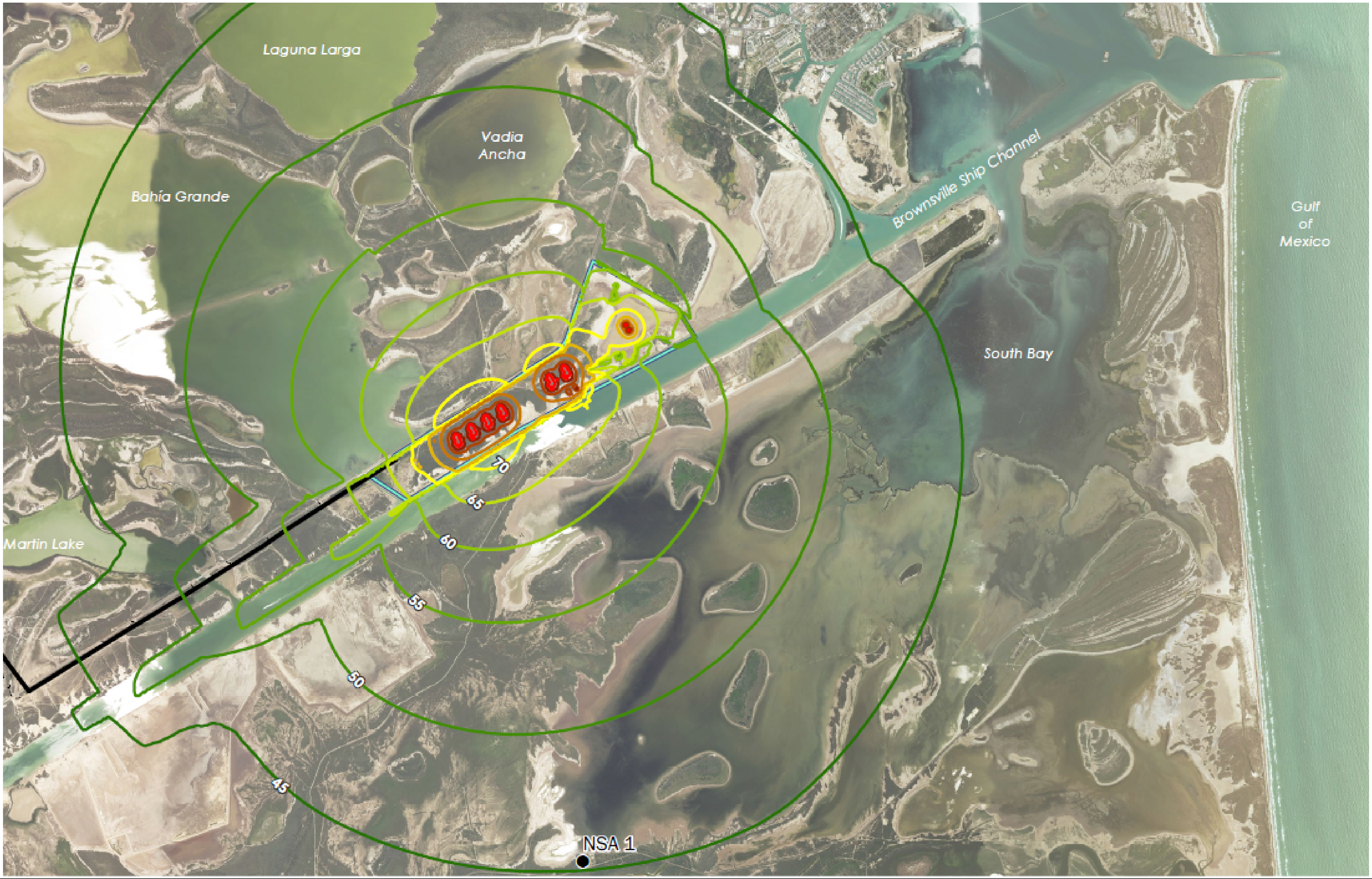
Table 4.11.2-7
Equipment Quantities and Sound Power Levels at the Rio Grande LNG Terminal

Equipment	Quantity	Sound Power Level Per Item (dBA)
Air cooled heat exchanger	1068	102 - 105
Compressors and associated components	216	97 - 113
Pumps	24	95 - 106
Piping segments	204	98 - 150

Table 4.11.2-8
Composite Noise Levels from the Rio Grande LNG Terminal at Nearby Noise Sensitive Areas during Operations

NSA	Distance (miles) and Direction from LNG Terminal	Existing Ambient L_{dn} (dBA)	Predicted LNG Terminal Contribution L_{dn} (dBA)	Ambient + LNG Terminal L_{dn} (dBA)[a]	Predicted Increase in Ambient Sound Level (dBA)
NSA 1	4.3 south	61.3	45.2	61.4	0.1
NSA 2	3.7 northeast	56.9	46.5	57.3	0.4
NSA 3	3.7 northeast	51.0	37.2	51.2	0.2
NSA 4	3.9 northeast	58.9	36.6	58.9	0.0
Palmito Ranch Battlefield	5.4 southwest	48.2	36.3	48.5	0.3
Palo Alto Battlefield	14.0 west	50.4	18.9	50.4	0.0

[a] Sound pressure levels are measured on a logarithmic scale; therefore, the predicted increase in ambient sound level at the NSAs during operation of the LNG Terminal would not be the sum of the two noise levels.



Noise Sensitive Area
Pipeline Route
Access Road
Terminal

Ldn Sound Contours (dBA)

45	60	80
50	65	85
55	70	90
	75	95

Rio Grande LNG Project

Sound Contours for Operation of the Rio Grande LNG Terminal

Figure 4.11.2-2

The results of the noise impact analysis indicate that the noise attributable to construction and operation of the LNG Terminal would be lower than the FERC sound level requirement of 55 dBA L_{dn} at the nearest NSA, and the predicted increases in ambient noise would be below perceptible levels. Since the time it conducted the noise impact analysis, RG LNG has modified the specifications for its air-cooled heat exchanges to mitigate some noise operational levels. Further, we recognize that actual results may be different from those obtained from modeling. To ensure that NSAs are not significantly affected by noise during operation of the LNG Terminal and Compressor Station 3, and to keep noise at an acceptable level of an L_{dn} of 55 dBA or less, **we recommend that:**

- **RG LNG should file a full power load noise survey with the Secretary for the LNG Terminal no later than 60 days after each liquefaction train is placed into service. If the noise attributable to operation of the equipment at the LNG Terminal and Compressor Station 3 exceeds an L_{dn} of 55 dBA at the nearest NSA, within 60 days RG LNG should modify operation of the liquefaction facilities or install additional noise controls until a noise level below an L_{dn} of 55 dBA at the NSA is achieved. RG LNG should confirm compliance with the above requirement by filing a second noise survey with the Secretary no later than 60 days after it installs the additional noise controls.**

In addition, **we recommend that:**

- **RG LNG should file a noise survey with the Secretary no later than 60 days after placing the entire LNG Terminal, including the Compressor Station 3, into service. If a full load condition noise survey is not possible, RG LNG should provide an interim survey at the maximum possible horsepower load within 60 days of placing the LNG Terminal and Compressor Station 3 into service and provide the full load survey within 6 months. If the noise attributable to operation of the equipment at the LNG Terminal and Compressor Station 3 exceeds an L_{dn} of 55 dBA at the nearest NSA under interim or full horsepower load conditions, RG LNG should file a report on what changes are needed and should install the additional noise controls to meet the level within 1 year of the in-service date. RG LNG should confirm compliance with the above requirement by filing an additional noise survey with the Secretary no later than 60 days after it installs the additional noise controls.**

RG LNG anticipates that flaring events would occur at the LNG Terminal site about four times per year. Each of these events would be associated with depressurization of a liquefaction train and routing the gas to the ground flare. The purpose of a flare system is to safely and reliably protect plant systems from overpressure during start-up, shutdown, plant upsets, and emergency conditions. The flaring creates noise with a low-pitched ‘roaring’ character. RG LNG has estimated the peak sound pressure level for a high-pressure flare at 1,500 feet to be 80 dBA. The sound pressure level at one of the closest NSAs (NSA 2), was estimated to be 59 dBA; the sound pressure level at NSA 3 is expected to be similar. This would result in a 4.2 dB increase above ambient levels and would constitute a moderate impact. However, RG LNG anticipates that flaring would occur only during daytime hours and for short periods (typically 15 minutes). Emergency flaring events are expected to be rare, but may occur at any time, either day or night. Blowdown events associated with the compressor stations are discussed below.

LNG carrier-loading at the LNG Terminal site would also be a source of sound. The LNG Terminal site would be able to receive and load up to two vessels at a time, with a maximum of nine LNG pumps operating at any time. In addition, sound would be generated from the LNG carriers during the loading process. RG LNG expects that sound from the pumps would not contribute to overall operational sound level impacts since the pumps would be completely submerged in LNG and encased in concrete tanks. Vessel traffic associated with operation of the LNG Terminal would also generate sounds. Noise above water would be similar to other large vessel traffic along the waterway and would result in temporary and minor noise impacts along the vessel transit route.

During operations, RG LNG would conduct maintenance dredging of its berthing area and turning basin, as described in section 2.6.1. Maintenance dredging is conducted by the COE for ongoing maintenance of the navigable channel within the BSC. Noise levels from maintenance dredging would be similar to those described for dredging during construction of the LNG Terminal, would be consistent with ongoing activity in the Project area, and are not expected to be perceptible at nearby NSAs.

Based on RG LNG's estimate that operation of the LNG Terminal will not result in a perceptible increase in sound levels at the nearest NSAs, and given our recommendation for measurement of operational sound levels, noise impacts would be minor at the NSAs in the vicinity of the LNG Terminal.

Pipeline Facilities

Construction

Construction activities associated with the Pipeline System would transpire over a 3-year period, with construction of both Pipeline 1 (including the Header System) and Pipeline 2 expected to take 12 months each. Construction of Pipeline 2 would begin about 18 months after the completion of Pipeline 1. Initial construction of the compressor stations and booster stations would occur in Year 3; however, activities at the compressor stations would continue through the third quarter of Year 7. A construction schedule is included in section 2.3. Construction activities would take place predominantly during the day, between the hours of 7:00 a.m. and 7:00 p.m., Monday through Saturday, though 24-hour construction may be necessary for specialized construction (such as at HDDs, operation of pumps at dry-ditch waterbody crossings, hydrostatic testing, and tie-ins). Construction activities associated with the pipeline facilities would involve clearing and grading associated with site preparation; trenching and HDD activities; materials and equipment delivery; installation of the pipelines; and construction of aboveground facilities. If, during construction, RB Pipeline determines that nighttime construction is warranted, it would be required to submit a variance request for review and written approval by the Director of OEP including certain details such as projected noise, dust, and light pollution impacts, and identify the measures that it would be implemented to mitigate these impacts.

Pipeline System

The most prevalent sound-generating equipment and activity during routine construction of the Header System and Pipelines 1 and 2 would be the operation of internal combustion engines associated with general construction equipment. Sound levels resulting from construction would vary over time and would depend upon the number and types of equipment operating, the level of operation, and the distance between sources and receptors. Construction equipment would be operated on an as-needed basis, and receptors near the construction areas may experience an increase in perceptible noise, but the effect would be temporary and local. The worst-case sound level from all construction equipment operating simultaneously would be 91 dBA at 50 feet, as indicated in table 4.11.2-9. Sound from construction activities near noise-sensitive receptors along the pipeline route could be either intermittent or continuous, but would occur over a limited duration at any one location; with construction near residences limited to the shortest timeframe possible to safely install the facilities.

Table 4.11.2-9
Estimated Sound Levels for Construction of the Pipeline System

Distance from Right-of-Way or Property Line (feet)	Pipeline Construction Sound Level (dBA L_{max}[a])
50	91
250	77
500	71
1,000	65
1,500	61

[a] Pipeline construction sound levels presented in this table do not include HDD operations.

HDD construction techniques would be used for pipeline crossings of sensitive resource areas, such as those occupied by waterbodies, wetlands, or areas with construction restrictions. HDD construction techniques differ from those proposed by RB Pipeline for typical pipeline construction, in that they would generate greater sound levels and could occur up to 24 hours a day, 7 days a week, for up to 10 weeks at each site. A total of eight locations were proposed for HDD construction (see section 2.5.2.1). Composite sound level estimates for equipment operating at HDD locations are detailed in table 4.11.2-10. The results of the HDD construction acoustical impact assessment indicated that L_{dn} sound levels for 24-hour operations would be above the FERC criterion of 55 dBA L_{dn} at NSAs in the vicinity of seven HDDs, and that the increases over ambient sound levels for some of these NSAs would result in a sound level increase greater than 10 dB. While RB Pipeline provided an assessment of impacts at additional NSAs, expected noise impacts at representative NSAs in the vicinity of 15 of the 19 proposed HDDs are presented for analysis in table 4.11.2-11.[38]

[38] RB Pipeline's full noise impact assessment for NSAs in the vicinity of the Pipeline System is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-454 or CP16-455 and accession numbers 20161229-5149 and 20180301-5019.

No NSAs are within 1 mile of the Donna Drain HDD (MP 86.5), unnamed waterbody SS-T09-001 HDD (MP 130.5), Channel to San Martin Lake HDD (MP 132.9), or Channel to Bahia Grande HDD (MP 134.5). HDD construction is not expected to exceed FERC noise criteria at these locations, and no further analysis is presented. RB Pipeline has proposed the following mitigation at HDD locations that would exceed the FERC noise criterion of an L_{dn} of 55 dBA at NSAs:

- use of temporary sound barriers around the HDD workspace;
- use of sound barriers or an acoustical enclosure around the drilling mud cleaning system; and
- offering temporary housing to residents in the vicinity of HDD operation.

Table 4.11.2-10
Horizontal Directional Drill Construction Sound Estimates

Distance from Right-of-Way or Property Line (feet)	HDD Entry Point Sound Level (dBA L_{max})	HDD Exit Point Sound Level (dBA L_{max})
50	87	86
100	81	80
250	73	72
500	67	66
1,000	61	60
2,500	53	52

However, RB Pipeline has not identified the site-specific mitigation measures that would be implemented at each HDD location, and, as identified in table 4.11.2-11, noise levels from seven of the HDDs are estimated to exceed FERC's noise criterion of an L_{dn} of 55 dBA at the nearest NSAs. Therefore, **we recommend that:**

- **<u>Prior to construction of HDDs at MPs 82.0, 92.0, 93.0, 99.8, 101.2, 102.0, and 118.7</u>, RB Pipeline should file with the Secretary, for review and written approval by the Director of OEP, a HDD noise mitigation plan to reduce noise levels attributable to the proposed drilling operations. The noise mitigation plan should identify all reasonable measures RB Pipeline would implement to reduce noise levels attributable to the proposed drilling operations to no more than an L_{dn} of 55 dBA at NSAs, and the resulting noise levels at each NSA with mitigation.**

Table 4.11.2-11
Ambient and Construction Sound Levels at Representative NSAs near HDDs

NSA[a, b]	Distance from HDD Entry (miles)	Existing Ambient	Entry			Exit[c]		
		L_{dn} (dBA)	HDD L_{dn} Contribution (dBA)	Combined HDD and Existing L_{dn} (dBA)	Sound Level Increase (dB)	HDD L_{dn} Contribution (dBA)	Combined HDD and Existing L_{dn} (dBA)	Sound Level Increase (dB)
Los Olmos Creek HDD (MP 18.8)								
NSA 1	1.5	67.5	53.6	67.7	0.2	50.2	67.6	0.1
Unnamed waterbody SS-T10-011 HDD (MP 77.6)								
NSA 1	0.8	56.8	50.7	57.8	1.0	52.9	58.3	1.5
NSA 2	0.9	58.3	49.7	58.9	0.6	47.5	58.6	0.3
Unnamed waterbody SS-T10-010 HDD (MP 79.0)								
NSA 1	1.0	56.8	48.8	57.4	0.6	49.5	57.5	0.7
NSA 2	1.1	52.1	47.5	53.4	1.3	47.0	53.3	1.2
East Main Drain SS-T10-003 HDD (MP 82.0)								
NSA 1	*1.0*	*55.8*	*48.3*	*56.5*	*0.7*	*55.3*	*58.6*	*2.8*
NSA 2	1.4	55.3	45.7	55.7	0.4	47.8	56.0	0.7
Unnamed waterbody SS-T04-005 HDD (MP 92.0)								
NSA 1	*0.8*	*67.0*	*65.0*	*69.1*	*2.1*	*67.4*	*70.2*	*3.2*
NSA 2	*0.9*	*53.1*	*63.0*	*63.4*	*10.3*	*65.4*	*65.6*	*12.5*
North Floodway SS-T02-004 HDD (MP 93.0)								
NSA 1	*0.2*	*63.9*	*65.0*	*67.5*	*3.6*	*50.0*	*64.1*	*0.2*
NSA 2	*0.2*	*61.0*	*63.0*	*65.1*	*4.1*	*51.5*	*61.5*	*0.5*
Unnamed waterbody SS-T04-008 HDD (MP 94.6)								
NSA 1	1.1	55.0	47.4	55.7	0.7	46.4	55.6	0.6
NSA 2	1.8	56.3	43.2	56.5	0.2	44.8	56.6	0.3

Table 4.11.2-11 (continued)
Ambient and Construction Sound Levels at Representative NSAs near HDDs

NSA[a, b]	Distance from HDD Entry (Miles)	Existing Ambient	Entry			Exit[c]		
		L_{dn} (dBA)	HDD Ldn Contribution (dBA)	Combined HDD and Existing Ldn (dBA)	Sound Level Increase (dB)	HDD Ldn Contribution (dBA)	Combined HDD and Existing Ldn (dBA)	Sound Level Increase (dB)
Unnamed waterbody SS-T04-006 HDD (MP 98.7)								
NSA 1	1.2	52.4	47.0	53.5	1.1	47.8	53.7	1.3
Arroyo Colorado HDD (MP 99.8)								
NSA 1	*0.5*	*49.9*	*65.1*	*65.3*	*15.4*	*61.9*	*62.2*	*12.3*
NSA 2	*0.6*	*43.5*	*57.2*	*57.4*	*13.9*	*54.7*	*55.1*	*11.6*
Unnamed waterbody SS-T14-004 HDD (MP 101.2)								
NSA 1	*0.2*	*68.2*	*62.5*	*69.2*	*1.0*	*54.6*	*68.4*	*0.2*
NSA 2	0.5	45.5	54.5	55.1	9.6	54.2	54.8	9.3
San Vincente Drainage SS-T08-001 Ditch HDD (MP 102.0)								
NSA 1	*0.5*	*53.5*	*55.1*	*57.4*	*3.9*	*54.7*	*57.2*	*3.7*
NSA 2	0.9	44.0	49.9	50.9	6.9	52.1	52.8	8.8
Unnamed waterbody SS-T04-007 HDD (MP 115.6)								
NSA 1	0.9	72.6	49.3	72.6	0.0	48.3	72.6	0.0
NSA 2	1.0	69.9	49.0	69.9	0.0	47.8	69.9	0.0
Unnamed waterbody SS-T05-003 HDD (MP 116.4)								
NSA 1	0.8	67.1	50.0	67.2	0.1	50.0	67.2	0.1
NSA 2	0.9	67.4	49.8	67.5	0.1	50.1	67.5	0.1
Resaca de los Cuates HDD (MP 118.7)								
NSA 1	*0.7*	*51.9*	*56.0*	*57.5*	*5.6*	*67.7*	*67.8*	*15.9*
NSA 2	*0.8*	*44.4*	*55.7*	*56.0*	*11.6*	*51.0*	*51.8*	*7.4*
Unnamed waterbody SS-T09-008 HDD (MP 124)								
NSA 1	0.6	58.3	53.0	59.4	1.1	52.8	59.4	1.1
NSA 2	1.2	66.1	46.8	66.2	0.1	44.9	66.1	0.0

[a] No NSAs are within 1 mile of the Donna Drain HDD (MP 86.5), Unnamed waterbody SS-T09-001 HDD (MP 130.5), Channel to San Martin Lake HDD (MP 132.9), or Channel to Bahia Grande HDD (MP 134.5). HDD construction is not expected to exceed FERC noise criteria at these locations.

[b] Where the data for an NSA are presented in italicized font, the noise attributable to HDD construction is estimated to exceed 55 dBA L_{dn} or would result in a 10 dB or greater increase in sound levels over ambient conditions.

Aboveground Facilities

Construction of the compressor and booster stations would take place between the first quarter of Year 3 and the third quarter of Year 7. Initial construction for each compressor station is expected to take a total of about 12 months; the installation of additional compressors would transpire in stages from the fourth quarter of Year 4 through the third quarter of Year 7 in conjunction with the staged construction of the LNG Terminal. RB Pipeline has stated that construction activities would predominantly take place during the day, from 7:00 a.m. through 7:00 p.m., Mondays through Saturdays; but depending on schedule, 24-hour construction may be necessary at times.

Construction activities associated with the compressor and booster stations would involve clearing and grading associated with site preparation; materials and equipment delivery; placing fill; and construction of foundations, equipment settings, ancillary equipment, piping, and structures (see section 2.5.2.2). Similar to pipeline construction, the most prevalent sound-generating equipment and activity during construction of the compressor stations is anticipated to be the operation of internal combustion engines associated with general construction equipment. Sound levels resulting from construction would vary over time and would depend upon the number and type of equipment operating, the level of operation, and the distance between sources and receptors. RB Pipeline estimated equipment needs for construction of the compressor stations as well as the resulting composite sound level from construction activities. Table 4.11.2-12 provides the estimated composite sound levels from construction of the compressor stations at various distances from the property boundary or right-of-way. Similar sound levels would be expected for construction of other aboveground facilities, including the booster stations and metering sites, which are not within 1 mile of any NSAs.

Table 4.11.2-12
Composite Construction Sound Estimates for Compressor Stations 1 and 2

Distance from Right-of-Way or Property Line (feet)	Site Preparation Sound Level (dBA L_{max}[a])	Facility Construction Sound Level (dBA L_{max}[a])
50	98	89
250	84	75
500	78	69
1,000	72	63
1,500	68	59

The nearest NSA (NSA 2) to Compressor Station 1 would be about 5.5 miles away. During construction activities, the composite sound level at NSA 2 is estimated to be 42.7 L_{eq} (dBA). The current daytime sound level at this NSA is 38.3 dBA L_{eq}, and the combined ambient and construction sound levels would be 44.1 dBA, a 5.8 dB increase above ambient levels. Noise levels would be below the FERC criterion of 55 dBA. In response to concerns expressed by the NPS regarding indirect effects on the King Ranch National Historic Landmark, RB Pipeline also assessed sound level impacts on the King Ranch Visitor Center, located approximately 9.7 miles northeast of Compressor Station 1.

Using ambient sound levels measured at NSA 2, RB Pipeline determined that construction of Compressor Station 1 would not impact sound levels at the King Ranch Visitor Center. Additional detail regarding potential impacts on the King Ranch are provided in section 4.8.

The nearest NSA to the proposed site for Compressor Station 2 (NSA 2) is about 2.9 miles away. During construction activities, the composite sound level at NSA 2 is estimated to be 42.2 dBA L_{eq}. The current daytime sound level at this NSA is 63.3 dBA L_{eq}, and the combined ambient and construction sound levels would not result in an increase above ambient levels. To minimize impacts from construction sound, RB Pipeline would implement mitigation measures that may include installation of temporary acoustic barriers, limiting construction to daytime hours as feasible, and offering temporary housing to residents in the vicinity construction.

The sound levels generated by construction activities at Compressor Station 1 would increase the existing daytime noise at the nearest NSA. However, due to the predicted minor increases and temporary nature of construction, we conclude that impacts on residents and the surrounding communities would be minor during construction of the aboveground facilities.

Operation

RB Pipeline's sources of operational sound would include daily operation of the aboveground facilities. There are no NSAs within 1 mile of any of the stand-alone metering sites, and potential sound level impacts associated with the operation of these metering sites would be minor and are not expected to be perceptible at any NSAs.

Noise would be associated with the compressor stations and booster stations on a continuous basis from operation of compressors, pumps, and cooling fans. Metering equipment at the facilities is expected to be much lower in volume in comparison to operating compressors. RB Pipeline used models to calculate the potential sound level impact of both Compressor Stations 1 and 2, as well as Booster Stations 1 and 2, on nearby NSAs. Sound level data from the proposed equipment were obtained from vendor information and typical noise control applications. Table 4.11.2-13 presents the results of the modeling, along with a comparison to the existing ambient sound levels. Based on these estimates, noise generated by Compressor Station 1 and the two booster stations would not result in a perceptible increase in ambient sound levels. In addition, operation of Compressor Station 1 would not result in an increase in sound levels at the King Ranch Visitor Center. The noise generated by Compressor Station 2 would result in slight increases in ambient sound levels at NSAs 1 and 2, but the overall sound level would remain below an L_{dn} of 55 dBA.

The compressor units at Compressor Stations 1 and 2 would be housed in compressor buildings. If necessary, RB Pipeline stated that it would use noise-insulated buildings to ensure that sound attributable to the compressor stations does not exceed 55 dBA L_{dn} at the nearest NSA. In addition, RB Pipeline would use centrifugal rotating equipment, rather than reciprocating engines, to ensure that operation of the compressor and booster stations would not result in increased perceptible vibration at nearby NSAs.

Table 4.11.2-13 Composite Sound Levels at Nearby Noise Sensitive Areas from Aboveground Facilities[a]					
NSA	Distance (miles) and Direction from Facility	Existing Ambient L_{dn} (dBA)	Predicted Facility Contribution L_{dn} (dBA)	Ambient + Facility L_{dn} (dBA)	Predicted Increase in Ambient Sound Level (dBA)
Compressor Station 1					
NSA 2	5.5, west	52.3	21.8	52.3	0.0
Compressor Station 2					
NSA 1	2.9, south	67.7	28.6	67.7	0.0
Booster Station 1					
NSA 1	1.7, west	67.5	26.8	67.5	0.0
Booster Station 2					
NSA 1	2.4, south	55.9	23.3	55.9	0.0

[a] There are no NSAs within 1 mile of any of the stand-alone metering sites, and potential sound level impacts associated with the operation of these metering sites would be minor and are not expected to be perceptible at any NSAs.

The results of the sound level impact analysis indicate that the sound attributable to operation of the aboveground facilities would be in compliance with the FERC sound level requirement of 55 dBA L_{dn} at the nearest NSA. We recognize, however, that actual results may be different from those obtained from modeling. Also, two compressor units at each compressor station would be installed during Stages 1 and 2 of LNG Terminal construction; one compressor unit at each compressor station would come online as each LNG train would commence service during subsequent stages of construction. The two interconnect booster stations would each include one compressor unit, installed during the first stage of construction. Therefore, to ensure that NSAs are not adversely impacted by the phased operation of the compressor stations, **we recommend that:**

- **RB Pipeline should file a noise survey with the Secretary <u>no later than 60 days</u> after each set of compressor units at Compressor Stations 1 and 2, and Booster Stations 1 and 2 are placed in service. If a full load condition noise survey is not possible, RB Pipeline should provide an interim survey at the maximum possible horsepower load <u>within 60 days</u> of placing the phased station into service and provide the full load survey <u>within 6 months</u>. If the noise attributable to the operation of all of the equipment at any of the facilities under interim or full horsepower load conditions exceeds an L_{dn} of 55 dBA at any nearby NSAs, RB Pipeline should file a report on what additional noise controls are needed and should install the additional noise controls to meet the level <u>within 1 year</u> of the in-service date. RB Pipeline should confirm compliance with the above requirement by filing an additional noise survey with the Secretary <u>no later than 60 days</u> after it installs the additional noise controls.**

In compliance with the recommendation above, RB Pipeline would need to complete several noise surveys to ensure that the phased-in compressor units are below an L_{dn} of 55 dBA at the nearest NSAs. A total of five noise surveys would be completed each at Compressor Stations 1 and 2 as each set of compressor units are placed in-service for each stage of construction. If the noise levels reported in any of the noise surveys are over an L_{dn} of 55 dBA at the nearest NSAs, RB Pipeline would need to implement the required mitigation to reduce the noise impacts on the nearest NSAs within the time specified in the recommendation.

In addition, blowdown events would also generate noise during operation of the pipeline facilities. RB Pipeline anticipates that one planned and one unplanned blowdown event would occur annually at each compressor and booster station. Planned blowdown events can happen during commission/decommissioning of a compressor station or during maintenance. Unplanned blowdown events are necessary in the event of an emergency and could occur at any time. Pipeline blowdown events are typically infrequent and of short duration; however, the frequency and length of the blowdown events depend upon the extent of the maintenance activity or type of emergency release. RB Pipeline would install silencers on all blowdown sources to minimize sound associated with blowdowns. Based on RB Pipeline's proposed mitigation and our recommendation, noise impacts from operation of the aboveground facilities would be minor.

While construction of the Rio Grande LNG Project would result in localized minor to moderate elevated noise levels near construction areas, impacts would be limited to the construction period for the Project. During operations, noise impacts would be minor at the aboveground facilities along the Pipeline System and at the NSAs in the vicinity of the LNG Terminal.

4.12 RELIABILITY AND SAFETY

4.12.1 LNG Terminal

4.12.1.1 LNG Facility Reliability, Safety, and Security Regulatory Oversight

LNG facilities handle flammable and sometimes toxic materials that can pose a risk to the public if not properly managed. These risks are managed by the companies owning the facilities, through selecting the site location and plant layout as well as through suitable design, engineering, construction, and operation of the LNG facilities. Multiple federal agencies that share regulatory authority over the LNG facilities and the operator's approach to risk management. The safety, security, and reliability of the Rio Grande LNG Project would be regulated by the DOT, the Coast Guard, and the FERC.

In February 2004, the DOT, the Coast Guard, 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 LNG terminal construction and operation. The DOT and the Coast Guard 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 proposed LNG Terminal's operation.

The DOT establishes and has the authority to enforce the federal safety standards for the siting, design, construction, operation, and maintenance of onshore LNG facilities, as well as for the siting of marine cargo transfer systems at waterfront LNG facilities, under the Natural Gas Pipeline Safety Act (49 USC 1671 et seq.). The DOT's LNG safety regulations are codified in 49 CFR 193, which prescribes safety standards for LNG facilities used in the transportation of gas by pipeline that are subject to federal pipeline safety laws (49 USC 60101 et seq.), and 49 CFR 192. On August 31, 2018, the DOT and FERC signed a MOU regarding methods to improve coordination throughout the LNG permit application process for FERC-jurisdictional LNG facilities. In the MOU, the DOT agreed to issue a LOD stating whether a proposed LNG facility would be capable of complying with location criteria and design standards contained in Subpart B of Part 193. The Commission committed to rely upon the DOT determination in conducting its review of whether the facilities would be in the public interest. The issuance of the LOD does not abrogate the DOT's continuing authority and responsibility over a proposed project's compliance with Part 193 during construction and future operation of the facility. The DOT's conclusion on the siting and hazard analysis required by Part 193 would be based on preliminary design information which may be revised as the engineering design progresses to final design. DOT regulations also contain requirements for the design, construction, installation, inspection, testing, operation, maintenance, and contingency plans for LNG facilities, which would be completed during later stages of the Project. If the Project is constructed and becomes operational, the liquefaction facilities would be subject to the DOT's inspection program to ensure compliance with the requirements of 49 CFR 193.

The Coast Guard 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 Coast Guard regulations over LNG facilities are codified in 33 CFR 105 and 33 CFR 127. As a cooperating agency, the Coast Guard assists the FERC staff in evaluating whether an applicant's proposed waterway would be suitable for LNG marine traffic and whether the terminal facilities would be operated in accordance with 33 CFR 105 and 33 CFR 127. If the facilities are constructed and become operational, the facilities would be subject to the Coast Guard inspection program to ensure compliance with the requirements of 33 CFR 105 and 33 CFR 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 Part 193 Subpart B. The level of detail necessary for this submittal requires the project sponsor to perform substantial FEED of the complete project. The design information is required to be site-specific and developed to the extent that further detailed design would not result in significant changes to the siting considerations, basis of design, operating conditions, major equipment selections, equipment design conditions, or safety system designs. As part of the review required for a FERC order, we use this information from the applicant to assess whether the proposed facilities would have a public safety impact and to suggest additional mitigation measures for the Commission to consider for incorporation as conditions in the order. If the facilities are approved and the suggested mitigation measures are incorporated into the order as conditions, FERC staff would review material filed to satisfy the conditions of the order and conduct periodic inspections throughout construction and operation.

4.12.1.2 DOT Safety Regulatory Requirements and 49 CFR Part 193 Subpart B Determination

Siting LNG facilities with regard to ensuring that the proposed site selection and location would not pose an unacceptable level or risk to public safety is required by DOT's regulations in 49 CFR Part 193 Subpart B. The Commission's regulations under 18 CFR 380.12 (o) (14) require RG LNG to identify how the proposed design complies with the siting requirements of 49 CFR Part 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.[39]

DOT reviews the information and criteria submitted by RG LNG to demonstrate compliance with the safety standards prescribed in 49 CFR Part 193 Subpart B and issues a LOD to the Commission on whether the proposed facilities would meet the DOT siting standards. The LOD will evaluate the hazard modeling results and endpoints used to establish exclusion zones, as well as RG LNG's evaluation on potential incidents and safety measures incorporated in the design or operation of the facility specific to the site that have a bearing on the safety of plant personnel and the surrounding public. The LOD will serve as one of the considerations for the Commission to deliberate in its decision to authorize, with or without conditions, or deny an application.

The requirements in 49 CFR Part 193 Subpart B state that an operator or government agency must exercise legal control over the activities as long the facility is in operation that can occur within an "exclusion zone," defined as the area around an LNG facility that could be exposed to specified levels of thermal radiation or flammable vapor in the event of a release of LNG or ignition of LNG vapor. Approved mathematical models must be used to calculate the dimensions of these exclusion zones.

The siting requirements specified in NFPA 59A (2001), an industry consensus standard for LNG facilities, are incorporated into 49 CFR Part 193 Subpart B by reference, with regulatory preemption in the event of conflict. The following sections of 49 CFR Part 193 Subpart B specifically address siting requirements:

- Section 193.2051, Scope, states that each LNG facility designed, replaced, relocated or significantly altered after March 31, 2000, must be provided with siting requirements

[39] 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.

in accordance with Subpart B and NFPA 59A (2001). In the event of a conflict with NFPA 59A (2001), the regulatory requirements in Part 193 prevail.

- Section 193.2057, Thermal radiation protection, requires that each LNG container and LNG transfer system have thermal exclusion zones in accordance with Section 2.2.3.2 of NFPA 59A (2001).

- Section 193.2059, Flammable vapor-gas dispersion protection, requires that each LNG container and LNG transfer system have a dispersion exclusion zone in accordance with Sections 2.2.3.3 and 2.2.3.4 of NFPA 59A (2001).

- Section 193.2067, Wind forces, requires that shop fabricated containers of LNG or other hazardous fluids less than 70,000 gallons must be designed to withstand wind forces based on the applicable wind load data in American Society of Civil Engineers (ASCE) 7 (2005). All other LNG facilities must be designed for a sustained wind velocity of not less than 150 mph unless the DOT Administrator finds a lower wind speed is justified or the most critical combination of wind velocity and duration for a 10,000-year mean return interval.

As stated in Section 193.2051, LNG facilities must meet the siting requirements of NFPA 59A (2001), Chapter 2, and include but may not be limited to:

- NFPA 59A (2001) Section 2.1.1(c) requires consideration of protection against forces of nature. Section 2.1.1(d) also requires that other factors applicable to the specific site that have a bearing on the safety of plant personnel and surrounding public be considered, including an evaluation of potential incidents and safety measures incorporated in the design or operation of the facility;

- NFPA 59A (2001) Section 2.2.3.2 requires provisions to minimize the damaging effects of fire from reaching beyond a property line, and requires provisions to prevent a radiant heat flux level of 1,600 British thermal units per square foot 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) Section 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;[40] and

---

40 DOT has approved two additional models for the determination of vapor dispersion exclusion zones in accordance with 49 CFR Part193.2059: FLACS 9.1 Release 2 (October 7, 2011) and PHAST-UDM Version 6.6 and 6.7 (October 7, 2011).

- Taken together, 49 CFR Part 193 Subpart B and NFPA 59A (2001) require that flammable LNG vapors from design spills do not extend beyond areas in which the operator or a government agency legally controls all activities. Furthermore, consideration of other hazards which may affect the public or plant personnel must be evaluated as prescribed in NFPA 59A (2001) Section 2.1.1(d).

- Title 49 CFR Part 193 Subpart B and NFPA 59A (2001) also specify three radiant heat flux levels which must be considered for LNG storage tank spills for as long as the facility is in operation:

- 1,600 Btu/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;[41]

- 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;[42] and

- 10,000 Btu/ft^2-hr - This level cannot extend beyond the plant property line that can be built upon.[43]

The requirements for design spills from process or transfer areas are more stringent. For LNG spills, the 1,600 Btu/ft^2-hr flux level cannot extend beyond the plant property line onto a property that can be built upon. In addition, Section 2.1.1 of NFPA 59A (2001) requires that factors applicable to the specific site with a bearing on the safety of plant personnel and surrounding public must be considered, including an evaluation of potential incidents and safety measures incorporated into the design or operation of the facility. DOT has indicated that potential incidents, such as vapor cloud explosions and toxic releases should be considered to comply with Part 193 Subpart B.[44]

---

41 The 1,600 Btu/ft2-hr flux level is associated with producing pain in less than 15 seconds, first degree burns in 20 seconds, second degree burns in approximately 30-40 seconds, 1 percent mortality in approximately 120 seconds, and 100 percent mortality in approximately 400 seconds, assuming no shielding from the heat, and is typically the maximum allowable intensity for emergency operations with appropriate clothing based on average an 10-minute exposure.

42 The 3,000 Btu/ft2-hr flux level is associated with producing pain in less than 5 seconds, first degree burns in 5 seconds, second degree burns in approximately 10-15 seconds, 1 percent mortality in approximately 50 seconds, and 100 percent mortality in approximately 180 seconds, assuming no shielding from the heat, and is typically the critical heat flux for piloted ignition of common building materials (e.g., wood, polyvinyl chloride, fiberglass, etc.) with prolonged exposures.

43 The 10,000 Btu/ft2-hr flux level is associated with producing pain in less than 1 seconds, first degree burns in 1 seconds, second degree burns in approximately 3 seconds, 1 percent mortality in approximately 10 seconds, and 100 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, polyvinyl chloride, fiberglass) and degradation of unprotected process equipment after approximate 10-minute exposure and to reinforced concrete after prolonged exposure.

44 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.

On November 29, 2016, the DOT provided a letter to FERC staff regarding the information DOT reviewed for the analysis of the Rio Grande LNG Project to determine it had no objection to the design spill methodologies being used for the selection of single accidental leakage sources as part of the requirements under 49 CFR Part 193 Subpart B.[45] In accordance with the August 31, 2018 MOU, the DOT will issue a LOD to the Commission after the DOT completes its analysis of whether the proposed Project facilities would meet the DOT's siting standards. The LOD will evaluate the hazard modeling results and endpoints used to establish exclusion zones, as well as RG LNG'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 surrounding public. The LOD will serve as one of the considerations for the Commission to deliberate in its decision to authorize or deny an application.

The DOT's conclusion on the siting and hazard analysis required by Part 193 would be based on preliminary design information which may be revised as the engineering design progresses to final design. DOT regulations also contain requirements for the design, construction, installation, inspection, testing, operation and maintenance, and contingency plans for LNG facilities, which would be completed during later stages of the Project. If the facilities are approved and constructed, final compliance with the requirements of 49 CFR 193 will be subject to DOT's inspection and enforcement programs.

4.12.1.3 Coast Guard Safety Regulatory Requirements and Letter of Recommendation

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.

---

45 November 29, 2016 letter "Re: Rio Grande LNG Project, FERC Docket CP16-454-000" from Kenneth Lee to Rich McGuire. Filed in Docket Number CP16-454-000 on November 29, 2016. Accession Number 20161129-4004.

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 Coast Guard, 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.

LNG Carrier Safety Regulatory Oversight

The Coast Guard exercises regulatory authority over LNG carriers under 46 CFR 154, which contains the United States safety standards for self-propelled vessels carrying bulk liquefied gases. The LNG carriers visiting the proposed facility would also be constructed and operated in accordance with the International Maritime Organization (IMO) *Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk* 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 Coast Guard Certificate of Inspection for U.S. flag vessels or a Coast Guard 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 Project 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 (e.g., 500 gross tons and larger), and ports servicing those regulated vessels, must adhere to the IMO standards. Some of the IMO requirements for ships are as follows:

- ships must develop security plans and have a Vessel Security Officer;
- ships must have a ship security alert system to transmit ship-to-shore security alerts identifying the ship, its location, and indication that the security of the ship is under threat or has been compromised;
- ships must have a comprehensive security plan for international port facilities, focusing on areas having direct contact with ships; and
- ships may have equipment onboard to help maintain or enhance the physical security of the ship.

In 2002, the Maritime Transportation Security Act (MTSA) was enacted by the U.S. Congress and aligned domestic regulations with the maritime security standards of the *International Ship and Port Facility Security Code* 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 Coast Guard'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 Coast Guard 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 Coast Guard 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 Coast Guard also has authority for LNG facility security plan review, approval, and compliance verification as provided in 33 CFR 105.

The Coast Guard 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. Title 33 CFR 127 applies to the marine transfer area for LNG of each new waterfront facility handling LNG and to new construction in the marine transfer areas for LNG of each existing waterfront facility handling LNG. The scope of the regulations includes the design, construction, equipment, operations, inspections, maintenance, testing, personnel training, firefighting, and security of the marine transfer area of LNG waterfront facilities. The safety systems, including communications, emergency shutdown, gas detection, and fire protection, must comply with the regulations in 33 CFR 127. Under 33 CFR 127.019, RG LNG would be required to submit two copies of its Operations and Emergency Manuals to the Coast Guard Captain of the Port (COTP) for examination.

Both the Coast Guard 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 LOI to the Coast Guard 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 (i.e., federal, state, local, and private sector) needed to carry out those measures. Until a facility begins operation, applicants must also annually review their WSAs and submit a report to the COTP as to whether changes are required. This document is reviewed and validated by the Coast Guard and forms the basis for the agency's LOR to the FERC.

In order to provide the Coast Guard 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 Coast Guard has published a Navigation and Vessel Inspection Circular – *Guidance on Assessing the Suitability of a Waterway for Liquefied Natural Gas (LNG) Marine Traffic* (NVIC 01-11).

NVIC 01-11 directs the use of the three concentric Zones of Concern, based on LNG carriers with a cargo carrying capacity up to 265,000 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 kilowatts per square meter (kW/m^2) (12,000 British thermal units per square foot (Btu/ft^2-hr) from a pool fire.

- Zone 2 – impacts would be significant but reduced, and damage from radiant heat levels are expected to transition from severe to minimal between 500 and 1,600 meters (1,640 and 5,250 feet). The outer perimeter of Zone 2 is approximately the distance to thermal hazards of 5 kW/m^2 (1,600 Btu/ft^2-hr) from a pool fire.

- Zone 3 – impacts on people and property from a pool fire or an un-ignited LNG spill are expected to be minimal between 1,600 meters (5,250 feet) and a conservative maximum distance of 3,500 meters (11,500 feet or 2.2 miles). The outer perimeter of Zone 3 should be considered the vapor cloud dispersion distance to the lower flammability limit from a worst case un-ignited release. Impacts to people and property could be significant if the vapor cloud reaches an ignition source and burns back to the source.

Once the applicant submits a complete Follow-On WSA, the Coast Guard 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 Coast Guard 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 Coast Guard 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.

RG LNG's Waterway Suitability Assessment

In a letter to the Coast Guard dated March 18, 2015, RG LNG submitted a LOI and a Preliminary WSA to the COTP, Sector Corpus Christi to notify the Coast Guard that it proposed to construct an LNG export terminal. In order to assess the safety and security aspects of this Project, the COTP Sector Corpus Christi consulted various safety and security working groups, including representatives from Port of BND, Port Isabel Navigation District, local facility security, the Brazos-Santiago Pilots Association, and Signet Maritime. In addition, the Coast Guard participated in meetings with the working group listed above, and other federal, state, and local agencies. RG LNG submitted the Follow-On WSA to the Coast Guard on December 17, 2015.

LNG Carrier Routes and Hazard Analysis

An LNG carrier's transit to the terminal would begin when it enters the U.S. Exclusive Economic Zone from well-established shipping lanes through the Gulf of Mexico. The LNG carrier would then enter the U.S. Territorial Sea limit (State Waters) to arrive at the Bravos Santiago Pass ocean buoy. At the Santiago Pass ocean buoy, pilots would board the LNG carrier before entering the BSC. From here, the LNG carrier transit would be executed with tug support at limiting speeds of 5 to 10 knots until it reaches the terminal. An LNG carrier port time with pilotage would normally be less than three hours for inbound transits (this includes time needed to turn the LNG carrier around and safely moor the LNG carrier along one of the two berths) and no more than two hours for outbound transits.

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 01-11 references the "Zones of Concern" for assisting in a risk assessment of the waterway. As LNG carriers proceed along the intended transit route, Hazard Zone 1 would encompass coastal areas along South Padre Island, Port Isabel and the BND, including a public boat ramp and approximately 30 RV hook-ups on South Padre Island, and the marine facilities associated with the proposed Texas LNG and Annova LNG Projects. Commercial vessels, recreational and fishing vessels may also fall within Zone 1, depending on their course. Transit of such vessels through a Zone 1 area of concern can be avoided by timing and course changes, if conditions permit. Zone 2 would cover a wider swath of coastal areas along South Padre Island, Port Isabel, and the BND, including the Coast Guard Station at South Padre Island, multiple residential buildings, commercial buildings, industrial buildings, a church, a university lab building, Schlitterbahn Water Park, and Long Island. Zone 3 would span larger portions of South Padre Island, Port Isabel and the BND, including the Port Isabel Police and Fire

Departments, multiple residential, commercial, and industrial buildings, 9 churches, 2 elementary schools, and the causeway between Port Isabel and South Padre Island. The areas impacted by the three different hazard zones are illustrated for accidental events in figure 4.12.1-1. The areas impacted by the three different hazard zones are illustrated for intentional events in figure 4.12.1-2.

4.12.1.4 Coast Guard Letter of Recommendation and Analysis

In a letter dated December 26, 2017, the Coast Guard issued an LOR and LOR Analysis to FERC stating that the BSC would be considered suitable for accommodating the type and frequency of LNG marine traffic associated with this Project. The LOR was based on full implementation of the strategies and risk management measures identified by the Coast Guard to RG LNG in its WSA.

Although RG LNG 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 Coast Guard regulations in 33 CFR 127 require that applicants annually review WSAs until a facility begins operation and submit a report to the Coast Guard 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 LNG marine traffic.

The Coast Guard’s LOR is a recommendation, regarding the current status of the waterway, to the FERC, the lead agency responsible for siting the on-shore LNG facility. Neither the Coast Guard 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 Coast Guard 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 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.

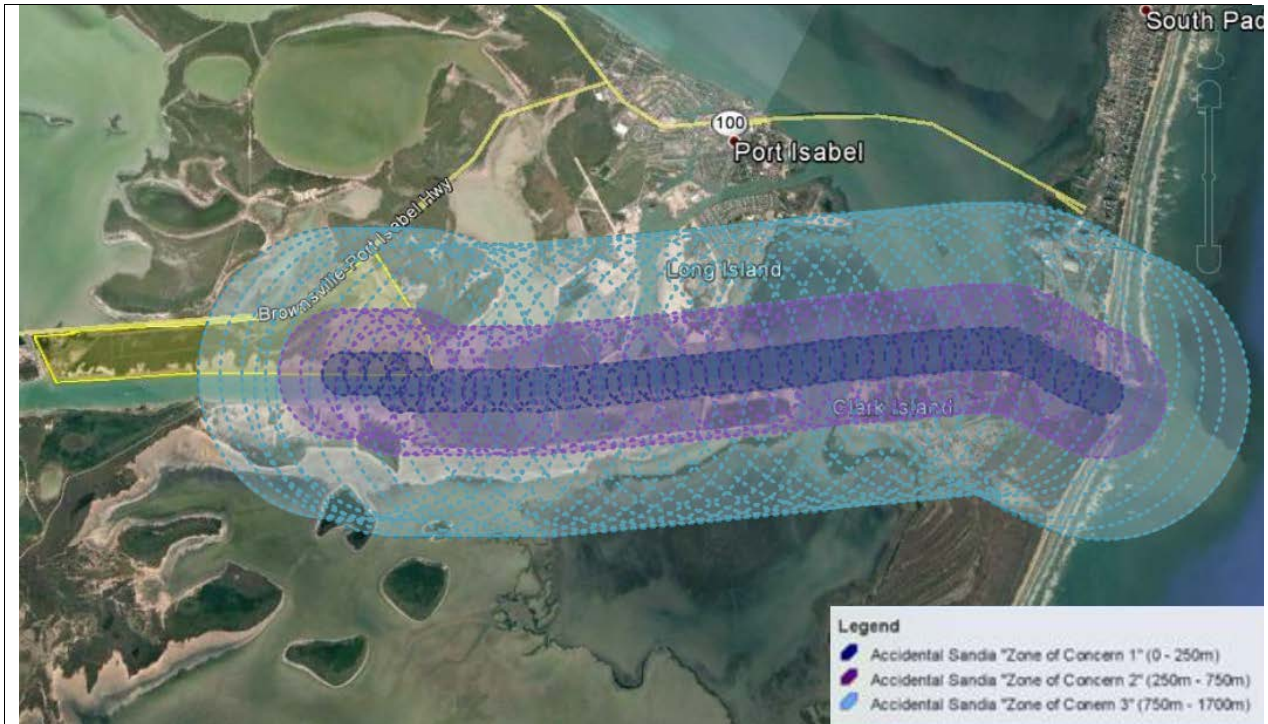


Figure 4.12.1-1 Accidental Hazard Zones along LNG Carrier Route

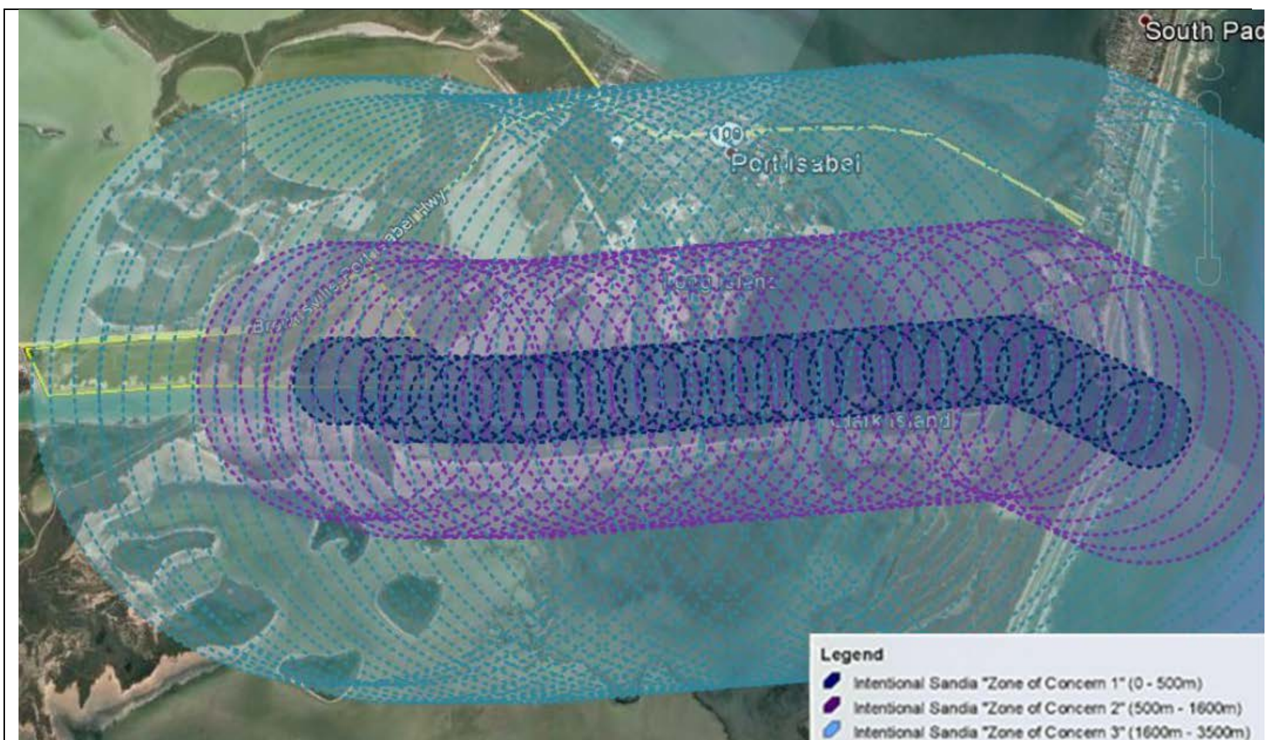


Figure 4.12.1-2 Intentional Hazard Zones along LNG Carrier Route

4.12.1.5 LNG Facility Security Regulatory Requirements

The security requirements for the proposed Project are governed by 33 CFR 105, 33 CFR 127, and 49 CFR Part 193 Subpart J – Security. Title 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 to the Coast Guard for review and approval before commencement of operations of the proposed Project facilities. RG LNG would also be required to control and restrict access, patrol and monitor the LNG Terminal, detect unauthorized access, and respond to security threats or breaches under 33 CFR 105. Some of the responsibilities of the applicant include, but are not limited to:

- designating a Facility Security Officer with a general knowledge of current security threats and patterns, security assessment methodology, vessel and facility operations, conditions, security measures, emergency preparedness, response, and contingency plans, who would be responsible for implementing the Facility Security Assessment and Facility Security Plan and performing an annual audit for the life of the Project;

- conducting a Facility Security Assessment to identify site vulnerabilities, possible security threats and consequences of an attack, and facility protective measures; developing a Facility Security Plan based on the Facility Security Assessment, with procedures for: responding to transportation security incidents; notification and coordination with federal, state, and local authorities; prevention of unauthorized access; measures to prevent or deter entrance with dangerous substances or devices; training; and evacuation;

- defining the security organizational structure with facility personnel with knowledge or training in current security threats and patterns; recognition and detection of dangerous substances and devices, recognition of characteristics and behavioral patterns of persons who are likely to threaten security; techniques to circumvent security measures; emergency procedures and contingency plans; operation, testing, calibration, and maintenance of security equipment; and inspection, control, monitoring, and screening techniques;

- implementing scalable security measures to provide increasing levels of security at increasing maritime security levels for facility access control, restricted areas, cargo handling, LNG carrier stores and bunkers, and monitoring; ensuring that the Transportation Worker Identification Credential (TWIC) program is properly implemented;

- ensuring coordination of shore leave for LNG carrier personnel or crew change out as well as access through the facility for visitors to the LNG carrier;

- conducting drills and exercises to test the proficiency of security and facility personnel on a quarterly and annual basis; and

- reporting all breaches of security and transportation security incidents to the National Response Center.

Title 33 CFR 127 has requirements for access controls, lighting, security systems, security personnel, protective enclosures, communications, and emergency power. In addition, an LNG facility regulated under 33 CFR 105 and 33 CFR 127 would be subject to the TWIC Reader Requirements Rule issued by the Coast Guard on August 23, 2016. This rule requires owners and operators of certain vessels and facilities regulated by the Coast Guard to conduct electronic inspections of TWICs (e.g., readers with biometric fingerprint authentication) as an access control measure. The final rule would also include recordkeeping requirements and security plan amendments that would incorporate these TWIC requirements. The TWIC program, including the electronic reader and authentication requirements in this final rule, is an important component of the Coast Guard's multi-layered system of access control requirements designed to enhance maritime security. The implementation of the rule was first proposed to be in effect August 23, 2018. In a subsequent notice issued on June 22, 2018, the Coast Guard indicated delaying the effective date for certain facilities by 3 years, until August 23, 2021. On August 2, 2018, the President of the United States signed into law the Transportation Worker Identification Credential Accountability Act of 2018 (H.R. 5729). This prohibits the Coast Guard from implementing the rule requiring electronic inspections of TWICs until after the Department of Homeland Security (DHS) has submitted a report to the Congress. Although the effective date of this rule has been postponed for certain facilities, the company should consider the rule when developing access control and security plan provisions for the facility.

Title 49 CFR Part 193 Subpart J also specifies security requirements for the onshore components 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 Project is constructed and operated, compliance with the security requirements of 33 CFR 105, 33 CFR 127, and 49 CFR Part 193 Subpart J would be subject to the respective Coast Guard and DOT inspection and enforcement programs.

RG LNG provided preliminary information on these security features and proposed to provide perimeter fencing, lighting, security personnel, security cameras, access control systems, identification and screening systems, intrusion detection systems, and communication systems. In response to data requests, RG LNG proposed revisions to their design that would remedy the identified concerns. In accordance with the February 2004 Interagency Agreement among FERC, DOT, and the Coast Guard, FERC staff would collaborate with the DOT and the Coast Guard on the Project’s security features.

4.12.1.6 FERC Engineering and Technical Review of the Preliminary Engineering Designs

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.[46] The failure of the LNG storage tank was due to the use of materials not suited for cryogenic temperatures. LNG migrated through streets and into underground sewers due to inadequate spill impoundments at the site. Current regulatory requirements ensure that proper materials suited for cryogenic temperatures are used in the design and that spill impoundments are designed and constructed properly to contain a spill at the site. To ensure that this potential hazard would be addressed for proposed LNG facilities, we evaluate the preliminary and final specifications for suitable materials of construction and for the design of spill containment systems that would properly contain a spill at the site.

Another operational accident occurred in 1979 at the Cove Point LNG plant in Lusby, Maryland. A pump electrical seal located on a submerged electrical motor LNG pump leaked causing flammable gas vapors to enter an electrical conduit and settle in a confined space. When a worker switched off a circuit breaker, the flammable gas ignited, causing 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 4.12.6 that RG LNG provide, for review and approval, the final design details of the electrical seal design at the interface between flammable fluids and the electrical conduit or wiring system, details of the electrical seal leak detection system, and the details of a downstream physical break (i.e., air gap) in the electrical conduit to prevent the migration of flammable vapors.

On January 19, 2004, a blast occurred at Sonatrach's Skikda, Algeria, LNG liquefaction plant that killed 27 and injured 56 workers. No members of the public were injured. The investigation suggested that a cold hydrocarbon leak occurred at Liquefaction Train 40 and was introduced into a high-pressure steam boiler by the combustion air fan. An explosion developed inside the boiler firebox, which subsequently triggered a larger explosion of the hydrocarbon vapors in the immediate vicinity. The resulting fire damaged the adjacent liquefaction process and liquid petroleum gas separation equipment of Train 40, and spread to Trains 20 and 30. Although Trains 10, 20, and 30 had been modernized in 1998 and 1999, Train 40 had been operating with its original equipment since start-up in 1981. To ensure that this potential hazard would be addressed for proposed facilities, we evaluate the preliminary design for mitigation of flammable vapor dispersion and ignition in buildings and combustion equipment to ensure they are adequately covered by hazard detection equipment that could isolate and deactivate any combustion equipment whose continued operation could add to or sustain an emergency. We also recommend in section 4.12.6 that RG LNG provide, for review and approval, the final design details drawings of hazard detection equipment, including the location and elevation of all detection equipment, instrument tag numbers, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment.

---

[46] 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.

On March 31, 2014, a detonation occurred within a gas heater at Northwest Pipeline Corporation's LNG peak-shaving plant in Plymouth, Washington.[47] 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 4.12.6 that RG LNG provide a plan for purging, for review and approval, which addresses the requirements of the American Gas Association *Purging Principles and Practice* and to provide justification if not using an inert or non-flammable gas for purging. In evaluating such plans, we 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 evaluate the plans against other recommended and generally accepted good engineering practices, such as NFPA 56, *Standard for Fire and Explosion Prevention during Cleaning and Purging of Flammable Gas Piping Systems*.

We also recommend in section 4.12.6 that RG LNG provide, for review and approval, operating and maintenance plans, including safety procedures, prior to commissioning. In evaluating such plans, we would assess whether the plans cover all standard operations, including purging activities associated with startup and shutdown. Also, in order to prevent other sources of projectiles from affecting occupied buildings and storage tanks, we recommend in section 4.12.6 that RG LNG incorporate mitigation into their final design with supportive information, for review and approval, that demonstrates it would mitigate the risk of a pressure vessel burst or boiling liquid expanding vapor explosion (BLEVE) from occurring.

FERC requires an applicant to provide safety, reliability, and engineering design information as part of its application, including hazard identification studies and FEED information for its proposed Project. FERC staff evaluates this information with a focus on potential hazards from within and nearby the site, including external events, which may have the potential to cause damage or failure to the 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. In general, FERC staff considers an

---

47 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.

acceptable design to include various layers of protection or safeguards to reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public. These layers of protection are generally independent of one another so that any one layer would perform its function regardless of the initiating event or failure of any other protection layer. Such design features and safeguards typically include:

- a facility design that prevents hazardous events, including the use of inherently safer designs; suitable materials of construction; adequate design margins from operating limits for process piping, process vessels, and storage tanks; adequate design for wind, flood, seismic, and other outside hazards;

- control systems, including monitoring systems and process alarms, remotely-operated control and isolation valves, and operating procedures to ensure that the facility stays within the established operating and design limits;

- safety instrumented prevention systems, such as safety control valves and emergency shutdown systems, to prevent a release if operating and design limits are exceeded;

- physical protection systems, such as appropriate electrical area classification, proper equipment and building spacing, pressure relief valves, spill containment, and cryogenic, overpressure, and fire structural protection, to prevent escalation to a more severe event;

- site security measures for controlling access to the plant, including security inspections and patrols, response procedures to any breach of security, and liaison with local law enforcement officials; and

- onsite and offsite emergency response, including hazard detection and control equipment, firewater systems, and coordination with local first responders, to mitigate the consequences of a release and prevent it from escalating to an event that could impact the public.

We believe the inclusion of such protection systems or safeguards in a plant design can minimize the potential for an initiating event to develop into an incident that could impact the safety of the offsite public. The review of the engineering designs for these layers of protection is initiated in the application process and carried through to the next phase of the proposed Project in final design if authorization is granted by the Commission.

The reliability of these layers of protection is informed by occurrence and likelihood of root causes and the potential severity of consequences based on past incidents and validated hazard modeling. As a result of the continuous engineering review, we recommend mitigation measures and continuous oversight to the Commission for consideration to include as conditions in the order. If a facility is authorized and recommendations are adopted as conditions to the order, FERC staff would continue its engineering reviews through final design, construction, commissioning, and operation.

Process Design

In order to liquefy natural gas, most liquefaction technologies require that the feed gas stream be pre-treated to remove components that could freeze out and clog the liquefaction equipment or would otherwise be incompatible with the liquefaction process or equipment, including mercury, H_2S, CO_2, water, and heavy hydrocarbons. For example, mercury is typically limited to concentrations of 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 solids and water droplets and for pressure regulation prior to entering feed gas pretreatment processes. Once the inlet gas is conditioned, the feed gas would be routed to the acid gas removal unit where a H_2S scavenger vessel absorbs most of the H_2S in the feed gas stream. The H_2S scavenger vessel would reduce the H_2S concentration to less than 0.4 parts per million by volume. The feed gas stream would then contact an amine-based solvent solution in an absorber column to remove the remaining acid gas components (predominantly CO_2 with trace amounts of H_2S carried over from the H_2S scavenger vessel). Once the acid gas components accumulate in the amine solution, an amine regenerator column would release the acid gas from the amine solution. The regenerated amine solution would be recycled back to the absorber column and the acid gas would be sent to a thermal oxidizer, where CO_2, any remaining traces of H_2S, and trace amounts of hydrocarbons would be incinerated.

The treated feed gas exiting the acid gas removal unit then enters the dehydration unit where water would be removed from the feed gas by using regenerative molecular sieve beds. During the mole sieve bed regeneration process, water would be recovered for use within the pretreatment system. After dehydration, mercury would be removed from the gas by a mercury adsorber bed that utilizes a sulfur impregnated activated carbon adsorbent (or metal oxide) until the beds adsorb enough mercury to require replacement.

The feed gas from the mercury adsorber bed is cooled to condense NGL in the NGL extraction unit. The resulting NGL stream would be stabilized and sent to the condensate storage tank. The stabilized condensate would be removed from the site by trucks.

After removal of the heavy hydrocarbons and the other components from the natural gas feed stream, RG LNG would liquefy the natural gas. In this process, the gas would be cooled using Air Products and Chemical Incorporated's propane-precooled mixed refrigerant liquefaction process that would utilize two main refrigeration cycles. In the first cycle, propane refrigerant would be used to pre-cool the feed gas and the mixed-refrigerant consisting of nitrogen, methane, ethylene/ethane, and propane. In the second cycle, the mixed refrigerant would be used to achieve the temperatures to liquefy and sub-cool the feed gas. Refrigerants required for the liquefaction process would be unloaded from trucks and stored onsite for initial filling and use, as needed, for make-up. After cooling the natural gas into its liquid form (i.e., LNG), it would be stored in four full-containment LNG storage tanks and sent out through in-tank pumps through a marine transfer line and marine transfer arms connected to LNG ships. The LNG transferred to the ships would displace vapors from the ships, which would be sent back to the LNG storage containers. Once loaded, the LNG ship would be disconnected and leave for export.

The Project would include many utilities and associated auxiliary equipment. The major auxiliary systems required for the operation of the liquefaction facility include BOG, fuel gas, hot oil, flares, instrument and utility air supply, water supply, demineralized water, diesel, nitrogen, and backup power.

Hot oil would be used to provide heat to the acid gas removal unit, NGL extraction unit, and the fuel gas system. There would be three ground flares (each ground flare would handle both dry gas and wet gas) and a vent located near the LNG tanks and ship loading area. The ground flares would be designed to handle the vent gases from the process areas associated with the pretreatment and liquefaction operations. The vent would be used during upset conditions in the LNG tank/ship loading area or to dispose of vent gas the cooldown of warm and inerted LNG carriers. Diesel would be stored onsite and used in the spare firewater pump and as fuel for the essential diesel generators. Nitrogen would be used to purge process equipment and as a seal gas for compressors and would be stored onsite as a liquid.

The failure of process equipment could pose potential harm if not properly safeguarded through the use of appropriate controls and operation. RG LNG would install process control valves and instrumentation to safely operate and monitor the facilities. Alarms would have visual and audible notification in the control room to warn operators that process conditions may be approaching design limits. Operators would have the capability to take action from the control room to mitigate an upset. RG LNG would develop facility operation procedures after completion of the final design; this timing is fully consistent with accepted industry practice. RG LNG would design their control systems and human machine interfaces (HMI) to the International Society for Automation Standards 5.3, 5.5, 60.1, 60.3, 60.4, and 60.6, and other standards and recommended practices.

We recommend in section 4.12.6 that RG LNG provide more information, for review and approval, on the operating and maintenance procedures, including safety procedures, hot work procedures and permits, abnormal operating conditions procedures, and personnel training prior to commissioning. We would evaluate these procedures to ensure that an operator can operate and maintain all systems safely, based on benchmarking against other operating and maintenance plans and comparing against recommended and generally accepted good engineering practices, such as, *Guidelines for Writing Effective Operating and Maintenance Procedures*.

In addition, we recommend in section 4.12.6 that RG LNG tag and label instrumentation and valves, piping, and equipment and provide car-seals/locks to address human factor considerations and improve facility safety and prevent incidents. RG LNG indicated an alarm management program in accordance with ISA Standard 18.2 would also be in place to ensure the effectiveness of the alarms. We recommend RG LNG provide their alarm management program for review and approval.

In the event of a process deviation, emergency shutdown (ESD) valves and instrumentation would be installed to monitor, alarm, shut down, and isolate equipment and piping during process upsets or emergency conditions. The Project would have a plant-wide ESD system to initiate closure of valves and shutdown of the process during emergency situations. Safety-instrumented systems would comply with International Electrotechnical Commission 61508/ISA Standard 84.00.01 and other recommended and generally accepted good engineering practices. We also recommend in section 4.12.6 that RG LNG file information, for review and approval, on the final design, installation, and commissioning of instrumentation and ESD equipment to ensure appropriate cause-and-effect alarm or shutdown logic and enhanced representation of the ESD system in the plant control room and throughout the plant.

In developing the FEED, RG LNG conducted a Hazard Identification - Environmental Hazard Identification (HAZID-ENVID) analysis on the Project's preliminary design based on the proposed site plan, block flow diagrams, heat and material balances, process flow diagrams, and utility flow diagrams. The HAZID-ENVID analysis identifies potential hazards or environmental issues in the early stage of the project's design that could produce undesirable consequences through the occurrence of an incident by evaluating the materials, systems, process, and plant design.

A more detailed hazard and operability review (HAZOP) analysis would be performed by RG LNG 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 consequences that may result from a process hazard, and identify whether there are adequate safeguards (e.g., engineering and administrative controls) to prevent or mitigate the risk from such events. Where insufficient engineering and administrative controls are identified, recommendations to prevent or minimize these hazards would be generated from the results of the HAZOP review. We recommend in section 4.12.6 that RG LNG file the HAZOP study on the completed final design for review and approval. We would evaluate the HAZOP to ensure all systems and process deviations are addressed appropriately based on likelihood, severity, and risk values with commensurate layers of protection in accordance with recommended and generally accepted good engineering practices, such as the American Institute of Chemical Engineers, *Guidelines for Hazard Evaluation Procedures*. We also recommend in section 4.12.6 that RG LNG file the resolutions of the recommendations generated by the HAZOP review for evaluation and approval by FERC staff. Once the design has been subjected to a HAZOP review, the design development team would track, manage, and keep records of changes in the facility design, construction, operations, documentation, and personnel. RG LNG would evaluate these changes to ensure that the safety, health, and environmental risks arising from these changes are addressed and controlled based on its management of change procedures. If FERC staff's recommendations are adopted into the order, resolutions of the recommendations generated by the HAZOP review would be monitored by FERC staff. We also recommend in section 4.12.6 that RG LNG file all changes to their FEED for review and approval by FERC staff. However, major modifications could require an amendment or new proceeding.

If the Project is authorized and constructed, RG LNG would install equipment in accordance with its design. We recommend in section 4.12.6 that Project facilities be subject to construction inspections and that RG LNG provide, for review and approval, commissioning plans, procedures and commissioning demonstration tests that would verify the performance of equipment.

In addition, we recommend in section 4.12.6 that RG LNG provide semi-annual reports that include abnormal operating conditions and planned facility modifications. Furthermore, we recommend in section 4.12.6 that the Project facilities would 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

RG LNG provided codes and standards for the design, fabrication, construction, and installation of piping and equipment and specifications for the facility. The design specifies materials of construction and ratings 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, B36.10, and 36.19. 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). Portions of the facility regulated under 33 CFR 127 for the marine transfer system, including piping, hoses, and loading arms should also be tested in accordance with 33 CFR 127.407. In addition, the operator should verify the set pressure of the pressure relief valves meet the requirements in 33 CFR 127.407.

Low-pressure storage tanks such as the LNG, amine, and condensate storage tanks, would be designed, inspected, and maintained in accordance with the API Standards 620, 625, 650, and 653. Concrete LNG storage tanks would also be designed in accordance with American Concrete Institute 376. All LNG storage tanks would also include BOG compression to prevent the release of boil-off to the atmosphere in accordance with NFPA 59A 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 594, 598, 600, 602, 603, 607, 608, and 609; ASME Standards B16.5, B16.10, B16.20, B16.25, and B16.34; and ISA Standards 75.01.01, 75.05.01, and 75.08.01.

Pressure and vacuum safety relief valves and flares would be installed to protect the storage containers, pressure vessels, process equipment, and piping. 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, 537, 2000, and other recommended and generally accepted good engineering practices. In addition, we recommend in section 4.12.6 that RG LNG provide final design information on pressure and vacuum relief devices, for review and approval, to ensure that the final sizing, design, and installation of these components are adequate and in accordance with the standards reference and other recommended and generally accepted good engineering practices.

If the Project is authorized and constructed, RG LNG would install equipment in accordance with its design and FERC staff would verify equipment nameplates to ensure equipment is being installed based on approved design. In addition, FERC staff would conduct construction inspections including reviewing quality assurance and quality control plans to ensure construction work is being performed according to proposed Project specifications, procedures, codes, and standards. We recommend in section 4.12.6 that RG LNG provide semi-annual reports that include equipment malfunctions and abnormal maintenance and that project facilities be subject to inspections to verify that the equipment is being properly maintained during the life of the LNG Terminal.

Hazard Mitigation Design

If operational control of the facilities were lost and operational controls and emergency shutdown systems failed to maintain the Project within the design limits of the piping, containers, and safety relief valves, a release could potentially occur. FERC regulations under 18 CFR 380.12 (o) (1) through (4) require applicants to provide information on spill containment, spacing and plant layout, hazard detection, hazard control, and firewater systems. In addition, 18 CFR 380.12 (o) (7) require applicants to provide engineering studies on the design approach and 18 CFR 380.12 (o) (14) requires applicants to demonstrate how they comply with 49 CFR 193 and NFPA 59A. As required by 49 CFR Part 193 Subpart I and by incorporation Section 9.1.2 of NFPA 59A (2001), fire protection must be provided for all DOT-regulated LNG facilities based on an evaluation of sound fire protection engineering principles, analysis of local conditions, hazards within the facility, and exposure to or from other property. NFPA 59A (2001) also requires the evaluation determine type, quantity, and location of hazard detection and hazard control, passive fire protection, emergency shutdown and depressurizing systems, and emergency response equipment, training, and qualifications.

All facilities, once constructed, must comply with the requirements of 49 CFR Part 193 Subpart I and would be subject to DOT's inspection and enforcement programs. However, NFPA 59A (2001) also indicates the wide range in size, design, and location of LNG facilities precludes the inclusion of detailed fire protection provisions that apply to all facilities comprehensively and includes subjective performance based language on where ESD systems and hazard control are required and does not provide any additional guidance on placement or selection of hazard detection equipment and provides minimal requirements on firewater. 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 below.

RG LNG 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 4.12.6 that RG LNG provide a final fire protection evaluation for review and approval, and to provide more information on the final design, installation, and commissioning of spill containment, hazard detection, hazard control, firewater systems, structural fire protection, and onsite and offsite emergency response procedures.

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 Part 193.2181 Subpart C specifies that each impounding system serving an LNG storage tank must have a minimum volumetric liquid capacity of 110 percent of the LNG tank's maximum design liquid capacity for an impoundment serving a single tank, unless surge is accounted for in the impoundment design. All facilities, once constructed, must comply with the requirements of 49 CFR Part 193 Subpart C and would be subject to DOT's inspection and enforcement programs. For full containment LNG tanks, we also consider it prudent to provide a barrier to prevent liquid from flowing to an unintended area (i.e., outside the plant property). The purpose of the barrier is to prevent liquid from flowing off the plant property and does not define containment or an impounding area for thermal radiation or flammable vapor exclusion zone calculations or other code requirements already met by sumps and impoundments throughout the site. RG LNG proposes four full-containment LNG storage tanks for which the outer tank wall would serve as the impoundment system. FERC staff verified that the LNG storage tank's outer concrete wall would have a liquid capacity of at least 110 percent of the inner LNG tank's maximum liquid capacity. In addition, RG LNG would also install a berm (i.e., storm levee with a crest elevation of 17 feet) around the Project site to prevent liquid from flowing off-site in the event of an outer tank failure.

RG LNG proposes to install curbing, paving, and trenches to direct potential LNG, MR, NGL, or refrigerant liquid releases to either the west LNG Train Spill Basin or the east LNG Train Spill Basin. LNG releases from the rundown headers and ship loading piping would be collected in a trench and routed to one of two LNG Storage and Jetty Loading Line Basins located between the four LNG storage tanks. Releases in the refrigerant storage area would be collected in curbed areas and directed via a trench to the Refrigerant Storage Area Basin. This basin capacity would be sized to be greater than the largest refrigerant storage tank. LNG releases during truck loading would be directed via trenches to the LNG Road Tanker Spill Basin. In addition, local bunds would be provided around the solvent storage tank, refrigerant truck unloading area, BOG compressor Suction Drum, Stabilized Condensate storage tanks, Hot Oil storage tank, Diesel storage tanks, flare knockout drums, liquid nitrogen storage tank, and the Slop Oil storage tank.

Under NFPA 59A (2001) Section 2.2.2.2, the capacity of impounding areas for vaporization, process, or LNG transfer areas must equal the greatest volume that can be discharged from any single accidental leakage source during a 10-minute period or during a shorter time period based upon demonstrable surveillance and shutdown provisions acceptable to the DOT. All facilities, once constructed, must comply with the requirements of 49 CFR Part 193 Subpart C and would be subject to DOT's inspection and enforcement programs.

As part of our preliminary engineering review, we evaluate impoundment systems to ensure they would be sized based on the largest flow capacity from a single pipe for 10 minutes or the capacity of the largest vessel served, whichever is greater. In addition, we recommend in section 4.12.6 that RGLNG provide additional information on the final design of the impoundment systems for review and approval.

RG LNG 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. Furthermore, RG LNG indicates that the stormwater pumps would be automatically operated by level control and interlocked using low temperature detectors to prevent pumps from operating if LNG is present. These stormwater removal pumps would be proposed for the large impoundment basins described above, however RG LNG proposes to install normally-closed valves on local bunds and curbed areas to allow analysis of stormwater prior to routing it to the drainage channels.

RG LNG is consulting with DOT on the use of normally-closed valves instead of stormwater removal pumps required in 49 CFR Part 193 Subpart C. Therefore, we recommend in section 4.12.6 that RG LNG provide DOT correspondence accepting the use of normally-closed valves to remove stormwater from curbed and bunded areas. If the facilities are approved and constructed, final compliance with the requirements of 49 CFR Part 193 Subpart C would be subject to DOT's inspection and enforcement programs.

If the Project is authorized and constructed, RG LNG would install spill impoundments in accordance with its design and FERC staff would verify during construction inspections that the spill containment system including dimensions, and slopes of curbing and trenches, and volumetric capacity matches final design information. In addition, we recommend in section 4.12.6 that Project facilities be subject to regular inspections throughout the life of the facility to verify that impoundments are being properly maintained.

Spacing and Plant Layout

The spacing of vessels and equipment between each other, from ignition sources, and to the property line would need to meet the requirements of 49 CFR Part 193 Subparts C, D, and E, which incorporate NFPA 59A (2001). NFPA 59A further references NFPA Standards 30, NFPA 58, and NFPA 59 for additional spacing and plant layout requirements. If the facilities are approved and constructed, final compliance with the requirements of 49 CFR 193 would be subject to DOT's inspection and enforcement programs.

To minimize risk for flammable or toxic vapor ingress into buildings, we recommend in section 4.12.6 that RG LNG conduct a technical review of facility, for review and approval, identifying all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and verify that these areas would be adequately covered by hazard detection devices that would isolate or shut down any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency.

FERC staff also recommend in section 4.12.6 that Project facilities be subject to periodic inspections during construction to verify flammable/toxic gas detection equipment is installed in heating, ventilation, and air condition intakes of buildings at appropriate locations. In addition, we recommend in section 4.12.6 that Project facilities be subject to regular inspections throughout the life of the facilities to continue to verify that flammable/toxic gas detection equipment installed in building air intakes function as designed and are being maintained and calibrated.

To minimize risk to the LNG carrier, 33 CFR 127 requires LNG impounding areas be located so that the heat flux from a fire over the impounding spaces does not cause structural damage to any LNG carrier moored or berthed at the waterfront facility handling LNG. Similarly, 49 CFR 193 through adoption of NFPA 59A requires that LNG container impounding areas must be located so that the heat flux from a fire over the impounding area will not cause major structural damage to any LNG marine carrier that could prevent its movement. DOT will address whether RG LNG's information and criteria complies with the requirements in NFPA 59A (2001), Section 2.2.3.6 as part of its LOD analysis. FERC staff evaluated the radiant heat flux from these impoundments at the LNG carrier and found 5,000 Btu/ft^2-hr would reach an LNG carrier berthed at the jetty. However, it would only reach a portion of the LNG carrier and it would take a prolonged exposure for this radiant heat flux to damage the LNG carrier. RG LNG included an ERP for LNG carriers berthed at the LNG Terminal. In addition, RG LNG proposes quick release hooks on the breasting dolphins and mooring dolphins that would allow for a quick departure in the event of an emergency that would allow for the LNG carrier to move outside of the damaging radiant heat before any structural damage would occur.

If the Project is authorized, RG LNG would finalize the plot plan and we recommend in section 4.12.6 that RG LNG provide any changes for review and approval to ensure capacities and setbacks are maintained. If facilities are constructed, RG LNG would install equipment in accordance with the spacing indicated on the plot plans. In addition, we recommend in section 4.12.6 that Project facilities be subject to periodic inspections during construction to verify equipment is installed in appropriate locations and the spacing is met in the field. We also recommend in section 4.12.6 that Project facilities be subject regular inspections throughout the life of the facilities to verify that equipment setbacks from other equipment and ignition sources are being maintained during operation.

Ignition Controls

RG LNG's plant areas would be designated with appropriate hazardous electrical classification and process seals commensurate with the risk of the hazardous fluids being handled in accordance with NFPA 59A (2001), 70, 497, and API RP 500. All facilities, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to DOT's inspection and enforcement programs, which require compliance, by incorporation by reference, with NFPA 59A (2001) and NFPA 70. Depending on the risk level, these areas would either be classified as non-classified, Class 1 Division 1, or Class 1 Division 2 areas. Electrical equipment located in these areas would be designed such that in the event a flammable vapor is present, the equipment would have a minimal risk of igniting the vapor. FERC staff evaluated the RG LNG electrical area classification drawings to verify that companies would meet these electrical area classification requirements.

If the Project is authorized, RG LNG would finalize the electrical area classification drawings and would describes changes made from the FEED design. We recommend in section 4.12.6 that RG LNG file the final design of the electrical area classification drawings for review and approval. If facilities are constructed, RG LNG would install appropriately classed electrical equipment, and we recommend in section 4.12.6 that Project facilities be subject to periodic inspections during construction for FERC staff to spot check electrical equipment and verify equipment is installed per classification and are properly bonded or grounded in accordance with NFPA 70. In addition, we recommend in section 4.12.6 that Project facilities be subject to regular inspections throughout the life of the facility to ensure electrical equipment is maintained (e.g., bolts on explosion proof equipment properly installed and maintained, panels provided with purge, etc.), and electrical equipment are appropriately de-energized and locked out and tagged out when being serviced.

In addition, submerged electrical motor pumps and instrumentation would be equipped with electrical process seals and instrumentation in accordance with NFPA 59A (2001) and NFPA 70. We recommend in section 4.12.6 that RG LNG provide, for review and approval, final design drawings showing process seals installed at the interface between a flammable fluid system and an electrical conduit or wiring system that meet the requirements of NFPA 59A (2001) and NFPA 70. Furthermore, we recommend in section 4.12.6 that RG LNG file, for review and approval, details of an air gap or vent equipped with a leak detection device that should continuously monitor for the presence of a flammable fluid, alarm the hazardous condition, and shut down the appropriate systems. In addition, we recommend in section 4.12.6 that Project facilities be subject to regular inspections throughout the life of the facility to ensure electrical process seals for submerged pumps continue to conform to NFPA 59A and NFPA 70 and that air gaps are being properly maintained.

Hazard Detection, Emergency Shutdown, and Depressurization Systems

RG LNG would also install hazard detection systems to detect cryogenic spills, flammable and toxic vapors, and fires. The hazard detection systems would alarm and notify personnel in the area and control room to initiate an ESD, depressurization, or initiate appropriate procedures, and would meet NFPA 72, ISA 12.13.01, 12.13, 12.13.01, and 12.15, and other recommended and generally accepted good engineering practices.

FERC staff evaluated the adequacy of the general hazard detection type, location, and layout to ensure adequate coverage to detect cryogenic spills, flammable and toxic vapors, and fires near potential release sources (i.e., pumps, compressors, sumps, trenches, flanges, and instrument and valve connections). FERC staff also review the cause and effect matrices that show which conditions would initiate an alarm, shutdown, depressurization, or other action based on the FEED. We recommend in section 4.12.6 that RG LNG provide additional information, for review and approval, on the final design of all hazard detection systems (e.g., manufacturer and model, elevations, etc.) and hazard detection layout drawings.

If the Project is authorized and constructed, RG LNG would install hazard detectors according to its specifications, and we recommend in section 4.12.6 that Project facilities be subject to periodic inspections during construction to verify hazard detectors and ESD pushbuttons are appropriately installed per approved design and functional based on cause and effect matrices prior to introduction of hazardous fluids. In addition, we recommend in section 4.12.6 that Project facilities be subject to regular inspections throughout the life of the facility to verify hazard detector coverage and functionality is being maintained and are not being bypassed without appropriate precautions.

Hazard Control

If ignition of flammable vapors occurred, hazard control devices would be installed to extinguish or control incipient fires and releases, and would meet NFPA 59A (2001), 10, 17, 2001, and 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 would 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. In addition, we recommend in section 4.12.6 that RG LNG file additional information on the final design of these systems, for review and approval, where details are yet to be determined (e.g., manufacturer and model, elevations, flowrate, capacities, etc.) and where the final design could change as a result of these details or other changes in the final design of the Project. If the Project is authorized and constructed, RG LNG would install hazard control equipment, and we recommend in section 4.12.6 that Project facilities be subject to periodic inspections during construction to verify hazard control equipment is installed in the field and functional prior to introduction of hazardous fluids. In addition, we recommend in section 4.12.6 that Pproject 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 or cryogenic releases onto facility components to insignificant levels, passive fire protection (e.g. fireproofing structural steel) should 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 would be applied to pressure vessels and structural supports to facilities that could be exposed to cryogenic liquids or to radiant heats of 4,000 Btu/ft^2-hr or greater from fires with durations that could result in failures[48] 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 4.12.6 that RG LNG provide additional information on the final design of these systems, for review and approval, where details are yet to be determined (e.g., calculation of structural fire protection materials, thicknesses, etc.) and where the final design could change as a result of these details or other changes in the final design of the Project.

---

48 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.

In addition, FERC staff evaluated if cryogenic protection would be provided to pressure vessels and structural supports potentially exposed to cryogenic releases with durations that could result in failures. RG LNG proposes to coat concrete surfaces subject to cryogenic spillage with an insulation paint. If the Project is authorized and constructed, RG LNG would install structural cryogenic and fire protection according to its design, and we recommend in section 4.12.6 that Project facilities be subject to periodic inspections during construction to verify structural cryogenic and fire protection is properly installed in the field as designed prior to introduction of hazardous fluids. In addition, we recommend in section 4.12.6 that Project facilities be subject to regular inspections throughout the life of the facility to continue to verify that passive protection is being properly maintained.

Firewater Systems

RG LNG would also provide firewater systems, including remotely operated firewater monitors, sprinkler systems, fixed water spray systems, and firewater hydrants and hoses for use during an emergency to cool the surface of storage vessels, piping, and equipment exposed to heat from a fire. These firewater systems would be designed to meet NFPA 59A (2001), 13, 14, 15, 20, 22, and 24 requirements. In addition, FERC staff evaluated whether fire protection systems (i.e., water mist) would be installed in gas turbine enclosures in accordance with NFPA 750. RG LNG would also install a low expansion foam and high expansion foam systems as well as an onsite foam fire truck to suppress hydrocarbon spills and fires as well as to reduce vaporization rates from LNG pools and would meet NFPA 59A, 11, and 1901. FERC staff evaluated the adequacy of the general firewater or foam system coverage and verify the appropriateness of the associated firewater demands of those systems and worst case fire scenarios to size the firewater and foam pumps.

FERC staff also assessed whether the reliability of the firewater pumps and firewater source or onsite storage volume would be appropriate. In addition, we recommend in section 4.12.6 that RG LNG file an updated fire protection evaluation on the final design, for review and approval, where details are yet to be determined (e.g., manufacturer and model, nozzle types, etc.) and where the final design could change as a result of these details or other changes in the final design of the Project.

If the Project is authorized and constructed, RG LNG would install the firewater and foam systems as designed, and we recommend in section 4.12.6 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, we recommend in section 4.12.6 that Project facilities be subject to regular inspections to ensure firewater and foam systems are being properly maintained and tested throughout the life of the LNG Terminal.

Geotechnical and Structural Design

RG LNG provided geotechnical and structural design information for its facilities to demonstrate the site preparation and foundation designs would be appropriate for the underlying soil characteristics and to ensure the structural design of the Project facilities would be in accordance with federal regulations, standards, and recommended and generally accepted good engineering practices. The application focuses on the resilience of the Project facilities against natural hazards, including extreme geological, meteorological, and hydrological events, such as earthquakes, tsunamis, seiche, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea level rise, landslides, wildfires, volcanic activity, and geomagnetism.

Geotechnical Evaluation

FERC regulations under 18 CFR 380.12 (h) (3) require geotechnical investigations to be provided. In addition, FERC regulations under 18 CFR 380.12 (o) (14) require an applicant demonstrate compliance with regulations under 49 CFR 193 and NFPA 59A. 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 incorporate by reference NFPA 59A (2001). NFPA 59A (2001) Section 2.1.4 requires soil and general investigations of the site to determine the design basis for the facility. However, no additional requirements are set out in 49 CFR 193 or NFPA 59A on minimum requirements for evaluating existing soil site conditions or evaluating the adequacy of the foundations, therefore FERC staff evaluated the existing site conditions, geotechnical report, and proposed foundations to ensure they are adequate for the LNG facilities as described below.

The Project would be located in the West Gulf section of the Coastal Plain physiographic province (USGS 2000). The Coastal Plain lies along the Atlantic seaboard and Gulf Coast of the U.S., stretching 100 to 200 miles inland and 100 to 200 miles offshore, to the edge of the continental shelf. This belt of Late Cretaceous to Holocene sedimentary rocks comprises an elevated sea bottom with low topographic relief dipping seaward. In Texas, the Coastal Plain includes a system of alternating synclines (troughs) and anticlines (peaks) oriented perpendicular to the coastline (Hosman 1996). The surficial geology underlying the region is composed of Quaternary Holocene and Pleistocene-aged sediments made of alluvium of the Rio Grande and coastal deposits of dune, estuary, lagoon, deltaic, tidal-flat, beach, and barrier island environments (Page et al. 2005).

RG LNG contracted Fugro Consultants, Inc. (Fugro) to conduct geotechnical investigations and report to evaluate existing soil site conditions and proposed foundation design for the Project. During the investigation, the facility was subdivided into two regions, Area 1 and Area 2. The average elevation of the existing grade in Area 1 ranged from +0.2 to +18.5 feet NAVD 88, and Area 2 ranged from +3.9 to 9.3 feet NAVD 88. The existing LNG Terminal site is generally flat with elevations ranging from +5 to +10 feet NAVD 88, except for piles of material dredged from the adjacent BSC and three lomas. Lomas are clay dunes that developed through wind-driven depositional processes (Bowler 1973). The elevations of these features reach +25 feet NAVD 88.

The site would be cleared, grubbed, and prepared using standard earthmoving and compaction equipment. Site preparation would result in a final grade elevation being raised to +10 to +12 feet NAVD 88 with varying amounts of fill that would be added across the site. The facility would be surrounded by a storm surge protective berm with the elevation ranging from +17 to +19 feet NAVD 88.

Fugro conducted 20 soil borings to depths ranging from 20 feet to 300 feet below existing, grade, 35 cone penetration tests (CPTs) to depths ranging from 50 feet to 172 feet (or to refusal) below existing grade, 10 seismic cone penetration tests (SCPTs) to depths ranging from 84 feet to 165 feet below existing grade, 4 temporary piezometers to measure groundwater levels, and over 5 different tests on more than 2,800 recovered soil samples, including classification tests (water content, Atterberg liquid and plastic limits, sieve tests), compression tests, corrosion potential tests (pH, sulfate, chloride, electrical resistivity) in general accordance with pertinent ASTM standards. In addition to the initial geotechnical investigation, Fugro conducted an additional 47 geophysical borings to further investigate a fault identified during initial boring within the proposed planned site area. Geophysical borings were performed to depths ranging from 320 feet to 350 feet below existing grade.

FERC staff evaluated the geotechnical investigation to ensure the adequacy in the number, coverage, and types of the geotechnical borings, CPTs, SCPTs, and other tests, and found them to adequately cover most major facilities, including the marine facilities, liquefaction areas, pretreatment areas, flare system, buildings, power generation, and berms at the site, however, an insufficient number of borings were performed beneath the tanks and facilities. Therefore, we recommend in section 4.12.6 that RG LNG conduct additional borings underneath the locations of the tanks to affirm or better characterize underlying conditions and validate the use of shallow foundations. FERC staff will continue its review of the results of the geotechnical investigation to ensure foundation designs are appropriate prior to construction of final design and throughout the life of the facilities.

Based on the test borings conducted, the subsurface profile of Area 1 consists of a layer of fill material extending to a depth of approximately 18 feet below the ground surface, which is designated as Stratum 1. Stratum 1 is underlain by a layer of natural soft to very still clay soils with varying amounts of sand and silt, Stratum 2, extending to a depth of approximately 55 feet below the ground surface. Below Stratum 2, the underlying strata are: Stratum 3, a natural granular layer consisting of loose to very dense sand, clayey sand, and silty sand extending to a depth of approximately 90 feet below existing grade; Stratum 4, a natural firm to hard cohesive layer extending to a depth of approximately 120 feet; Stratum 5, a natural very dense sand and silty sand layer extending to a depth of approximately 140 feet; Stratum 6, a natural stiff to hard cohesive layer extending to a depth of approximately 150 feet. Stratum 6 in Area 1 is underlain by Stratum 7, a natural very dense sand, clayey sand, and silty sand, extending to a depth of approximately 260 feet below the ground surface. Below Stratum 7 is Stratum 8, a natural very stiff to hard cohesive layer extending to a depth of approximately 300 feet below the ground surface. Test borings in Area 2 were terminated at 150 feet below existing ground surface consists of Stratums 1 through 6, however not all the stratums terminate at the same depths as those in Area 1. Stratum 1, 2, 3, 4, 5, and 6, terminate at depths of approximately 18 feet, 55 feet, 90 feet, 110 feet, 130 feet, and 150 feet below existing ground surface respectively. Measurements from the temporary piezometers show groundwater levels varied from -0.5 feet and +1.5 feet NAVD 88.

Considering the subsurface conditions for the LNG facility, RG LNG is proposing to support the LNG tanks and most of the facility structures on mat foundations placed on improved ground. Fugro provided considerations for ground improvement techniques including preloading, deep soil mixing or grouting, Vibro Replacement with stone columns, dynamic compaction, and Vibrofloatation. In areas where ground improvement is utilized, RG LNG is proposing to utilize deep soil mixing ranging in depth of 10 to 40 feet, depending on the foundation loading and soil suitability for ground improvement, to bring foundations capacities and settlements within acceptable limits. Structures that are located in areas that are not suitable for deep soil mixing due to specific load requirements or would perform unsatisfactorily with dynamic loads are proposed to be placed on 24-inch diameter 60 foot long auger cast-in-place piles.

Dredging would be required for the LNG ships to traverse to the terminal as well as for the construction of the marine facilities. The existing shoreline would be excavated, dredged, and sloped during construction. The post-construction shoreline would be approximately 500 feet east of the current location. To prevent slumping of the dredged slope, maintain the berthing line position, and provide structural integrity support to the landside facilities, the excavated shoreline would be reinforced with rip-rap armoring. The increase in large ship traffic within the BSC is also considered for shoreline erosion. The proposed rip-rap armoring would minimize the potential for erosion where the shoreline would be excavated.

The results of RG LNG's geotechnical investigation at the Project site indicate that subsurface conditions are suitable for the proposed facilities, if proposed site preparation, foundation design, and construction methods are implemented in addition to the satisfaction of proposed recommendations.

<u>Structural and Natural Hazard Evaluation</u>

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, evaluate how these events would affect reliability, and describe what design features and procedures that would be used to reduce potential hazards. In addition, 18 CFR 380.12 (o)(14) require an applicant to demonstrate how they would comply with 49 CFR 193 and NFPA 59A. DOT regulations under 49 CFR 193 have some specific requirements on designs to withstand certain loads from natural hazards and also incorporates by reference NFPA 59A (2001 and 2006) and ASCE 7-05 and ASCE 7-93 via NFPA 59A (2001). NFPA 59A (2001) Section 2.1.1 (c) also requires that RG LNG consider the plant site location in the design of the Project, with respect to the proposed facilities being protected, within the limits of practicality, against natural hazards, such as from the effects of flooding, storm surge, and seismic activities. This would be covered in PHMSA's LOD on 49 CFR Part 193 Subpart B. However, the LOD would not cover whether the facility is designed appropriately against these hazards, which would be part of 49 CFR Part 193 Subpart C. Unlike other natural hazards, wind loads are covered in 49 CFR Part 193 Subpart B and would be covered in the LOD. All facilities, once constructed, must comply with the requirements of 49 CFR 193 and would be subject to the DOT's inspection and enforcement programs.

In addition, the facilities would be constructed to the requirements in the 2006 International Building Code (IBC), 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. FERC staff also evaluated potential engineering design to withstand impacts from natural hazards, such as earthquakes, tsunamis, seiche, hurricanes, tornadoes, floods, rain, ice, snow, regional subsidence, sea level rise, landslides, wildfires, volcanic activity, and geomagnetism. In addition, we recommend in section 4.12.6 that RG LNG 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, the company would install equipment in accordance with its final design. In addition, we recommend in section 4.12.6 that RG LNG file, for review and approval, settlement results during hydrostatic tests of the LNG storage containers and periodically thereafter to verify settlement is as expected and does not exceed the applicable criteria in API 620, API 625, API 653, and ACI 376.

Earthquakes, Tsunamis, and Seiche

FERC regulations under 18 CFR 380.12 (h)(5) requires evaluation of earthquake hazards based on whether there is potential seismicity, surface faulting, or liquefaction. Earthquakes and tsunamis have the potential to cause damage from shaking ground motion and fault ruptures. Earthquakes and tsunamis often result from sudden slips along fractures in the earth's crust (i.e., faults) and the resultant ground motions caused by those movements, but can also be a result of volcanic activity or other causes of vibration in the earth's crust. The damage that could occur as a result of ground motions is affected by the type/direction and severity of the fault activity and the distance and type of soils the seismic waves must travel from the hypocenter (or point below the epicenter where seismic activity occurs). To assess the potential impact from earthquakes and tsunamis, RG LNG 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) (USGS 2018a) RG LNG would not be near such faults, which are primarily on the West Coast. However, in the Gulf Coastal Plains, there are several hundred growth faults that are known or suspected to be active. Most of these growth faults are located within the Houston-Galveston area subsidence bowl, but many others are known to exist from Brownsville to east of New Orleans, Louisiana. Evidence of modern activity of these growth faults includes changes in elevation that can lead to damage to pavement, buildings, and other structures. Subsidence has also been recorded occurring naturally through fault movements and compaction/consolidation of Holocene deposits.

RG LNG hired Fugro to perform a site-specific fault and seismic analysis for the Project, involving field investigations and subsequent data evaluation. The initial growth fault study identified a higher than average potential susceptibility for growth faults. This led to a more detailed fault study that mapped an identified growth fault in the southwest portion of the site. The average regional subsidence being observed is less than 0.05 feet over a 33-year study period, or 0.018 inches per year according to the TDWR. However, due to the identified growth fault, Fugro recommends accounting for additional vertical movement of up to 0.1 inch per year.

In addition, Fugro developed several recommendations for locating major structures away from the fault, designing nearby structures adjacent to the fault to take into account displacements in all three directions along the fault over time, and orienting structures perpendicular to the strike face of the fault which has a dip angle between 63 degrees. Fugro also recommended that structures within the fault hazard zone be placed on shallow foundations, establish threshold movement levels, implement a routine monitoring plan with permanent benchmarks and survey monuments, and include an action plan should threshold levels be exceeded. FERC staff agree with Fugro's recommendations and we recommend in section 4.12.6 that RG LNG adopt these recommendations in its design and throughout the life of the LNG Terminal.

While the presence of major tectonic faults and growth faults can require special consideration, the presence or lack of major tectonic 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 Part 193.2101 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 Part 193.2101 Subpart C require that LNG tanks be designed to have the ability to safely shutdown when subjected to earthquake ground motions which have a 2 percent probability of being exceeded in 50 years (2,475 year mean return interval) at the ground surface at the site (termed the safe shutdown earthquake [SSE]). DOT regulations in 49 CFR Part 193.2101 Subpart C also incorporate by reference NFPA 59A (2001) Chapter 6, which require piping systems conveying flammable liquids and flammable gases with service temperatures below -20 °F, be designed as required for seismic ground motions. The facilities, once constructed, are subject to the DOT's inspection and enforcement programs.

In addition, FERC staff recognizes RG LNG would also need to address hazardous fluid piping with service temperatures at -20 °F and higher and equipment other than piping, and LNG storage (shop built and field fabricated) containers. We also recognize the current FERC regulations under 18 CFR 380.12(h)(5) continue to incorporate National Bureau of Standards Information Report 84-2833. Report 84-2833 provides guidance on classifying stationary storage containers and related safety equipment as Category I and classifying the remainder of the LNG Terminal 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 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 ANSI consensus design standard, its seismic requirements are based directly on the National Earthquake Hazards Reduction Program Recommended Provisions, and it is referenced directly by the IBC. Having a link directly to the IBC and ASCE 7 is important to accommodate seals by the engineer of record because the IBC is directly linked to state professional licensing laws while the Program Recommended Provisions are not.

The geotechnical investigations of the existing site performed by Fugro indicate the site is classified as Site Class E[49] based on a site average shear wave velocity that ranged between 541 and 701 feet per second in Area 1, and between 456 and 646 feet per second in Area 2 (Fugro 2015a). This is in accordance with ASCE 7-05, which is incorporated directly into 49 CFR 193 for shop fabricated containers less than 70,000 gallons and via NFPA 59A (2006) for field fabricated containers.[50] This is also in accordance with IBC (2006). Sites with soil conditions of this type would experience significant amplifications of surface earthquake ground motions. However, due to the absence of a major fault in proximity to the site and lower ground motions, the seismic risk to the site is considered low.

Fugro performed a site-specific seismic hazard study for the site. The study concluded that the site would have an OBE PGA of 0.008 g and 0.01 g for Area 1 and 2, respectively, and a SSE PGA of 0.04 g and 0.048 g (Fugro 2015a). The study also concluded that earthquake ground motions at the ground surface of the site that have a 2 percent probability of being exceeded in 50 years have a 0.2-second spectral acceleration value of 0.09 g for Area 1 and 0.11 g for Area 2, and a 1.0-second spectral acceleration at the site is 0.09 g for Area 1 and 0.09 g for Area 2.

Based on the design ground motions for the site and the importance of the facilities, the facility seismic design is assigned Seismic Design Category A in accordance with the IBC (2006) and ASCE 7-05. These ground motions are relatively low compared to other locations in the United States. FERC staff verified the ground accelerations using Applied Technology Council and USGS calculators, which indicate SSE PGA of 0.039 g (USGS 2018b, Applied Technology Council 2018).

ASCE 7-05 also requires determination of the Seismic Design Category based on the Occupancy Category (or Risk Category in ASCE 7-10 and 7-16) and severity of the earthquake design motion. The Occupancy Category (or Risk Category) is based on the importance of the facility and the risk it poses to the public.[51]

---

49 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).

50 Site Class E is analogous Soil Profile Type S_4 criteria in ASCE 7-93, which is incorporated into 49 CFR Part 193 via NFPA 59A (2001) for piping systems conveying flammable liquids and flammable gases with service temperatures below 20 °F.

51 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.

FERC staff has identified the Project as a Seismic Design Category A based on the ground motions for the site and an Occupancy Category (or Risk Category) of III or IV, this seismic design categorization would appear to be consistent with the IBC (2006) and ASCE 7-05 (and ASCE 7-10).

Seismic events can also result in soil liquefaction in which saturated, non-cohesive soils temporarily lose their strength/cohesion and liquefy (i.e., behave like viscous liquid) as a result of increased pore pressure and reduced effective stress when subjected to dynamic forces such as intense and prolonged ground shaking. Areas susceptible to liquefaction may include saturated soils that are generally sandy or silty. Typically, these soils are located along rivers, streams, lakes, and shorelines or in areas with shallow groundwater.

The site-specific seismic study indicates sandy layers between -45 and -85 feet below grade; 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 either a site improved with deep soil mixing or in some cases deep foundations, which would mitigate any potential impacts of soil liquefaction. Should soil improvement be required to counteract soil liquefaction, RG LNG 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 to suggest that the 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 2014b), 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). RG LNG's *Seismic and Fault Study* report included a Tsunami Hazard Assessment for the Project area. There are four main submarine landslide hazard zones in the Gulf of Mexico including the Northwest Gulf of Mexico, Mississippi Canyon and Fan, the Florida Escarpment, and the Campeche Escarpment (USGS 2009). Based on modeling and limited historical data, it is estimated that tsunamis generated from landslides would be 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, RG LNG evaluated such events historically. The severity of these events are often determined on the probability that they occur and are sometimes referred to as the average number years that the event is expected to re-occur, or in terms of its mean return/recurrence interval.

Because of its location, the Project site would likely be subject to hurricane force winds during the life of the Project. RG LNG stated that the Project would be designed to ASCE 7-05 using Allowable Stress Design as opposed to the strength design. RG LNG indicates the design wind speed using ASCE 7-05 Allowable Stress Design for LNG facilities and hazardous structures, which would be categorized as Occupancy Category III and IV, would be 145 mph 3-second gust. When converting the Allowable Stress Design to a strength design, this would equate to a 183 mph 3-second gust or 150 mph sustained wind speed and be approximately equivalent to a 10,000 year mean return interval or have a 0.11 percent probability of exceedance in a 50-year period for the site. 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). RG LNG also indicates the design wind speed for other non-hazardous structures, which would be categorized as Occupancy Category I and II, would be 130 mph 3-second gust per ASCE 7-05 Figure 6-1A. However, FERC staff found that when reviewing Figure 6-1A of ASCE 7-05, the Project location is closest to the 140 mph 3-second gust isocontour.

FERC staff also utilized the Applied Technology Council hazard tool, which interpolates site specific wind speed using ASCE's 3-second gust wind speed, to evaluate the ASCE 7-05 the 3-second gust wind speed and found it to be 141 mph. We also recognize ASCE 7-10 and ASCE 7-16 would require a 139 mph 3-second gust for Risk Category I non-hazardous structures and 149 mph 3-second gust for Risk Category II non-hazardous structures. In addition, it is unclear as to whether some of these non-hazardous buildings and structures would qualify as LNG facilities under DOT regulations, and, if so, whether anything less than 150 mph sustained (183 3-second gust) or a 10,000 year return period (179 to 185 mph 3-second gust) would meet DOT requirements. Therefore, we recommend in section 4.12.6 that RG LNG consult with PHMSA staff as to whether the design wind speed for other non-hazardous buildings and structures would be subject to DOT requirements prior to the end of the comment period of the draft EIS.

RG LNG must meet 49 CFR Part 193.2067 Subpart B for wind load requirements. In accordance with the MOU, the DOT will evaluate in its LOD whether an applicant's proposed project meets the DOT requirements under Subpart B. If the project is constructed and becomes operational, the facilities would be subject to the DOT's inspection and enforcement programs. Final determination of whether the facilities are in compliance with the requirements of 49 CFR Part 193 Subpart B would be made by the DOT staff.

In addition, as noted in the limitation of ASCE 7-05, tornadoes were not considered in developing basic wind speed distributions. This leaves a potential gap in potential impacts from tornadoes. Therefore, FERC staff evaluated the potential for tornadoes. Appendix C of ASCE 7-05 makes reference to American Nuclear Society 2.3 (1983 edition), *Standard for Estimating Tornado and Extreme Wind Characteristics at Nuclear Power Sites*. This document has since been revised in 2011 and reaffirmed in 2016 and is consistent with NUREG/CR-4461, *Tornado Climatology of the Contiguous U.S.*, Rev. 2 (NUREG 2007). These documents provide maps of a 100,000-mean-year return period for tornadoes using 2 degree 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 114 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 114 mph 3-second gust in American Nuclear Society 2.3 and NUREG/CR-4461.

As a result, FERC staff believes the use of an equivalent 183 mph 3-second gust, is adequate for the LNG storage tanks and conservative from a risk standpoint for the other LNG and hazardous facilities. DOT will provide a LOD on the Project's compliance with 49 CFR Part 193 Subpart B in regard to wind speed. This determination will be provided to the Commission as further consideration to the Commission on its decision to authorize or deny the Project. We also recommend in section 4.12.6 that RG LNG revise the wind speed to be no less than 139 mph 3-second gust for Occupancy Category I non-hazardous structures and 149 mph 3-second gust for Occupancy Category II non-hazardous structures.

The DOT regulations in 49 CFR Part 193.2067 Subpart B would require the impounding system for the LNG storage tanks to withstand impact forces from wind borne missiles. ASCE 7 also recognizes the facility would be in a wind borne debris region. Windborne debris has the potential to perforate equipment and the LNG storage tanks if not properly designed to withstand such impacts. The potential impact is dependent on the equivalent projectile wind speed, characteristics of projectile, and methodology or model used to determine whether penetration or perforation would occur. However, no criteria are provided in 49 CFR 193 or ASCE 7 for these specific parameters. NFPA 59A (2016) recommends CEB 187 be used to determine projectile perforation depths.

In order to address the potential impact, we recommend in section 4.12.6 that RG LNG provide a projectile analysis for review and approval to demonstrate that the outer concrete impoundment wall of a full-containment LNG tank could withstand wind borne projectiles prior to construction of the final design. The analysis should detail the projectile speeds and characteristics and method used to determine penetration or perforation depths. FERC staff would compare the analysis and specified projectiles and speeds using established methods, such as CEB 187, and DOE and Nuclear Regulatory Commission guidance.

In addition, FERC staff evaluated historical tropical storm, hurricane, and tornado tracks in the vicinity of the Project facilities using data from the DHS Homeland Infrastructure Foundation Level Data and NOAA Historical Hurricane Tracker (DHS 2018), NOAA 2018c). Brownsville has had 30 tropical storms or hurricanes hit within 65 nautical miles since 190*0, and* Cameron County has been impacted by 10 hurricanes or tropical storms since 1900. The most recent major hurricane was Hurricane Bret, 1999, just north of Cameron County, which peaked as a Category (Cat) 4 hurricane with 144 mph sustained winds and made landfall as a Category 3 hurricane with 115 mph sustained winds. [52] Prior to Hurricane Bret, Cameron County was hit by Hurricane Allen (Cat 5 peak, Cat 3 landfall) in 1980, Hurricane Beulah (Cat 5 peak, Cat 5 landfall) in 1967 and two unnamed hurricanes in 1933 (Cat 5 peak, Cat 3 landfall) and 1916 (Cat 4 peak, Cat 4 landfall). Hurricanes in Cameron County have been observed to have peaked when reaching landfall with 161 mph sustained winds and to have produced storm surges up to 18 feet. The estimated return period for a major hurricane passing within 50 nautical miles of the coast of Cameron County is about 30 years (NOAA 2016b).

Potential flood levels may also be informed from the FEMA Flood Insurance Rate Maps, which identifies Special Flood Hazard Areas (base flood) that have a 1 percent probability of exceedance in 1 year to flood (or a 100-year mean return interval) and moderate flood hazard areas that have a 0.2 percent probability of exceedance in 1 year to flood (or a 500-year mean return interval). According to the FEMA National Flood 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 (2017a), the 100-year flood elevation at the Site is +9.6 feet NAVD 88 and the 500-year flood elevation is +13.5 feet NAVD 88. FERC staff recognizes 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 the standing water elevation (SWEL) and wave crests. Furthermore, FERC staff believes 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,[53] 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. RG LNG has indicated that the facility would be designed to handle a 100-year storm surge without any wave overtopping, and would be designed to accommodate the wave overtopping that would occur from a 500-year storm surge.

RG LNG has proposed to construct an earthen berm and floodwalls around the perimeter of the site to minimize impacts associated with potential storm surges. The floodwall and berm are proposed to be designed with a crest elevation ranging between +17 feet and +19 feet NAVD 88. In addition, RG LNG has indicated that it would provide an additional 4 inches over-height margin to the crest elevations (so initial crest elevations will be 17.33 and 19.33 feet) to account for initial relative sea level rise concerns. RG LNG conducted a storm surge analysis that identified the storm surge elevation for the 100-year and 500-year events. Storm surge elevations were found to be 9.6 feet and 13.5 feet, respectively. Wave run-up calculations were carried out for the proposed berm and floodwall using the EurOtop overtopping formulations Technical Advisory Committee for Water Retaining structures methodology, as applied by FEMA. These calculations determined that at the 100-year return period the maximum wave run-up elevations are 22.5 feet. *Wave crest elevations would rang*e between 11.3 and 12.8 feet

---

52 A major hurricane is defined as a hurricane that has been classified as Hurricane Category 3 or higher.

53 *Global And Regional Sea Level Rise Scenarios for the United States*, U.S. Department Of Commerce, NOAA, National Ocean Service Center for Operational Oceanographic Products and Services, January 2017.

NAVD 88 for 100-year storms and 15.9 feet to 17.8 feet NAVD 88 for 500-year storms. Analysis of a 500-year recurrence interval storm surge with worst-case levee overtopping volumes and associated rainfall over a 24-hour period indicates a maximum flood level associated with the overtopping of 10.5 feet NAVD 88 within the confines of the levee system. This would result in general inundation of the LNG Terminal site, but maximum water elevations would be 6 inches below the top of foundations of all equipment, piping, and buildings.

We evaluated the design against a 500-year SWEL with a 500-year wave crest and sea level rise and subsidence. RG LNG indicated that the anticipated sea level rise and subsidence for the LNG Terminal would be approximately 0.7 feet over the life of the Project. FERC staff found that utilizing COE online tool for estimating sea level rise and subsidence, the project could be subjected to a sea level rise and subsidence value of up to approximately 1 foot. Adding the 500-year storm surge, wave crest elevations, and sea level rise and subsidence results in a total elevation of between 16.9 feet to 18.8 feet. FERC staff evaluated RG LNG's proposed 500-year flood against the 2018 FEMA Flood Insurance Study for Cameron County (FEMA 2018), which provides various transection lines and associated 10-, 50-, 100-, and 500-year SWELs, 500-year wave envelopes, and 500-year wave effects along the length of the transection lines. The Project intersects with transection line 38, but the eastern face of the site is most likely to receive the most severe storm surge is closest to transection line 45. Transection line 45 from the Flood Insurance Study transects the channel-side of the proposed site and has a maximum 500-year SWEL of 12.5 feet NAVD 88 and a maximum wave height of 3 feet NAVD 88. Typically, FEMA computes a wave crest as 70 percent of the total wave height above the still water level; that is, the 500-year wave effect is taken as 70 percent of 3 feet, or 2.1 feet. Adding the SWEL, wave crest elevation, and sea level rise and subsidence, results in a total elevation of +15.6 feet NAVD 88. As a result, FERC staff believes the facility would be able to withstand storm surge without damage during a 500-year storm event. Furthermore, RG LNG has committed to a periodic perimeter levee elevation survey program for the life of the facility. This program would include the monitoring of the crest elevations of the perimeter berm and remediation actions such as placing additional material on top of the berm to maintain the crest to its design elevation.

The Texas and Louisiana Gulf Coast area is experiencing the highest rates of coastal erosion and wetland loss in the United States (Ruple 1993). The average coastal erosion rates is -1.2 meters per year between 2000 and 2012 along the Texas coastal shoreline, with South Padre Island experiencing a shoreline loss rate of -1.6 meters per year between 2000 and 2012 (McKenna 2014). Shoreline erosion could occur at the Project site and along the opposite shoreline as a result of waves, currents, and vessel wakes. To prevent erosion, new revetment in the form rip rap would be installed in the dredged marine berth and maneuvering areas. Even though shoreline erosion is a concern at the site, the proposed mitigation measures would minimize erosion and scour impacts.

Landslides and other Natural Hazards

Due to the low relief across the Project site, there is little likelihood that landslides or slope movement at the site would be a realistic hazard. Landslides involve the downslope movement of earth materials under force of gravity due to natural or human causes. The Project area has low relief which reduces the possibility of landslides.

Volcanic activity is primarily a concern along plate boundaries on the West Coast and Alaska and also Hawaii. Based on FERC staff review of maps from USGS (2018c) and DHS (2018) of the nearly 1,500 volcanoes with eruptions since the Holocene period (in the past 10,000 years) there are no known active or historic volcanic activity within proximity of the site with the closest being over 400 miles away across the Gulf of Mexico in Los Atlixcos, Mexico.

Geomagnetic disturbances 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. The USGS provides a map of geomagnetic disturbance intensities with an estimated 100-year mean return interval (USGS 2018d). The map indicates the LNG Terminal could experience geomagnetic disturbance intensities of 70-90 nano-Tesla with a 100-year mean return interval. However, RG LNG would be designed such that if a loss of power were to occur the valves would move into a fail-safe position.

External Impact

To assess the potential impact from external events, FERC staff conducted a series of reviews to evaluate transportation routes, land use, and activities within the facility and surrounding the Project site and the safeguards in place to mitigate the risk from events, where warranted. FERC staff coordinated the results of the reviews with other federal agencies to assess potential impacts from vehicles and rail; aircraft impacts to and from nearby airports and heliports; pipeline impacts from nearby pipelines; impacts to and from adjacent facilities that handle hazardous materials under the EPA's Risk Management Plan (RMP) regulations and power plants, including nuclear facilities under Nuclear Regulatory Commission's regulations. Specific mitigation of impacts from use of external roadways, rail, helipads, airstrips, or pipelines are also considered as part of the engineering review done in conjunction with the NEPA review.

FERC staff uses a risk based approach to assess the potential impact of the external events and the adequacy of the mitigation measures. The risk based approach uses data based on the frequency of events that could lead to an impact and the potential severity of consequences posed to the Project site and the resulting consequences to the public beyond the initiating events. The frequency data is based on past incidents and the consequences are based on past incidents and/or hazard modeling of potential failures.

<u>Road</u>

FERC staff reviewed whether any truck operations would be associated with the project and whether any existing roads would be located near the site. FERC staff uses this information to evaluate whether the Project and any associated truck operations could increase the risk along the roadways and subsequently to the public and whether any pre-existing unassociated vehicular traffic could adversely increase the risk to a 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 Part 193.2155 (a) (5) (ii) Subpart C require that structural members of an impoundment system 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, incorporated by reference in 49 CFR 193, requires transfer piping, pumps, and compressors to be located or protected by barriers so that they are safe from damage by rail or vehicle movements. However, the DOT regulations and NFPA 59A (2001) requirements do not indicate what collision(s) or explosion(s) could reasonably be expected to cause the most severe loading. FERC staff evaluated consequence and frequency data from these events to evaluate these potential impacts.

FERC staff evaluated the risk of the truck operations based on the consequences from a release, incident data from the Federal Highway Administration, National Highway Traffic Safety Administration, and PHMSA, frequency of trucks, and proposed mitigation to prevent or reduce the impacts of a vehicular incident. Unmitigated consequences under worst case weather conditions from catastrophic failures of trucks proposed at the site generally can range from 200 to 2,000 feet for flammable vapor dispersion, 850 to 1,500 feet for radiant heat of $5kW/m^2$ from fireballs, and 275 to 350 feet for radiant heat of $5kW/m^2$ from jet fires with projectiles from BLEVEs possibly extending farther. These values are also close to the distances provided by the Federal Highway Administration for designating hazardous material trucking routes (0.5 miles for flammable gases for potential impact distance) and PHMSA for emergency response (0.5 to 1 mile for initial evacuation and 1 mile for potential BLEVEs for flammable gases). Unmitigated consequences under average ambient conditions from releases of 1,000 gallons through a 1-inch hole would result in much more modest distances ranging from 25 to 200 feet for flammable vapor dispersion, and 75 to 175 feet for jet fires.

Incident data indicates hazardous material incidents are very infrequent (4e-3 incidents per lane mile per year) and nearly 75 to 80 percent of hazardous material vehicular incidents occur during unloading and loading operations while the other 20 to 25 percent occur while in transit or in transit storage. In addition, approximately 99 percent of releases are 1,000 gallons or less and catastrophic events that would spill 10,000 gallons or more make up less than 0.1 percent of releases. In addition, less than 1 percent of all reportable hazardous material incidents with spillage result in injuries and less than 0.1 percent of all reportable hazardous material incidents with spillage result in fatalities.

During operation of the Project, the number of trucks would depend on market conditions for LNG and the amount of condensate in the feed gas with estimates of up to approximately 33,000 trucks or tanker trucks to transport commodities (e.g., LNG, refrigerants, diesel, hot oil, condensate product, etc.) to or from the facility each year. This total assumes maximum use of LNG and Condensate truck loading facilities, which would not be likely.

SH-48 would border the northern side of the proposed site. State Highway 48 is a four-lane highway with speed limits up to 75 mph. RG LNG proposes to install a 17-foot-high storm levee (i.e., berm) that would separate SH-48 from the process equipment and piping within the LNG facility. Distances from SH-48 to the berm would be approximately 230 feet with another approximately 390 feet from the berm to equipment. FERC staff did not identify any other major highways or roads within close proximity to piping or equipment containing hazardous materials at the site that would not be protected by the berm to raise concerns of direct impacts from a vehicle impacting the site. The berm and separation distances would also provide protection from flammable vapor dispersion and radiant heats.

We believe the berm and separation distances would provide adequate protection from most potential accidental and intentional vehicle impacts. Furthermore, RG LNG would install deceleration, acceleration, and turning lanes at all vehicle access points for safe vehicular access/departure. Each entrance would also have vehicular barriers and RG LNG would install crash barriers, bollards, and guard posts to protect onsite process equipment to further mitigate accidental and intentional vehicle impacts. We recommend in section 4.12.6 that RG LNG provide, for review and approval, final design details of vehicular barriers at each entrance to the site. As a result of the protective berm and separation distances protecting piping and equipment containing hazardous materials and a negligible increase in risk of hazardous material incidents impacting the facilities and nearby population, FERC staff does not believe the proposed Rio Grande LNG Project would pose a significant risk or significant increase in risk to the public due to vehicle impacts.

<u>Rail</u>

FERC staff reviewed 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 RG LNG 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 Part 193.2155 (a) (5) (ii) Subpart C state if the LNG facility adjoins the right-of-way of any railroad, the structural members of an impoundment system must be designed and constructed to prevent impairment of the system's performance reliability and structural integrity as a result of a collision by or explosion of a train or tank car that could reasonably be expected to cause the most severe loading.

Section 8.5.4 of NFPA 59A (2001), incorporated by reference in 49 CFR 193, requires transfer piping, pumps, and compressors to be located or protected by barriers so that they are safe from damage by rail or vehicle movements. However, the DOT regulations and NFPA 59A (2001) requirements do not indicate what collision(s) or explosion(s) could reasonably be expected to cause the most severe loading. Therefore, FERC staff evaluated consequence and frequency data from these events to evaluate these potential impacts. There would be no rail transportation associated with the Project. FERC staff evaluated the risk of the rail operations based on the consequences from a release, incident data from the Federal Railroad Administration and PHMSA, and frequency of rail operations near the LNG Terminal site.

Unmitigated consequences under worst case weather conditions from catastrophic failures of rail cars containing various flammable products generally can range from 300 to 3,000 feet for flammable vapor dispersion, 1,250 to 2,100 feet for radiant heat of $5kW/m^2$ from fireballs, and 450 to 575 feet for radiant heat of 5kW/m^2 from jet fires with projectiles from BLEVEs possibly extending farther. These values are also close to the distances provided by PHMSA for emergency response (0.5 to 1 mile for initial evacuation and 1 mile for potential BLEVEs for flammable gases) (USGS 2018d). Unmitigated consequences under average ambient conditions from releases of 1,000 gallons through a 1-inch hole would result in much more modest distances ranging from 25 to 200 feet for flammable vapor dispersion, and 75 to 175 feet for jet fires.

Incident data indicates hazardous material incidents are very infrequent (6e-3 incidents per rail mile per year). In addition, approximately 95 percent of releases are 1,000 gallons or less, and catastrophic events that would spill 30,000 gallons or more make up less than 1 percent of releases. In addition, less than 1 percent of hazardous material incidents result in injuries and less than 0.1 percent of hazardous material incidents result in fatalities. The closest rail line is located approximately 5 miles to the west of the Project site. This would be farther than the consequence distances under worst case weather conditions and events. Given the distance and position of the closest rail lines relative to the populated areas to the east of the LNG Terminal, FERC staff does not believe the proposed Project would 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 reviewed 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 Part 193.2155 (b) Subpart C requires that an LNG storage tank must not be located within a horizontal distance of one mile from the ends, or 0.25 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 FAA requirements. In addition, FERC staff evaluated the risk of an aircraft impact from nearby airports.

There would be no aircraft associated with the Project that would warrant a review that would increase in risk to the public from aircraft operations. The closest airports to the RG LNG Project site would be the Port Isabel Cameron County Airport located approximately 11 miles to the northwest and the Brownsville South Padre Airport located approximately 12 miles to the west.

FERC staff also identified 2 smaller airports within a 20-mile radius from the proposed site: Drennan Farm located approximately 13 miles away and Rancho Buena Vista Airport located approximately 16 miles away. In addition, FERC staff identified three heliports: Coast Guard Station Heliport located approximately 6 miles to the northeast, Southeastern Helicopters Heliport located approximately 8 miles to the northeast, and Columbia Valley Regional Heliport located approximately 14.5 miles to the west of the Project site.

FERC staff analyzed existing aircraft operation frequency data based on the airports identified above and their proximity to the LNG storage tanks and process areas, 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, FERC staff determined the proposed Project would not pose a significant risk to the public as a result of the proximity of the Project to the airports.

The FAA regulations in 14 CFR 77 require RG LNG 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 the waterway would require notification to FAA. RG LNG proposes to limit heights of permanent structures to 200 feet and has received FAA Determination of No Hazard to Air Navigation in accordance with 14 CFR 77 for the temporary construction cranes that would exceed 200 feet in height. RG LNG would also need to file a notice to FAA if the LNG carrier is higher than other objects that traverse the waterway in accordance with 14 CFR 77. Therefore, we recommend in section 4.12.6 that RG LNG determines if the LNG carrier would be above the height of the highest mobile object that would normally traverse the waterway, and if so for RG LNG to file a notice to FAA for the LNG carrier.

Finally, comments from the public and feedback from FAA indicated potential impacts to and from the Project and the nearby SpaceX launch facility. FERC staff conducted internal analyses, utilized a third party contractor, and requested information from the applicant on the likelihood and consequences from a potential launch failure impacting the Project. In our review, we determined while there would be debris above a threshold of 3e-5 years, which is the failure rate level we evaluate the potential for cascading damage and the failure rates used by FAA in space launch failures prior to 2017,[54] the cascading damage at the Project site would not impact the public. In addition, the Coast Guard would determine any mitigation measures needed on a case by case basis to safeguard public health and welfare from LNG carrier operations during rocket launch activity. However, our review determined that rocket launch failures could impact onsite construction workers and plant personnel. Therefore, we recommend in section 4.12.6 that construction crews be positioned outside of higher risk areas during rocket launch activity and for plant personnel to monitor the rocket launches and shut down operating equipment in the event of a rocket launch failure.

In addition, the federal government indemnifies, subject to Congressional appropriations, commercial space licensees from liability for any claims above the liability insurance required under regulation. The maximum probable loss used to determine the insurance and liability uses $3 million for each casualty from direct and indirect effects from a failed launch. Since the LNG facilities would be valued up to approximately $25 billion,

---

54 FAA's 14 CFR 417.107 (b) regulations were updated from 3e-5 casualties for three different events (in 2016 edition) to 1e-4 casualties cumulative (in 2017 edition).

conventional LNG ships would be valued at $200-250 million, and a peak construction workforce would total over 5,000 workers, a potential exists for the federal government to be liable for a large sum of money that could exceed the current indemnification levels by a large margin. As a result, the Project may have possible impact to the SpaceX operation due to the insurance premiums that could increase costs to SpaceX, limit the frequency and types of launches out of the Brownsville SpaceX launch site. Depending on the reliance of the National Space Program on the Brownsville SpaceX launch site, this could also have an impact on the National Space Program. There is also potential impact to the liability of the federal government due to indemnification by the federal government for losses above 3.1 billion dollars. However, the extent of these impacts would be not be fully known until SpaceX submits an application requesting to launch with the FAA and whether the LNG plant is under construction or in operation.

Pipelines

FERC staff reviewed whether any pipeline operations would be associated with the Project and whether any existing pipelines would be located near the site. FERC staff uses this information to evaluate whether the Project and any associated pipeline operations could increase the risk to the pipeline facilities and subsequently to the public and whether any pre-existing unassociated pipeline operations could adversely increase the risk to the Project site and subsequently increase the risk to the public. In addition, pipelines associated with this Project must meet DOT regulations under 49 CFR 192 and are discussed in Section 4.12.2. All facilities, once constructed, must comply with the requirements of 49 CFR 192 and 49 CFR 193 and would be subject to DOT's inspection and enforcement programs. FERC staff evaluated the risk of a pipeline incident impacting the Project and the potential of cascading damage increasing the risk to the public based on the consequences from a release, incident data from PHMSA, and proposed mitigation to prevent or reduce the impacts of a pipeline incident from RG LNG.

For existing pipelines, FERC staff identified an abandoned gas gathering pipeline within the southern border of the Project site and the nearest active gas gathering pipeline would be located approximately 1.4 miles to the west of the Project site. These pipelines would be inactive or located too far to impact the Project site in the event of an incident.

In addition, FERC staff and cooperating agencies identified Enbridge's non-jurisdictional Valley Crossing Pipeline (VCP) currently under construction routed through the Project site's proposed 75-feet wide utility easement. The VCP will be a 42-inch diameter 2.6 Bcf/d cross-border natural gas pipeline with a Maximum Allowable Operating Pressures (MAOP) of 3,000 psi between Texas and Mexico that will be used for power generation and industrial customers. The VCP is to extend southwest from a header system in Nueces County, near the Agua Dulce Hub near Corpus Christi, to the proposed border-crossing facility, and would be subject to the jurisdiction of the RRC. Two compressor stations, multiple meter stations and ancillary facilities are also under construction. The VCP would be considered a Class 1 Area after the pipeline is constructed and placed into service assuming that the LNG Terminal is not constructed. The class location is determined under 49 CFR 192.5 based on the population density and land use within 660 feet surrounding the pipeline. The class location impacts the pipeline design, operating, and maintenance requirements, including, but not limited to: the steel pipe design factors under 49 CFR 192.111, transmission line sectionalizing block valve spacing under 49

CFR 192.179, inspection and testing of welds under 49 CFR 192.241, depth of cover of soil or consolidated rock under 49 CFR 192.327, test pressures under 49 CFR 192 Subpart J, patrol intervals under 49 CFR 192.705, and leak survey intervals under 49 CFR 192.706. In addition, the class location and the Potential Impact Radius (PIR) is used to determine whether a pipeline is within a high consequence area (HCA), which are used to determine integrity management requirements specified in 49 CFR 192 Subpart O. FERC staff, in consultation with DOT, calculated the VCP would have a PIR of 1,587 feet based on the 42-inch pipeline diameter and 3,000 psi and in accordance with 49 CFR 192.903.[55]

If the Project site is approved and begins construction, the proposed Project facilities would be within the PIR with portions within 660 feet from the VCP.[56] The additional 5,000 construction workers and 270 operating personnel that may be within 660ft would require a change in class location under 49 CFR 192.609. RG LNG indicated that it anticipates that VCP would be required to change the class designation from a Class 1 Area to a Class 3 Area based number of workers estimated within 660 feet of the pipeline centerline during construction and once the facility is in operation.[57] The change in class location would impact the pipeline design, operating, and maintenance requirements. In addition, the VCP would become a HCA based on the estimated number of people within the PIR and Enbridge would be required to perform an updated HCA analysis and potentially make modifications to the design or operation of the VCP in the vicinity of the Project site.

Specifically, the design factor would change from 0.72 for Class 1 to 0.50 for Class 3, the transmission line sectionalizing block valve spacing would change from pipeline being within 10 miles of a valve for Class 1 locations to the pipeline being within 4 miles of a valve for Class 3 locations,[58] inspection and testing of welds would change from 10 percent of field butt welds having to be tested for Class 1 locations to 100 percent of field butt welds having to be tested for Class 3 locations,[59] depth of cover of soil or consolidated rock would change from 30 inches of cover under normal soil for Class 1 locations to 36 inches for Class 3 locations, test pressures would change from testing to a maximum allowable hoop stress up to 80 percent of the specified minimum yield strength for Class 1 locations to 30 or 50 percent of specified minimum yield strength (depending on test medium) for Class 3 locations, and patrol and leak survey intervals would change from 15 month (but at least once per calendar year) maximum intervals for Class 1 locations to 7.5 months (but at least twice each calendar year) for Class 3 locations. In addition,

---

55 The PIR indicates the potential area impacted by approximately 5,000 Btu/ft2-hr (15.7 kW/m^2), which could result in 1 percent mortality rate for an exposure of 30 seconds and ignition of buildings constructed of wood. The C-FER report that forms the basis of the PIR assumes a 30 second exposure is reasonable based on the assumptions that a person exposed to thermal radiation due to a jet fire would remain in their original position for between 1 and 5 seconds, in order to evaluate the situation, and subsequently travel at 5 mph (2.5 m/s), in the direction of shelter, and find a shelter in 200 feet.

56 RGLNG's Central Control Building is within approximately 575 feet of the VCP PIR and majority of other facilities are within PIR.

57 See 49 CFR Part 192.5 Class locations.

58 Enbridge responses to DOT questions indicate that the amount of natural gas loss in the event of leak or rupture event of the Class 1 system would be 87 million standard cubic foot (MMscf) based on pipeline isolation between the Brownsville Compressor Station and mainline valve and 2,082 MMscf based on pipeline isolation between the mainline valve at MP 146 and at a valve where the receiving pipeline comes onshore in Mexico.

59 Unless impractical, in which case at least 90 percent.

as indicated in the information filed by RG LNG on February 21, 2018, Enbridge indicated that the VCP will be incorporated into Enbridge Inc.'s existing comprehensive integrity management program (IMP). Any future revisions to Enbridge's IMP would also be applied to the VCP. Enbridge will develop and implement revisions to its existing IMP, as necessary, to comply with additional integrity management requirements specified in Texas Railroad Commission regulations. Enbridge indicated that in-line inspection (ILI) tools will be utilized for detection of metal loss and deformation anomalies, and a baseline ILI tool will be run through the pipeline within 10 years after the line goes into service.[60] Enbridge also indicated that subsequent reassessments will be done at a maximum interval of 7 calendar years.

In addition, DOT and FERC request more information on how the VCP would be protected during the initial construction and into the operations stage of the Project. RG LNG indicated that extra protective measures would be put in place to mark and warn of the pipeline's route. For example, the VCP would be marked with flagging during construction activities and special protective crossings would be constructed to distribute vehicular loads. RG LNG indicated that the Project's access control to the utility corridor would minimize the risk of accidental damage to the VCP from external causes and any unauthorized activity on the pipeline right-of-way, thereby further managing the already very small risk of a leak or rupture of the VCP along the RG LNG Terminal. RG LNG would also place temporary board mats and fill over the utility corridor to adequately distribute the load for construction vehicle crossings. RG LNG also indicated no other heavy construction activities would occur over the VCP along the north and east sides of the LNG Terminal site. RG LNG would replace the temporary crossings with permanent crossings at facility access points that distribute the load and prevent long-term settling impacts to the VCP. In addition, adjacent construction activities, including grading, levee construction, and piling would be offset as to not produce excessive shear forces or loads that could impact the VCP. In addition, RG LNG indicated that dredging of the berths/turning basin area is not anticipated to impact the VCP because the pipeline will be HDD under the BSC. Furthermore, according to Enbridge, the VCP will be part of the "One-Call" System. The VCP pipeline will be marked at road/railroad crossing and line of sight through the Class 3 areas. Aerial patrols to identify any changes along the right-of-way or potential threats to the pipeline will be conducted more frequently than required by 49 CFR 192.705.

In addition to the potential design changes and mitigation proposed by RG LNG to protect the VCP from impacts, FERC staff evaluated the potential risk (consequences and likelihood) of incidents from the pipeline and its potential impact. The consequence and frequency of an incident will depend on the type of incident. The types of incidents that are reported to DOT PHMSA are categorized as ruptures, leaks, mechanical punctures, or other incidents, such as releases from emergency shutdown blowdowns, relief valves, or vent valves. The consequence of a rupture would be representative of a full guillotine rupture of a line and would have similar impact distances to structures as the PIR and potentially farther impact distances to people, including cascading damage to the Rio Grande LNG Terminal and potentially fatal effects to 5,000 construction workers and 270 operating personnel located onsite

---

[60] While DOT is aware that VCP has a plan for an ILI launcher facility at the Brownville Compression Station at MP 138 upstream of the LNG Terminal site, DOT is not yet clear where the ILI pigs will be received to properly conduct future instrumented ILI tool inspections in accordance with 49 CFR 192.150 (a) for the VCP to comply with IMP regulations, including a baseline ILI within 10 years of the line becoming operational.

that are not adequately sheltered. The most probable consequences of the cascading effects would not likely extend beyond the consequences of the initiating pipeline incident and would not reach the offsite public. The consequence of leaks, mechanical punctures, and other incidents would have lesser consequences. RG LNG modeled consequences from a 2-inch release, which would be representative of many of these scenarios and the results indicated the consequences would not just reach onsite, but would not be expected to cause cascading impacts to the RG LNG facilities or likely impact workers (unless in close proximity to the incident). However, the likelihood of any pipeline incident or failure is extremely low (less than 4e-4 per mile per year or 0.4 percent probability of occurring on any given mile in any given year). A worst-case full rupture scenario is even less likely constituting approximately 10 percent of all reported incidents with the vast majority of incidents categorized as the less consequential leaks (40 percent), mechanical punctures (10 percent), or other incidents (40 percent). In addition, RG LNG and VCP indicate the pipeline would likely be re-classed from Class 1 to Class 3, which would further reduce the likelihood of ruptures. In fact, there have been no ruptures of Class 3 interstate natural gas transmissions systems from 2010 to present and those that occurred prior to 2010 were nearly all pipelines installed prior to 1970.

RG LNG estimated the likelihood of a rupture of a 30-inch diameter or greater onshore natural gas pipeline to be 8e-6 per mile per year. Based on DOT PHMSA data, the likelihood of an interstate natural gas transmission pipeline incident would change from 4e-5 per mile per year for Class 1 locations to less than 1e-5 per mile per year for Class 3 locations. While the Class 1 incident rate for ruptures is above the 3e-5 per year that FERC staff determine as initial screening criteria for credible events to consider, the Class 3 incident rate data would be below the 3e-5 per year that FERC staff determine as initial screening criteria for credible events to consider. As a result, FERC staff does not believe the proposed Project would significantly increase the risk to the offsite public beyond existing risk levels that would be present from a worst-case pipeline rupture event or other incident within the vicinity of the Project site, but recognize there could be a period of time the construction workers are subject to risk associated with a Class 1 pipeline rupture until it is reclassed to a Class 3 pipeline. However, to ensure the Project does not significantly increase the likelihood of an incident to the pipeline, we recommend in section 4.12.6 that RG LNG provide calculations demonstrating that the loads would be adequately distributed for the temporary crossings during initial construction activities prior to initial site preparation and for the permanent crossings prior to construction of final design.

Hazardous Material Facilities and Power Plants

FERC staff reviewed whether any EPA RMP regulated facilities handling hazardous materials and power plants were located near the site to evaluate whether the 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 facilities handling hazardous materials or power plants identified adjacent to the site. The closest EPA RMP regulated facilities handling hazardous materials would be the Port Isabel Wastewater Treatment Plant located approximately 2.4 miles, Port Isabel Water Treatment Plant located approximately 2.5 miles, and Texas Pack, Inc. located approximately 2.4 miles from the site. The closest power plant identified would be Silas Ray Gas Plant approximately 18 miles away with the closest nuclear plant located over 200 miles to the northeast of the site.

In addition, the proposed Texas LNG Terminal would border the site to the east and the proposed Annova LNG Terminal would be located across the BSC. These proposals would be subject to 49 CFR Part 193 Subpart B regulatory requirements that establishes exclusion zones for safety of plant personnel and the surrounding public. Each proposal would consider potential incidents and safety measures that would need to be incorporated in the design or operation to ensure risk to surrounding public is not increased. Given the distances and locations of the facilities relative to the populated areas of the Port Isabel, South Padre Island, and Brownsville communities, FERC staff does not believe the proposed Project would pose a significant increase in risk to the public or that the hazardous material facilities and power plants would pose a significant risk to the Project and subsequently to the public.

Military Facilities and Operations

In accordance with the 2007 MOU between the FERC and the U.S. Department of Defense (DOD) (http://www.ferc.gov/legal/mou/mou-dod.pdf), the FERC sent a letter to the DOD on June 25, 2015 requesting their comments on whether the planned Project could potentially have an impact on the test, training, or operational activities of any active military installation. On June 4, 2018, the FERC received a response letter from the DOD Siting Clearinghouse stating that the Rio Grande LNG Terminal would have a minimal impact on military training and operations conducted in Cameron County.

Onsite and Offsite Emergency Response Plans

As part of its application, RG LNG indicated that the Project would develop a comprehensive ERP with local, state, and federal agencies and emergency response officials to discuss the Facilities. RG LNG 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 Subpart F, RG LNG would need to prepare emergency procedures manuals that provide for: a) responding to controllable emergencies and recognizing an uncontrollable emergency; b) taking action to minimize harm to the public including the possible need to evacuate the public; and c) coordination and cooperation with appropriate local officials. Specifically, 49 CFR 193.2509 (b) (3) requires "Coordinating with appropriate local officials in preparation of an emergency evacuation plan…," which sets forth the steps required to protect the public in the event of an emergency, including catastrophic failure of an LNG storage tank. DOT regulations under 49 CFR 193.2905 Subpart J also require at least two access points in each protective enclosure to be located to minimize the escape distance in the event of emergency.

Title 33 CFR 127.307 also requires the development of emergency manual that incorporates additional material, including LNG release response and ESD procedures, a description of fire equipment, emergency lighting, and power systems, telephone contacts, shelters, and first aid procedures. In addition, 33 CFR 127.207 establishes requirements for warning alarm systems. Specifically, 33 CFR 127.207 (a) requires that the LNG marine transfer area to be equipped with a rotating or flashing amber light with a minimum effective flash intensity, in the horizontal plane, of 5000 candelas with at least 50 percent of the required effective flash intensity in all directions from 1.0 degree above to 1.0 degree below the horizontal plane. Furthermore, 33 CFR 127.207 (b) requires the marine transfer area for LNG to have a siren with a minimum 1/3-octave band sound pressure level at l meter of 125 dB referenced to 0.0002 microbars. The siren must be located so that the sound signal produced is audible over 360 degrees in a horizontal plane. Lastly, 33 CFR 127.207 (c) requires that each light and siren be located so that the warning alarm is not obstructed for a distance of 1.6 km (1 mile) in all directions. The warning alarms would be required to be tested in order to meet 33 CFR 127. RG LNG would be required to meet the warning alarms requirements specified in 33 CFR 127.207.

In accordance with the EPAct 2005, FERC must also approve an ERP covering the terminal and ship transit prior to construction. Section 3A(e) of the NGA, added by Section 311 of the EPAct 2005, stipulates that in any order authorizing an LNG terminal, the Commission must require the LNG terminal operator to develop an ERP in consultation with the Coast Guard 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 marine carriers that serve the facility. The cost-sharing plan must specify what the LNG terminal operator would provide to cover the cost of the state and local resources required to manage the security of the LNG terminal and LNG marine carrier, and the state and local resources required for safety and emergency management, including:

- direct reimbursement for any per-transit security and/or emergency management costs (for example, overtime for police or fire department personnel);
- capital costs associated with security/emergency management equipment and personnel base (for example, patrol boats, firefighting equipment); and
- annual costs for providing specialized training for local fire departments, mutual aid departments, and emergency response personnel; and for conducting exercises.

The cost-sharing plan must include the LNG terminal operator's letter of commitment with agency acknowledgement for each state and local agency designated to receive resources. RG LNG described the ERP that would be developed to addresses emergency events and potential release scenarios described in the application. The ERP would include public notification, protection, and evacuation. As part of FEED, FERC staff evaluate the initial draft of the emergency response procedures to assure that it covers the hazards associated with the Project. In addition, we recommend in section 4.12.6 that RG LNG provide additional information, for review and approval, on development of updated ERPs prior to initial site preparation. We also recommend in section 4.12.6 that RG LNG file three-dimensional drawings, for review and approval, that demonstrate there is a sufficient number of access and egress locations.

If this Project is authorized and constructed, RG LNG would coordinate with local, state, and federal agencies on the development of an ERP and cost-sharing plan. We recommend in section 4.12.6 that RG LNG provide periodic updates on the development of these plans for review and approval, and ensure they are in place prior to introduction of hazardous fluids. In addition, we recommend in section 4.12.6 that Project facilities be subject to regular inspections throughout the life of the facility and would continue to require companies to file updates to the ERP.

4.12.1.7 Recommendations from FERC Preliminary Engineering and Technical Review

Based on our preliminary engineering and technical review of the reliability and safety of the Project, we recommend the following mitigation measures to the Commission for consideration to incorporate as possible conditions to an order. These recommendations would be implemented prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout the life of the facility to enhance the reliability and safety of the facility and to mitigate the risk of impact on the public.

- **<u>Prior to the end of the draft EIS comment period</u>, RG LNG should determine if the heights of the LNG carriers would be higher than other objects that traverse the waterway and if applicable, file for an Aeronautical Study under 14 CFR 77 for LNG carriers that may exceed the height requirements in 14 CFR 77.9.**

- **<u>Prior to the end of the draft EIS comment period</u>, RG LNG should consult with DOT PHMSA on whether using normally-closed valves as a stormwater removal device on local bunds and curbs would meet the requirements of 49 CFR 193.**

- **<u>Prior to the end of the draft EIS comment period</u>, RG LNG should consult with DOT on whether the use of 130 mph 3-second gust in ASCE 7-05 for "other structures" would be subject to DOT requirements under 49 CFR 193 Subpart B.**

- **<u>Prior to initial site preparation</u>, RG LNG should file with the Secretary documentation demonstrating LNG carriers would be no higher than existing ship traffic or it has received a determination of no hazard (with or without conditions) by DOT FAA for mobile objects that exceed the height requirements in 14 CFR 77.9.**

- **<u>Prior to construction of final design</u>, RG LNG should file with the Secretary the following information, stamped and sealed by the professional engineer-of-record licensed in the state where the Project is being constructed:**

a. site preparation drawings and specifications;

b. LNG storage tank and foundation design drawings and calculations;

c. LNG Terminal structures and foundation design drawings and calculations;

d. seismic specifications for procured Seismic Category I equipment; and

e. quality control procedures to be used for civil/structural design and construction.

In addition, RG LNG should file, in its Implementation Plan, the schedule for producing this information.

- **<u>Prior to construction of final design</u>, RG LNG should file with the Secretary design information adopting the recommendations presented by Fugro to minimize the impacts of the identified surface growth fault in the southwestern portion of the LNG Terminal, stamped and sealed by the professional engineer-of-record registered in Texas.**

- **<u>Prior to commencement of service</u>, RG LNG should file with the Secretary a monitoring and maintenance plan, stamped and sealed by the professional engineer-of-record registered in Texas, for the perimeter levee which ensures the crest elevation relative to mean sea level will be maintained for the life of the facility considering berm settlement, subsidence, and sea level rise.**

Information pertaining to these specific recommendations should be filed with the Secretary for review and written approval by the Director of OEP, or the Director's designee, within the timeframe indicated by each recommendation. Specific engineering, vulnerability, or detailed design information meeting the criteria specified in Order No. 833 (Docket No. RM16-15-000), including security information, should be 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 FR 93,732 (December 21, 2016), FERC Stats. & Regs. 31,389 (2016). Information pertaining to items such as offsite emergency response, procedures for public notification and evacuation, and construction and operating reporting requirements would be subject to public disclosure. All information should be filed <u>a minimum of 30 days</u> before approval to proceed is requested.

- **<u>Prior to initial site preparation</u>, RG LNG should develop, file, and implement procedures to position construction crews outside of areas that could be impacted by rocket debris of a failed launch during initial moments of rocket launch activity.**

- **<u>Prior to initial site preparation</u>, RG LNG should file calculations demonstrating the loads on buried pipelines and utilities at temporary crossings would be adequately distributed. The analysis should be based on API RP 1102 or other approved methodology.**

- **<u>Prior to initial site preparation</u>, RG LNG should file pipeline and utility damage prevention procedures for personnel and contractors. The procedures should include provisions to mark buried pipelines and utilities prior to any site work and subsurface activities.**

- **<u>Prior to initial site preparation</u>, RG LNG should conduct and provide results of a minimum of five equally distributed borings, cone penetration tests, and/or seismic cone penetration tests to a depth of at least 100 feet or refusal underneath the locations of each LNG storage tank to affirm or better characterize underlying conditions and validate the proposed use of shallow foundations.**

- **<u>Prior to initial site preparation</u>, RG LNG should file an overall Project schedule, which includes the proposed stages of the commissioning plan.**

- **<u>Prior to initial site preparation</u>, RG LNG should file quality assurance and quality control procedures for construction activities for both the Engineering Procurement Contractor and RG LNG to monitor construction activities.**

- **<u>Prior to initial site preparation</u>, RG LNG should file procedures for controlling access during construction.**

- **<u>Prior to initial site preparation</u>, RG LNG should develop an ERP (including evacuation) and coordinate procedures with the Coast Guard; state, county, and local emergency planning groups; fire departments; state and local law enforcement; and appropriate federal agencies. This plan should include at a minimum:**

  a. d**esignated 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.

RG LNG should notify the FERC staff of all planning meetings in advance and should report progress on the development of its ERP <u>at 3‑month intervals</u>.

- **<u>Prior to initial site preparation</u>, RG LNG should file a Cost-Sharing Plan identifying the mechanisms for funding all Project-specific security/emergency management costs that would be imposed on state and local agencies. This comprehensive plan should include funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base. RG LNG should notify FERC staff of all planning meetings in advance and should report progress on the development of its Cost Sharing Plan <u>at 3-month intervals</u>.**

- **<u>Prior to construction of final design</u>, RG LNG should file calculations demonstrating the loads on buried pipelines and utilities at permanent crossings would be adequately distributed. The analysis should be based on API RP 1102 or other approved methodology.**

- **<u>Prior to construction of final design</u>, RG LNG should include change logs that list and explain any changes made from the front end engineering design provided in RG LNG's application and filings. A list of all changes with an explanation for the design alteration should be provided and all changes should be clearly indicated on all diagrams and drawings. Records of changes should be kept so FERC staff can verify during construction inspections.**

- **<u>Prior to construction of final design</u>, RG LNG should provide information/revisions pertaining to RG LNG' response numbers 5, 6, 7, 8, 14, 19, 22, 24, 25, 31, and 44 of its October 20, 2016 filing, which indicated features to be included or considered in the final design.**

- **<u>Prior to construction of final design</u>, RG LNG should file a plot plan of the final design showing all major equipment, structures, buildings, and impoundment systems.**

- **<u>Prior to construction of final design</u>, RG LNG should include three-dimensional plant drawings to confirm plant layout for maintenance, access, egress, and congestion.**

- **<u>Prior to construction of final design</u>, RG LNG should provide an up-to-date equipment list, process and mechanical data sheets, and specifications. The specifications should include:**

a. **building specifications (control buildings, electrical buildings, compressor buildings, storage buildings, pressurized buildings, ventilated buildings, blast resistant buildings);**

b. **mechanical specifications (piping, valve, insulation, rotating equipment, heat exchanger, storage tank and vessel, other specialized equipment);**

c. **electrical and instrumentation specifications (power system specifications, control system specifications, safety instrument system (SIS) specifications, cable specifications, other electrical and instrumentation specifications);**

d. **security and Fire Safety Specifications (security, passive protection, hazard detection, hazard control, firewater).**

- **<u>Prior to construction of final design</u>, RG LNG should file the design specifications for the feed gas inlet facilities (e.g., metering, pigging system, pressure protection system, compression, etc.).**

- **<u>Prior to construction of final design</u>, RG LNG should include up-to-date process flow diagrams and piping and instrument diagrams (P&IDs). The PFDs should include heat and material balances. The P&IDs should include the following information:**

a. **equipment tag number, name, size, duty, capacity, and design conditions;**

b. **equipment insulation type and thickness;**

c. **storage tank pipe penetration size and nozzle schedule;**

d. **valve high pressure side and internal and external vent locations;**

e. **piping with line number, piping class specification, size, and insulation type and thickness;**

f. **piping specification breaks and insulation limits;**

g. **all control and manual valves numbered;**

h. **relief valves with size and set points; and**

i. **drawing revision number and date.**

- **<u>Prior to construction of final design</u>, RG LNG should file P&IDs, specifications, and procedures that clearly show and specify the tie-in details required to safely connect subsequently constructed facilities with the operational facilities.**

- **<u>Prior to construction of final design</u>, RG LNG should file a car seal philosophy and a list of all car-sealed and locked valves consistent with the P&IDs.**

- **<u>Prior to the construction of final design</u>, and at the onset of detailed engineering, RG LNG should compete a preliminary hazard and operability review of the proposed design. A copy of the review, a list of recommendations, and actions taken on the recommendations should be filed.**

- **<u>Prior to construction of final design</u>, RG LNG should include 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.**

- **<u>Prior to the construction of final design</u>, RG LNG should evaluate the need for additional check valves and relief valves in the truck LNG fill line.**

- **<u>Prior to construction of final design</u>, RG LNG should provide the safe operating limits (upper and lower), alarm and shutdown set points for all instrumentation (i.e., temperature, pressures, flows, and compositions).**

- **<u>Prior to construction of the final design</u>, RG LNG should file cause-and-effect matrices for the process instrumentation, fire and gas detection system, and emergency shutdown system for review and approval. The cause-and-effect matrices should include alarms and shutdown functions, details of the voting and shutdown logic, and set points.**

- **<u>Prior to construction of final design</u>, RG LNG 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.**

- **<u>Prior to construction of the final design</u>, RG LNG should demonstrate that, for hazardous fluids, piping and piping nipples 2 inches or less in diameter are designed to withstand external loads, including vibrational loads in the vicinity of rotating equipment and operator live loads in areas accessible by operators.**

- **<u>Prior to construction of final design</u>, RG LNG should file electrical area classification drawings.**

- **<u>Prior to construction of the final design</u>, RG LNG should file drawings and details of how process seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system meet the requirements of NFPA 59A (2001 edition).**

- **<u>Prior to construction of the final design</u>, RG LNG should file details of an air gap or vent installed downstream of process seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system. Each air gap should vent to a safe location and be equipped with a leak detection device that should continuously monitor for the presence of a flammable fluid, alarm the hazardous condition, and shut down the appropriate systems.**

- **<u>Prior to construction of final design</u>, RG LNG should include drawings of the storage tank piping support structure and support of horizontal piping at grade including pump columns, relief valves, pipe penetrations, instrumentation, and appurtenances.**

- **<u>Prior to construction of final design</u>, RG LNG should include LNG storage tank fill flow measurement with high flow alarm.**

- **<u>Prior to construction of final design</u>, RG LNG should include BOG flow measurement from each LNG storage tank.**

- **<u>Prior to construction of final design</u>, RG LNG should file the structural analysis of the LNG storage tank and outer containment demonstrating they are designed to withstand all loads and combinations.**

- **<u>Prior to construction of final design</u>, RG LNG should file an analysis of the structural integrity of the outer containment of the full containment LNG storage tanks when exposed to a roof tank top fire or adjacent tank top fire.**

- **<u>Prior to construction of final design</u>, RG LNG should file a projectile analysis 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.**

- **<u>Prior to construction of final design</u>, RG LNG should file the sizing basis and capacity for the final design of the flares and/or vent stacks as well as the pressure and vacuum relief valves for major process equipment, vessels, and storage tanks.**

- **<u>Prior to construction of final design</u>, RG LNG should file a drawing showing the location of the emergency shutdown buttons. ESD 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>, RG LNG should specify that all ESD valves are to be equipped with open and closed position switches connected to the Distributed Control System/Safety Instrumented System.**

- **<u>Prior to construction of final design</u>, and prior to injecting corrosion inhibitors into the 42-inch pipeline at any time during the life of the plant, RG LNG should provide the information used to determine that an inhibitor is required, the material data sheet for the inhibitor, the amount injected, and the schedule of injections.**

- **<u>Prior to construction of final design</u>, the feed gas flow to the Inlet Gas/Gas Exchanger (E-1701) should include a high temperature alarm and shutdown to protect from exposure to hot feed gas.**

- **<u>Prior to the construction of final design</u>, the De-ethanizer (C-1701) should include an additional cryogenic manual isolation valve downstream of shutoff valve (XV-117011).**

- **<u>Prior to the construction of final design</u>, RG LNG should equip a low-low temperature shutdown on the temperature transmitter (TT-117014) located on the de-ethanizer bottoms discharge piping to detect temperatures that may reach below the minimum design metal temperature of the discharge piping transition from stainless to carbon steel. This shutdown should include isolation under cryogenic conditions.**

- **<u>Prior to the construction of final design</u>, RG LNG should provide an explanation and justification for the dump lines located upstream of each LNG Loading Arm.**

- **<u>Prior to the construction of final design</u>, RG LNG should provide the complete range of anti-surge recycle conditions on the LP MR Compressor to confirm that the minimum temperature conditions would not require stainless steel piping.**

- **<u>Prior to the construction of final design</u>, RG LNG should specify the set pressure of high pressure alarm (PAH-141002) is to be below the set pressure of regulator PCV-141005 on the hot oil expansion drum.**

- **<u>Prior to the construction of final design</u>, RG LNG should provide the design details of the shelters to verify safe access in all weather conditions.**

- **<u>Prior to construction of final design</u>, RG LNG should file complete plan drawings of the security fencing and facility access and egress.**

- **Prior to construction of final design, RG LNG should file drawings and specifications for vehicle barriers at each facility entrance for access control.**

- **Prior to construction of final design, RG LNG should file security camera, intrusion detection, and lighting drawings. The security camera drawings should show the location, areas covered, and features of the camera (fixed, tilt/pan/zoom, motion detection alerts, low light, mounting height, etc.) to verify camera coverage of the entire perimeter with redundancies for cameras interior to the facility to enable rapid monitoring of the LNG plant. The intrusion detection drawings should show or note the location of the intrusion detection to verify it covers the entire perimeter of the LNG plant. The lighting drawings should show the location, elevation, type of light fixture, and lux levels of the lighting system.**

- **Prior to construction of final design, RG LNG should file an updated fire protection evaluation of the proposed facilities. A copy of the evaluation, a list of recommendations and supporting justifications, and actions taken on the recommendations should be filed.**

- **Prior to construction of final design, RG LNG should file spill containment system drawings with dimensions and slopes of curbing, trenches, impoundments, and capacity calculations considering any foundations and equipment within impoundments, as well as the sizing and design of the down-comer that would transfer spills from the tank top to the ground-level impoundment system.**

- **Prior to construction of final design, RG LNG should file complete drawings and a list of the hazard detection equipment. The drawings should clearly show the location and elevation of all detection equipment. The list should include the instrument tag number, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment.**

- **Prior to construction of final design, RG LNG should file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas of the hazard detectors when determining the lower flammable limit set points for methane, propane, ethane/ethylene, and condensate.**

- **Prior to construction of final design, RG LNG should file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas of hazard detectors when determining the set points for toxic components such as natural gas liquids and hydrogen sulfide.**

- **Prior to construction of final design, RG LNG should include 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> RG LNG should file complete plan drawings and a list of the fixed and wheeled dry-chemical, hand-held fire extinguishers, and other hazard control equipment. Drawings should clearly show the location by tag number of all fixed, wheeled, and hand-held extinguishers. The list should include the equipment tag number, type, capacity, equipment covered, discharge rate, and automatic and manual remote signals initiating discharge of the units.**

- **<u>Prior to construction of final design</u>, RG LNG should file facility plan drawings showing the proposed location of the firewater and any foam systems. Plan drawings should clearly show the location of firewater and foam piping, post indicator valves, and the location and area covered by each monitor, hydrant, hose, water curtain, deluge system, foam system, water mist system, and sprinkler. The drawings should also include piping and instrumentation diagrams of the firewater and foam systems.**

- **<u>Prior to construction of final design,</u> RG LNG should specify that the firewater flow test meter is equipped with a transmitter and that a pressure transmitter is installed upstream of the flow transmitter. The flow transmitter and pressure transmitter should be connected to the DCS and recorded.**

- **<u>Prior to the construction of final design</u>, RG LNG should specify the dimension ratio (DR) to be DR 7 for the high density polyethylene piping to allow consistent pressure rating requirements with the firewater system.**

- **<u>Prior to construction of final design</u>, RG LNG should file drawings and specifications for the structural passive protection systems to protect equipment and supports from cryogenic releases.**

- **<u>Prior to construction of final design</u>, RG LNG 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 to 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 should be supported by calculations for the thickness limiting temperature rise and active mitigation should be**

justified with calculations demonstrating flow rates and durations of any cooling water would mitigate the heat absorbed by the vessel.

- **<u>Prior to construction of final design</u>, RG LNG should provide an evaluation of the voting logic and voting degradation for hazard detectors.**

- **<u>Prior to the construction of final design</u>, RG LNG should file the fire proofing specifications to show that the Jetty Marine Buildings would withstand an LNG tank roof fire.**

- **<u>Prior to commissioning</u>, RG LNG should provide 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. RG LNG should file documentation certifying that each of these milestones has been completed before authorization to proceed with the next phase of commissioning and startup will be issued.**

- **<u>Prior to commissioning</u>, RG LNG should file detailed plans and procedures for: testing the integrity of onsite mechanical installation; functional tests; introduction of hazardous fluids; operational tests; and placing the equipment into service.**

- **<u>Prior to commissioning</u>, RG LNG should provide the procedures for pressure/leak tests which address the requirements of ASME VIII and ASME B31.3. The procedures should include a line list of pneumatic and hydrostatic test pressures.**

- **<u>Prior to commissioning</u>, RG LNG should file a plan for clean-out, dry-out, purging, and tightness testing. This plan should address the requirements of the American Gas Association's Purging Principles and Practice required by 49 CFR 193, and should provide justification if not using an inert or non-flammable gas for clean-out, dry-out, purging, and tightness testing.**

- **<u>Prior to commissioning</u>, RG LNG should file the operation and maintenance procedures and manuals, as well as safety procedures, hot work procedures and permits, abnormal operating conditions reporting procedures, simultaneous operations procedures, and management of change procedures and forms.**

- **<u>Prior to commissioning</u>, RG LNG should tag all equipment, instrumentation, and valves in the field, including drain valves, vent valves, MLVs, and car-sealed or locked valves.**

- **<u>Prior to commissioning</u>, RG LNG should maintain a detailed training log to demonstrate that operating staff has completed the required training.**

- **Prior to commissioning, RG LNG should provide 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, RG LNG 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.**

- **Prior to introduction of hazardous fluids, RG LNG should complete all pertinent tests (e.g., Factory Acceptance Tests, Site Acceptance Tests, Site Integration Tests) associated with the Distributed Control System/Safety Instrumented System that demonstrates full functionality and operability of the system.**

- **Prior to introduction of hazardous fluids, RG LNG should provide an alarm management program to reduce alarm complacency and maximize the effectiveness of operator response to alarms.**

- **Prior to introduction of hazardous fluids, RG LNG should develop and implement procedures for plant personnel to monitor the rocket launches and shut down operating equipment in the event of a rocket launch failure.**

- **Prior to introduction of hazardous fluids, RG LNG should complete a firewater pump acceptance test and firewater monitor and hydrant coverage test. The actual coverage area from each monitor and hydrant should be shown on facility plot plan(s).**

- **Prior to introduction of hazardous fluids, RG LNG should complete and document a prestartup safety review to ensure that installed equipment meets the design and operating intent of the facility. The prestartup 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.**

- **RG LNG should file a request for written authorization from the Director of OEP or designee prior to unloading or loading the first LNG commissioning cargo. After production of first LNG, RG LNG should file weekly reports on the commissioning of the proposed systems that detail the progress toward demonstrating the facilities can safely and reliably operate at or near the design production rate. The reports should include a summary of activities, problems encountered, and remedial actions taken. The weekly reports should also include the latest commissioning schedule, including projected and actual LNG production by each**

liquefaction train, LNG storage inventories in each storage tank, and the number of anticipated and actual LNG commissioning cargoes, along with the associated volumes loaded or unloaded. Further, the weekly reports should include a status and list of all planned and completed safety and reliability tests, work authorizations, and punch list items. Problems of significant magnitude <u>should be reported to the FERC within 24 hours</u>.

- **<u>Prior to commencement of service</u>, RG LNG should label piping with fluid service and direction of flow in the field, in addition to the pipe labeling requirements of NFPA 59A (2001 edition).**

- **<u>Prior to commencement of service</u>, RG LNG 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>, RG LNG should develop procedures for handling offsite contractors' including responsibilities, restrictions, and limitations and for supervision of these contractors by RG LNG staff.**

- **<u>Prior to commencement of service</u>, RG LNG should notify the FERC staff of any proposed revisions to the security plan and physical security of the plant.**

- **<u>Prior to commencement of service</u>, RG LNG should file a request for written authorization from the Director of OEP. Such authorization would only be granted following a determination by the Coast Guard, under its authorities under the Ports and Waterways Safety Act, the Magnuson Act, the MTSA of 2002, and the Security and Accountability For Every Port Act, that appropriate measures to ensure the safety and security of the facility and the waterway have been put into place by RG LNG or other appropriate parties.**

The following recommendations would apply <u>throughout the life of the facilities</u>:

- **The facilities should be subject to regular FERC staff technical reviews and site inspections on at least an <u>annual basis</u> or more frequently as circumstances indicate. Prior to each FERC staff technical review and site inspection, RG LNG should respond to a specific data request including information relating to possible design and operating conditions that may have been imposed by other agencies or organizations. Up-to-date detailed P&IDs reflecting facility modifications and provision of other pertinent information not included in the semi-annual reports described below, including facility events that have taken place since the previously submitted 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 quantities, boil off/flash gas); and plant modifications, including future plans and progress thereof. Abnormalities should include, but not be limited to, unloading/loading/shipping problems, potential hazardous conditions from offsite vessels, storage tank stratification or rollover, geysering, storage tank pressure excursions, cold spots on the storage tanks, storage tank vibrations and/or vibrations in associated cryogenic piping, storage tank settlement, significant equipment or instrumentation malfunctions or failures, non-scheduled maintenance or repair (and reasons therefore), relative movement of storage tank inner vessels, hazardous fluids releases, fires involving hazardous fluids and/or from other sources, negative pressure (vacuum) within a storage tank, and higher than predicted boil off rates. Adverse weather conditions and the effect on the facility also should be reported. Reports should be submitted within 45 days after each period ending June 30 and December 31. In addition to the above items, a section entitled "Significant Plant Modifications Proposed for the Next 12 Months (dates)" should be included in the semi-annual operational reports. Such information would provide the FERC staff with early notice of anticipated future construction/maintenance at the LNG facilities.**

- **In the event the temperature of any region of any secondary containment, including imbedded pipe supports, becomes less than the minimum specified operating temperature for the material, the Commission should be notified 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 facility's emergency plan. Examples of reportable hazardous fluids-related incidents include:**

  a. fire;

  b. explosion;

c. estimated property damage of $50,000 or more;

d. death or personal injury necessitating in-patient hospitalization;

e. release of hazardous fluids for 5 minutes or more;

f. unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of an LNG facility that contains, controls, or processes hazardous fluids;

g. any crack or other material defect that impairs the structural integrity or reliability of an LNG facility that contains, controls, or processes hazardous fluids;

h. any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes hazardous fluids to rise above its maximum allowable operating pressure (or working pressure for LNG facilities) plus the build-up allowed for operation of pressure-limiting or control devices;

i. a leak in an LNG facility that contains or processes hazardous fluids that constitutes an emergency;

j. inner tank leakage, ineffective insulation, or frost heave that impairs the structural integrity of an LNG storage tank;

k. any safety-related condition that could lead to an imminent hazard and cause (either directly or indirectly by remedial action of the operator), for purposes other than abandonment, a 20 percent reduction in operating pressure or shutdown of operation of a pipeline or an LNG facility that contains or processes hazardous fluids;

l. safety-related incidents from hazardous fluids transportation occurring at or en route to and from the LNG facility; or

m. an event that is significant in the judgment of the operator and/or management even though it did not meet the above criteria or the guidelines set forth in an LNG facility's incident management plan.

In the event of an incident, the Director of OEP has delegated authority to take whatever steps are necessary to ensure operational reliability and to protect human life, health, property, or the environment, including authority to direct the LNG facility to cease operations. Following the initial company notification, the FERC staff would determine the need for a separate follow-up report or follow up in the upcoming semi-annual operational report. All company follow-up reports should include investigation results and recommendations to minimize a reoccurrence of the incident.

4.12.1.8 Conclusions on LNG Facility and Carrier Reliability and Safety

As part of the NEPA review and NGA determinations, Commission staff assessed the potential impact to the human environment in terms of safety and whether the proposed facilities would be in the public interest based on whether it would operate safely, reliably, and securely.

As a cooperating agency, the DOT assisted FERC staff in evaluating whether RG LNG's proposed design would meet the DOT's 49 CFR Part 193 Subpart B siting requirements. The DOT reviewed the design spill information submitted by RG LNG and on November 29, 2016, provided a letter to FERC staff stating that the DOT had no objection to RG LNG's design spill selection methodology to comply with the 19 CFR 193 siting requirements for the LNG Terminal facilities. DOT will provide a LOD on the Project's compliance with 49 CFR Part 193 Subpart B. This determination will be provided to the Commission as further consideration to the Commission on its decision to authorize or deny the Project. If the Project is authorized and constructed, the facility would be subject to the DOT's inspection and enforcement program; final determination of whether a facility is in compliance with the requirements of 49 CFR 193 would be made by the DOT staff.

Furthermore, DOT's 49 CFR 192 requirements would apply to the currently under construction VCP that would be routed through the northern part of the LNG Terminal site. FERC staff has evaluated the potential risk and impact from an incident on the VCP. Based on PHMSA's incident data, the likelihood of a pipeline incident or failure would be low and a worst-case pipeline rupture scenario would be even less likely. If a pipeline incident were to occur, the likely consequences from these cascading effects would not reach the public. To protect the VCP during construction and operation of the Project, RG LNG has identified extra protective measures and we have made additional recommendations regarding temporary and permanent crossings. Therefore, FERC staff does not believe the proposed Project would significantly increase the risk to offsite public.

As a cooperating agency, the Coast Guard also assisted the FERC staff by reviewing the proposed LNG Terminal and the associated LNG marine carrier traffic. The Coast Guard reviewed a WSA submitted by RG LNG that focused on the navigation safety and maritime security aspects of LNG carrier transits along the affected waterway. On December 26, 2017, the Coast Guard issued a LOR to FERC staff indicating the BSC 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 Coast Guard's NVIC 01-11. If the Project is authorized and constructed, the facility would be subject to the Coast Guard's inspection and enforcement program to ensure compliance with the requirements of 33 CFR 105 and 33 CFR 127.

As a cooperating agency, the FAA assisted FERC staff in evaluating impacts on and from the SpaceX rocket launch facility in Cameron County. Specific recommendations are included to address potential impacts from rocket launch failures on the Project. However, the extent of impacts on SpaceX operations, the National Space Program, and to the federal government would not fully be known until SpaceX submits an application with the FAA requesting to launch and whether the LNG Terminal is under construction or in operation at that time.

FERC staff conducted a preliminary engineering and technical review of the RG LNG design, including potential external impacts based on the site location. Based on this review, we recommend the Commission consider incorporating into any authorization for the Project, a number of proposed mitigation measures, which would ensure continuous oversight prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout life of the LNG Terminal, in order to enhance the reliability and safety of the terminal to mitigate the risk of impact on the public. With the incorporation of these mitigation measures and oversight, FERC staff concluded that RG LNG's Terminal design would include acceptable layers of protection or safeguards that would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public.

4.12.2 Pipeline Facilities

Natural gas pipeline transmission carries risks to workers and the public that result from the potential for unintended gas release. Although rare, risks primarily include fire and/or explosion after a gas pipeline leak or rupture. Potential hazards to the safe construction and operation of natural gas pipelines include corrosion, equipment malfunction, and external forces such as third-party line strikes and natural forces including lightning, flooding, tornados, and earthquakes.

Methane is the primary constituent of natural gas. The gas is colorless, odorless, and tasteless. It is not considered poisonous but poses a low inhalation hazard that could result in asphyxiation. Methane is light and will quickly disperse in areas where there is sufficient air flow. However, if released in enclosed, poorly ventilated areas and consumed in high doses, injuries and fatalities are possible. In concentrations between 5 percent and 15 percent, methane is flammable and will automatically ignite at 1,000 °F. These properties of methane and the potential for pipeline ruptures require that natural gas transmission pipelines be carefully regulated.

4.12.2.1 Pipeline Safety Standards

Public scoping comments expressed concern regarding the safety of the RB Pipeline; additional detail and responses to these scoping comments are addressed in section 4.12.2.3. The DOT regulates natural gas transmission pipelines and pipeline facilities as specified in 49 (USC 601. The DOT's PHMSA administers the national regulatory program to ensure the safe transportation of natural gas and other hazardous materials by pipeline. It develops safety regulations and other approaches to risk management that ensure safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Many of the regulations are written as performance standards 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.

PHMSA's workload is shared by agencies at all government levels. States that participate in the federal pipeline safety program have agreed to adopt the minimum pipeline safety regulations. In addition, they may pass more stringent regulations through their own legislating bodies. Participating states are authorized to oversee safety programs and to enforce federal safety standards for intrastate pipeline facilities under Section 5(a) of the Natural Gas Pipeline Safety Act. Section 5(b) only permits a state agency that does not participate under Section 5(a) to conduct inspection and monitoring procedures of intrastate natural gas facilities. For interstate facilities, states are also authorized to act of agents of the DOT to inspect the facilities within its state boundaries, though only the DOT may enforce regulations. Texas has adopted the minimum federal pipeline safety regulations as authorized by PHMSA under Section 5(a) to assume all aspects of the safety program intrastate, but not interstate, facilities (PHMSA 2016a). In Title 16 of the TAC, Texas has also instituted multiple more stringent safety requirements beyond the federal standards. The RRC is charged with overseeing the state's safety program for intrastate natural gas facilities.

Under a Memorandum of Understanding on Natural Gas Transportation Facilities (Memorandum) dated January 15, 1993, between the DOT and the FERC, the DOT has the exclusive authority to promulgate federal safety standards used in the transportation of natural gas. Section 157.14(a)(9)(vi) of the FERC's regulations require that an applicant certify that it will design, install, inspect, test, construct, operate, replace, and maintain the facility for which a Certificate is requested in accordance with federal safety standards and plans for maintenance and inspection. 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 Memorandum to promptly alert DOT. The Memorandum also provides for referring complaints and inquiries made by state and local governments and the general public involving safety matters related to pipelines under the Commission's jurisdiction. 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.

RB Pipeline must design, construct, operate, and maintain the pipelines and aboveground facilities in accordance with the safety standards prescribed in 49 CFR 192. Federal safety standards include area classifications that are based on population density in proximity to natural gas pipelines. More stringent safety requirements are imposed around populated areas. Class location units are assigned based on the evaluation of populated areas within 660 feet of both sides of a pipeline centerline. The class location units 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 would be located within 100 yards of any building or small well-defined outside area used for recreation or public assembly that is occupied by 20 or more people at least 5 days per week for 10 weeks in a 12-month period; and
- Class 4: location where buildings with four of 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.

The class designations determine the need for additional safety regarding pipeline depth of cover, pipe wall thickness, the distance between MLVs, hydrostatic test pressure, and MAOP. In addition, the number of pipeline welds and inspection surveys are also governed by class location unit assignments along a pipeline. RB Pipeline would adhere to the pipeline design requirements based on class assignments along the proposed route.

RB Pipeline has completed a class location study for its Pipeline System. The results indicate that the entire system between MPs 0.0 and 135.5 may be assigned to Class 1. The pipeline would be routinely surveilled by air to determine whether changes to the class assignment are necessary. If a subsequent increase in population density adjacent to the right-of-way results in a change in class location for the pipeline, RB Pipeline 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 HCAs. The DOT has published rules that define HCAs where a gas pipeline accident could do considerable harm to people and their property and requires an integrity management program to minimize the potential for an accident. This definition satisfies, in part, the Congressional mandate for DOT to prescribe standards that establish criteria for identifying each gas pipeline facility in a high-density population area. HCAs are defined by using the techniques described in one of the following two ways:

1) An area defined as:

- a Class 3 or Class 4 location; or
- any area in a Class 1 or 2 location where the potential impact radius[61] is greater than 660 feet and contains 20 or more buildings within the impact circle[62] intended for human occupancy; or
- any area in a Class 1 or 2 location where the potential impact circle contains an identified site.

---

[61] The potential impact radius is calculated as the product of 0.69 and the square root of: the MAOP of the pipeline in pounds per square inch gauge multiplied by the square of the pipeline diameter in inches.

[62] The potential impact circle is a circle of radius equal to the potential impact radius.

2) The area within a potential impact circle containing:

- 20 or more buildings intended for human occupancy; or
- an identified site.

An identified site, as defined by 49 CFR 192.903, is an outside area or structure occupied by 20 or more people for 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. Once HCAs have been identified, the operator must implement its Integrity Management Program in those areas. The Pipeline Safety Improvement Act of 2002 requires RB Pipeline to conduct risk analyses of identified HCAs, baseline assessments of all pipeline segments and schedule inspections using designated methods. The integrity management program must include a plan to conduct inspections of the pipeline within HCAs every 7 years. The completed analysis for HCAs near the Pipeline System indicates the presence of one identified site about 300 feet from the pipeline near MP 37.0 and does not impact the pipeline class designation.

RB Pipeline must develop an operations and maintenance plan in addition to its ERP as required under Subpart L of 49 CFR 192. These plans must include specific procedures necessary to minimize potential pipeline hazards during normal operations and in the event of an emergency. Aspects of RB Pipeline's Operations and Maintenance Plan and ERP would be compliant with federal requirements and include procedures for the following:

- responses to emergency incidents including gas leaks, fires, explosions and, natural disaster;
- communications with local law enforcement officials including fire and police departments as well as emergency medical personnel;
- keeping trained RB Pipeline staff supplied with proper equipment at emergency sites;
- ensuring that life, property and the environment are safe in hazardous situations; and
- safely shutting down and restoring service to the Pipeline System in emergencies.

Operators are required to keep liaisons with appropriate emergency responders and public authorities to establish roles and responsibilities in the event of a natural gas pipeline emergency. The applicant would review the ERP with local emergency agencies and would provide them with Project mapping of all facilities including access roads. In addition, facility-specific training would be provided to emergency responders. RB Pipeline must also develop continuing education programs. In accordance with the API's Recommended Practice 1192, RB Pipeline would establish a Public Awareness and Damage Prevention Program that requires information regarding pipeline safety be disseminated to landowners, local residents, excavators and first responders. The program would include holding meetings with the public and emergency personnel. Materials would also be mailed about the properties of natural gas, how to recognize a pipeline marker and right-of-way, who to call in an emergency and the role of emergency responders during an emergency. Additional measures for maintaining the safety of the public from potential hazards may be divided in into three categories: passive protection, active protection, and procedural controls. RB Pipeline would include components of each protective measure category.

Passive Protection Measures

Passive protection measures are intended to minimize hazards through design and process features. RB Pipeline would implement the following passive protection measures:

- design, construction, operations, and maintenance would exceed PHMSA's regulations as specified in 49 CFR 192;
- pipe materials would meet or exceed the minimum API 5L requirements;
- pipe bends would exceed federal standards would be factory bent and fittings including elbows would be factory-manufactured;
- external pipe coating materials would comply with federal standards (girth welds would be field-coated using factory-equivalent coating materials to retain integrity);
- "One-Call" or "Call Before You Dig" system would be implemented to identify buried utilities before beginning excavations; and
- pipeline markers would be placed at frequent intervals along the right-of-way and where streets, highways, railroads and other major intersections.

Active Protection Measures

Active protection measures (or engineering controls) include procedures or tools such as valves, pigs, automated monitoring, and shutdown systems that are engineered to prevent or detect potential hazards. RB Pipeline would exceed the federal requirement for pipeline burial in Class 1 zones by burying the pipelines with a minimum of 36 inches of cover, except in areas with consolidated rock, which would include a minimum of 24 inches depth of cover. In addition, RB Pipeline would implement the following active protection measures:

- the use of soil cover or matting when working over exiting in-service pipelines;
- testing of all pipeline by x-ray, ultrasonic testing, or a combination of both under the supervision of a trained RB Pipeline welding inspector;
- hydrostatically pressure testing pipeline sections above MAOP to meet federal regulations;
- sand padding may be used in rocky ditches to protect the bottom of the pipe;

- 24-hour monitoring by RB Pipeline's gas control office and routine patrols of the right-of-way by operations personnel;
- installation of cathodic protection systems to prevent external corrosion;
- routine use of in-line inspection tools such as smart pigs and caliper pigs to check the pipeline for anomalies such as corrosion or dents;
- maintenance of safe traffic flow in the vicinity of construction activities through placement of warning signs and the use of flagmen in compliance with local and state requirements;
- use of SCADA systems to monitor the Pipeline System, provide alerts, and control facility equipment;
- automatic override systems designed to shut down the pipeline and facilities in the event of an emergency; and
- video surveillance, security fencing, and gate access control to aboveground facilities.

Procedural Control Measures

Procedural control measures (or administrative controls) include the use of procedures including a worker training program, inspections and monitoring to prevent incidents or to minimize the effects of pipeline incidents. As previously discussed, RB Pipeline would implement the procedural measures as detailed in its Operations and Maintenance Plan, ERP, and Public Awareness and Damage Prevention Program. RB Pipeline would adhere to its pipeline safety monitoring program that includes the following PHMSA-required procedural control measures:

- training of operations personnel in equipment use and first aid;
- inspection of all factory produced equipment and the inspection of welds and pipe coatings during construction;
- annual overflight inspections or routine pipeline right-of-way walkover patrols and leak surveys by trained operations personnel;
- prior notifications regarding the need for heavy machinery, grading, or excavations over or near existing rights-of-way;
- inspection of rectifiers at least six times per year;
- annual testing of the cathodic protection system; and
- annual inspection and maintenance of the MLVs.

4.12.2.2 Pipeline Accident Data

Significant pipeline incidents include pipeline leaks that result in death or injury that requires a hospital stay. Liquid releases resulting in fire or explosion and incidents that result in property damages greater than $50,000 (in 1984 dollars)[63] are also considered significant. According to 49 CFR 191, all significant pipeline incidents must be reported to the DOT within 20 days. During the 20-year period from 1996 through 2015, a total of 1,310 significant incidents were reported on the more than 300,000 total miles of natural gas transmission pipelines nationwide. Additional insight into the nature of service incidents may be found by examining the primary factors that caused the failures. Table 4.12.2-1 provides a distribution of the causal factors as well as the number of each incident by cause.

Table 4.12.2-1
Onshore Natural Gas Transmission Pipeline Significant Incidents by Cause 1996-2015

Cause[a]	Number of Incidents	Percentage
Pipeline material, weld or equipment failure	354	27.0
Corrosion	311	23.7
Excavation	210	16.0
All other causes[b]	165	12.6
Natural force damage[c]	146	11.1
Outside force[d]	84	6.4
Incorrect operation	40	3.1
Total	**1,310**	--

a All data gathered from PHMSA Significant Incident files, February 2016. http://www.phmsa.dot.gov/pipeline/library/data-stats/pipelineincidenttrends (PHMSA 2016b).
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 data presented in table 4.12.2-1 include natural gas transmission system failures of all magnitudes with widely varying consequences. The dominant causes of pipeline incidents are corrosion; and pipeline material, weld, or equipment failure, together which constitute 50.7 percent of all significant incidents. The pipelines included in the data set in table 4.12.2-1 vary widely in terms of age, diameter, and level of corrosion control. Each variable influences the incident frequency that may be expected for a specific segment of pipeline. 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 are a time-dependent process.

63 $50,000 in 1984 dollars is approximately $112,955.73 as of May 2015 (CPI, Bureau of Labor Statistics, 2015).

The use of both an external protective coating and a cathodic protection system,[64] 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 4.12.2-2 provides a breakdown of external force incidents by cause.

Older pipelines have a higher frequency of outside forces incidents partly because their location may be less well known and less well marked than newer lines. In addition, 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.

Table 4.12.2-2
Outside Forces Incidents by Cause[a] 1996-2015

Cause	Number of Incidents[b]	Percent of All Incidents[c]
Third party excavation damage	172	13.1
Heavy rains, floods, mudslides, landslides	74	5.6
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**	**-**

[a] Excavation, outside force, and natural force from table 4.12.2-1.
[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] Percentage of all incidents was calculated as a percentage of the total number of incidents natural gas transmission pipeline significant incidents (i.e., all causes) presented in table 4.12.2-1.

---

64 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.

Since 1982, operators have been required to participate in "One-Call" public utility programs in populated areas to minimize unauthorized excavation activities in the vicinity of pipelines. The "One-Call" program is a service used by public utilities and some private sector companies (e.g., oil pipelines and cable television) to provide preconstruction information to contractors or other maintenance workers on the underground location of pipes, cables, and culverts.

4.12.2.3 Impacts on Public Safety

Public scoping comments expressed concern regarding the safety of the RB Pipeline, including potential damage due to weather events such as flooding, leak detection, and pipeline accidents (including releases of natural gas and explosions). As described above, RB Pipeline must operate and maintain its facilities in compliance with the DOT regulations at 49 CFR 192 to minimize the potential for pipeline damage and accidents. These requirements include specifications for the depth of soil cover over the pipeline, which would protect the pipe from damage or exposure during flood events.

Operation of the facilities would be monitored electronically on a continuous basis, and an emergency shutdown system would be installed. In addition, annual overflight inspections or routine pipeline right-of-way walkover patrols and leak surveys would be conducted by trained operations personnel to detect pipeline damage or integrity concerns. While fire and/or explosion after a gas pipeline leak or rupture are rare, implementation of DOT safety regulations and RB Pipeline's integrity management program would further reduce the risk of an incident.

On December 15, 2017, the Union Pacific Railroad Company noted its objection to the proposed Project and cited safety concerns from a possible hazardous material release by the pipeline and adverse consequences from an accident. The Union Pacific Railroad Company indicates that the pipeline appears to cross the railroad tracks at approximate MP 46.5 and parallel the track from approximate MPs 46.5 to 97.

According to the information in the project docket, RB Pipeline proposed to cross the railroad tracks by the bore method at MP 69.9 and then construct its pipeline parallel to the railroad in multiple areas between MPs 19.9 and 67.7. As previously indicated in this EIS, RB Pipeline must operate and maintain its facilities in compliance with the DOT regulations at 49 CFR 192 to minimize the potential for pipeline damage and accidents. Further, the DOT's Federal Railroad Administration includes guidelines and requirements for infrastructure crossing railroad facilities. In its letter, the Union Pacific Railroad Company also indicated a request for coordination between RB Pipeline on compensation for the right to cross the railroad property.

The FERC is not an arbitrator between parties with regards to compensation. We believe that reimbursement is more appropriately determined during the permanent right-of-entry agreement process. However, there should be coordination between RB Pipeline and Union Pacific Railroad Company regarding construction, operation, and safety concerns. RB Pipeline has not responded on the FERC docket to the comment letter. Therefore, **we recommend that**:

- **Prior to pipeline construction across, in, or adjacent to the Union Pacific Railroad Company right-of-way, RB Pipeline should file with the Secretary details concerning the pipeline construction under the railroad (the depth of cover for the pipeline under the railroad, and how RB Pipeline would monitor the path of the drill during the pilot hole and reaming process for the HDD); correspondence with the Union Pacific Railroad Company regarding construction and operation of the pipeline under and parallel to the railroad; and the specific federal and state regulations that RB Pipeline would follow to ensure safety and reliability of the pipeline operations in or under the railroad right-of-way.**

Table 4.12.2-3 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 4.12.2-3
Injuries and Fatalities - Natural Gas Transmission Pipelines

Year	Injuries	Fatalities
2011	1	0
2012	7	0
2013	2	0
2014	1	1
2015	14	6
Source: PHMSA 2016b		

The nationwide totals of accidental fatalities from various anthropogenic and natural hazards are listed in table 4.12.2-4 in order to provide a relative measure of the industry-wide safety of natural gas transmission pipelines. Direct comparisons between accident categories should be made cautiously, however, because individual exposures to hazards are not uniform among all categories. The data nonetheless indicate a low risk of death due to incidents involving natural gas transmission pipelines compared to the other categories. Furthermore, the fatality rate is much lower than the fatalities from natural hazards such as lightning, tornados, or floods.

Table 4.12.2-4 Nationwide Accidental Deaths[a]	
Type of Accident	**Annual No. of Deaths**
Motor vehicle[a]	35,369
Poisoning[a]	38,851
Falls[a]	30,208
Drowning[a]	3,391
Fire, smoke inhalation, burns[a]	2,760
Floods[b]	81
Tornado[b]	72
Lightning[b]	49
Hurricane[b]	47
Natural gas distribution lines[c]	13
Natural gas transmission 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 (Centers for Disease Control 2013).

[b] NOAA National Weather Service, Office of Climate, Water and Weather Services, 30-year average (1985-2014) (NOAA 2015).

[c] Accident data presented for natural gas distribution lines and transmission pipelines represent the 20-year average between 1996 and 2015 (PHMSA 2016b).

The available data show that natural gas transmission pipelines continue to be a safe, reliable means of energy transportation. From 1996 to 2015, there were an average of 65.4 significant incidents, 9.1 injuries, and 2.3 fatalities per year. The number of significant incidents over the more than 303,000 miles of natural gas transmission lines indicates the risk is low for an incident at any given location. While the data indicate that the operation of the RB Pipeline would represent a slight increase in risk to the safety of the nearby public, that the risk would be considered low.

4.13 CUMULATIVE IMPACTS

NEPA requires the lead federal agency to consider the potential cumulative impacts of proposals under its review. Cumulative impacts may result when the environmental effects associated with the proposed action are superimposed on or added to impacts associated with past, present, and reasonably foreseeable future projects, regardless of what agency or person undertakes such other actions. Although the individual impact of each separate project may be minor, the additive or synergistic effects of multiple projects could be significant.

This cumulative impacts analysis uses an approach consistent with the methodology set forth in relevant guidance (CEQ 1997b, 2005; EPA 1999). Under these guidelines, inclusion of actions within the analysis is based on identifying commonalities between the impacts that would result from the Rio Grande LNG Project and the impacts likely to be associated with other potential projects.

The Project-specific impacts of the Rio Grande LNG Project are discussed in detail in other sections of this EIS. The purpose of this section is to identify and describe cumulative impacts that would potentially result from implementation of the proposed Project along with other projects in the vicinity that could affect the same resources in the same approximate timeframe. To ensure that this analysis focuses on relevant projects and potentially significant impacts, the actions included in the cumulative impact analysis include projects that:

- impact a resource potentially affected by the proposed Project;
- impact that resource within all or part of the time span encompassed by the proposed or reasonably expected construction and operation schedule of the proposed Project; and
- impact that resource within all or part of the same geographic area affected by the proposed Project. The geographic area considered varies depending on the resource being discussed, which is the general area in which the projects could contribute to cumulative impacts on that particular resource (geographic scope of analysis).

A geographic scope was identified for each specific environmental resource that would be affected by the Project, as described in table 4.13.1-1.

4.13.1 Projects and Activities Considered

With respect to past actions, CEQ guidance (2005) allows agencies to adopt a broad, aggregated approach without "delving into the historical details of individual past actions," an approach we have taken here. The current regional landscape in south Texas, which is a mix of large tracts of open land that support ranch and cattle operations, NWRs, and an assortment of industrial facilities already sited along the BSC forms the environmental baseline described in other sections of this EIS and against which the impacts of reasonably foreseeable future actions are considered. Recently completed projects that may still be undergoing restoration or that were identified during the agency review process as projects of concern are also included in the cumulative impacts assessment.

Reasonably foreseeable projects that might cause cumulative impacts in combination with the proposed Project includes projects that are under construction, approved, proposed, or planned. For FERC-regulated projects, proposed projects are those for which the proponent has submitted a formal application to the FERC, and planned projects are projects that are either in pre-filing or have been announced, but have not been officially proposed. Planned projects also include projects not under the FERC's jurisdiction that have been identified through publicly available information such as press releases, internet searches, and the applicants' communications with local agencies.

Table 4.13.1-1 Geographic Scope for Cumulative Impact Analysis	
Environmental Resource	**Geographic Scope**
Geologic Resources and Soils	Area affected by and adjacent to the Project - direct effects of geologic hazards would be highly localized and limited primarily to the period of construction; cumulative impacts from geologic hazard impacts would only occur if other projects are constructed at the same time and place as the proposed facilities.
Water Resources (Groundwater, Surface Water, and Wetlands)	HUC-12 subwatershed - impacts on groundwater, surface waters and wetlands can result in downstream contamination or turbidity; therefore, the Project could result in additional incremental impacts on waters further downstream.
Vegetation and Wildlife	HUC-12 subwatershed – impacts on vegetation within the HUC-12 subwatershed could contribute to impacts on vegetation communities and wildlife habitat within the watershed.
Aquatic Resources	HUC-12 subwatershed – impacts on surface water within the HUC-12 subwatershed could contribute to downstream impacts on aquatic organisms and their habitats.
Threatened and Endangered Species	HUC-12 subwatershed – impacts within the HUC-12 subwatershed could contribute to impacts on vegetation communities and threatened and endangered species habitat within the watershed. For marine species, impacts on marine/estuarine waterbodies in the HUC-12 subwatershed and established shipping channels used by LNG carriers are also within the geographic scope. Due to the diversity in life history and range of threatened and endangered species potentially affected by the Rio Grande LNG Project, cumulative impacts were independently reviewed for each species or group of species.
Land Use and Recreation	Cameron County; and land within 1 mile of the Pipeline System - to encompass any large areas with specialized or recreational uses.
Visual Resources	For aboveground facilities, distance that the tallest feature at the planned facility would be visible from neighboring communities (about 12 miles). For the Pipeline System, a 0.25-mile buffer and existing visual access points (e.g., road crossings).
Socioeconomics	Affected counties and municipalities.
Environmental Justice	Census tracts within affected counties.
Cultural Resources	Overlapping resource impacts. Direct impacts on cultural resources are highly localized; thus, cumulative impacts would only occur if other projects are constructed in the same place or impact the same historic properties impacted by the proposed Project.
Air Quality – Construction	Within 0.5 mile of the proposed pipeline facilities and within 1.0 mile of the LNG Terminal, because construction emissions are highly localized.
Air Quality – Operations	Within 31 miles of the proposed LNG Terminal, interconnect booster stations, and compressor stations.
Noise - Construction	Within 0.25 mile from pipeline or aboveground facilities, 0.5 mile from HDD entry and exit locations, and overlapping NSAs that would be affected by construction of the LNG Terminal.
Noise - Operations	Other facilities that would impact any NSA within 1 mile of a noise emitting permanent aboveground facility, or projects within a 2-mile radius of the LNG Terminal site or potential overlapping impacts on nearby NSAs.

Table 4.13.1-2 lists the projects and activities that we considered in this cumulative impact analysis, including the location, distance from the project, project timeframe, and resource(s) potentially cumulatively affected in conjunction with the Rio Grande LNG Project. Project locations are depicted in figures 4.13.1-1 and 4.13.1-2. Descriptions of potential cumulative impacts by resource category are discussed in section 4.13.2. For some projects we were unable to obtain quantitative information (e.g., project planning stage, size, etc.), in these cases our analysis relies on qualitative information for the project.

4.13.1.1 Future LNG Liquefaction Projects

Annova LNG Brownsville Project

Annova LNG has proposed a liquefaction and LNG export terminal along the BSC in Cameron County. The Annova LNG Brownsville Project (Annova LNG Project) would affect about 491 acres of land about 0.3 mile south of the Rio Grande LNG Terminal (see figure 3.3.2-1) and would include six LNG trains with an overall LNG capacity of about 6 MTPA, two 160,000 m^3 LNG storage tanks, and a marine berth to accommodate one LNG carrier. A new, intrastate natural gas header pipeline would deliver domestic feed gas from the Isla Grande pipeline system to the proposed Annova LNG Terminal.

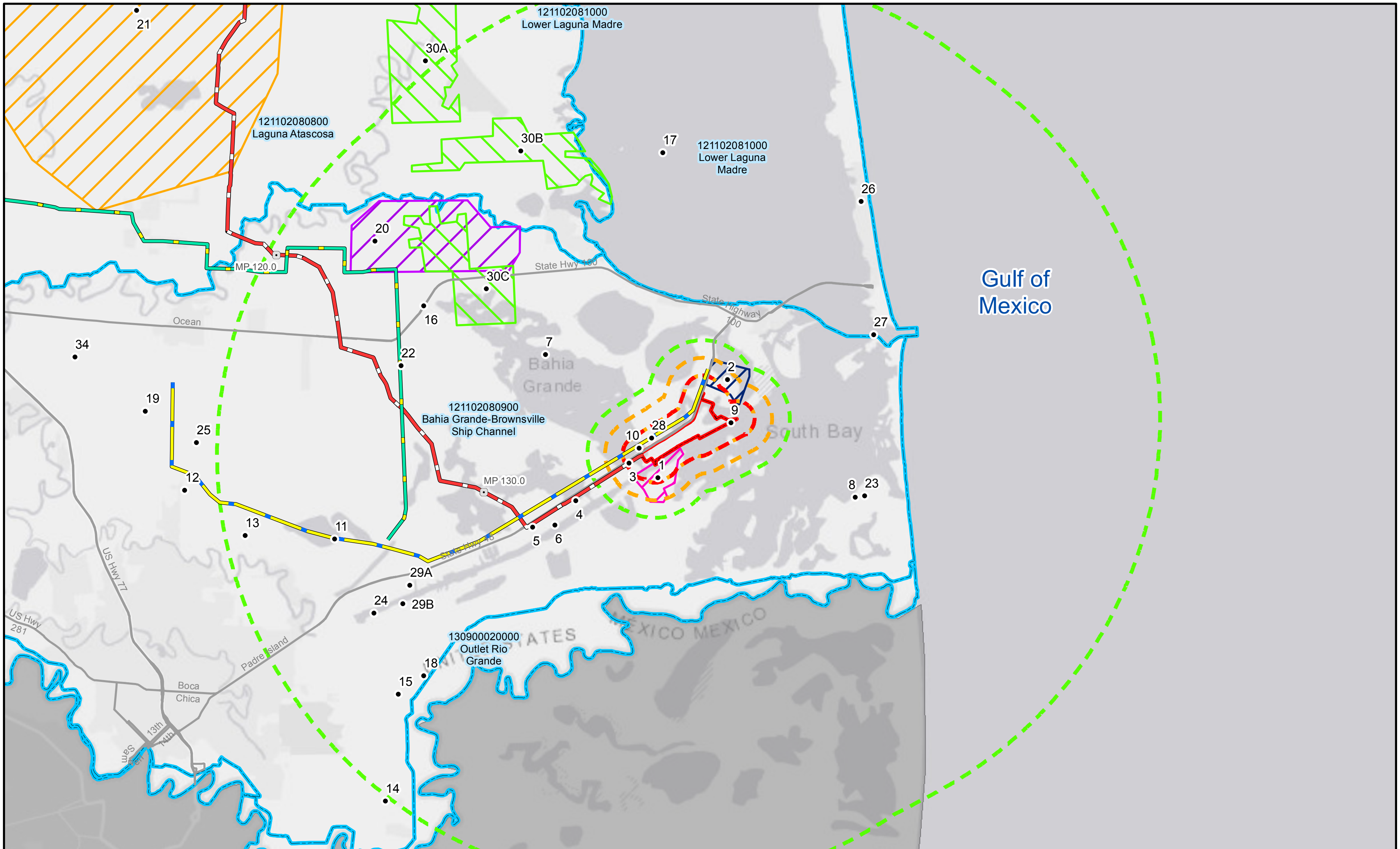
The FERC approved Annova LNG's request to enter the FERC pre-filing process on March 27, 2015, under Docket No. PF15-15; its formal application was filed with the FERC on July 13, 2016, under Docket No. CP16-480. Annova LNG initially anticipated that construction of the project would begin in 2018, and would have an in-service date of 2021. However, this timeline no longer appears feasible. Other non-jurisdictional facilities for the Annova LNG Project would include a natural gas interconnect facility within the terminal site, electricity to be provided by South Texas Electric Cooperative, and potable water to be provided by BND through planned expansions to serve various customers of the Port of Brownsville (including RG Developers). These non-jurisdictional facilities are discussed below (section 4.13.1.2).

Barca and Eos LNG Project

Barca and Eos were planning to develop a liquefaction and LNG export facility at the Port of Brownsville, about 2 miles west of the proposed Rio Grande LNG Terminal site. While the DOE authorized Eos and Barca to export to FTA nations, the applicants have not requested to participate in the FERC pre-filing process. Further, the lease option with BND has expired. As such, we conclude that the project is highly speculative, at best, and have excluded it from our cumulative impact analysis, as indicated in table 4.13.1-2.

Gulf Coast Liquefaction Project

Gulf Coast LNG Export, LLC (Gulf Coast) was planning to develop a liquefaction and LNG export facility on a 500-acre site at the Port of Brownsville, about 4 miles west of the Rio Grande LNG Terminal site (see figure 3.3.2-1). In May 2016, Gulf Coast filed a request to withdraw its application and vacate its authorization previously received from DOE to export to FTA nations and non-FTA nations. Therefore this project is no longer active, and it has not been included in our cumulative impact analysis, as indicated in table 4.13.1-2.



Legend

- Cumulative Impact Analysis Project
- Proposed LNG Terminal Boundary
- Proposed Rio Bravo Pipeline
- 0.5-Mile Buffer
- 1-Mile Buffer
- 12-Mile Buffer
- Watershed (HUC12)

Basemap Source: ESRI 2013

N

0 2 4

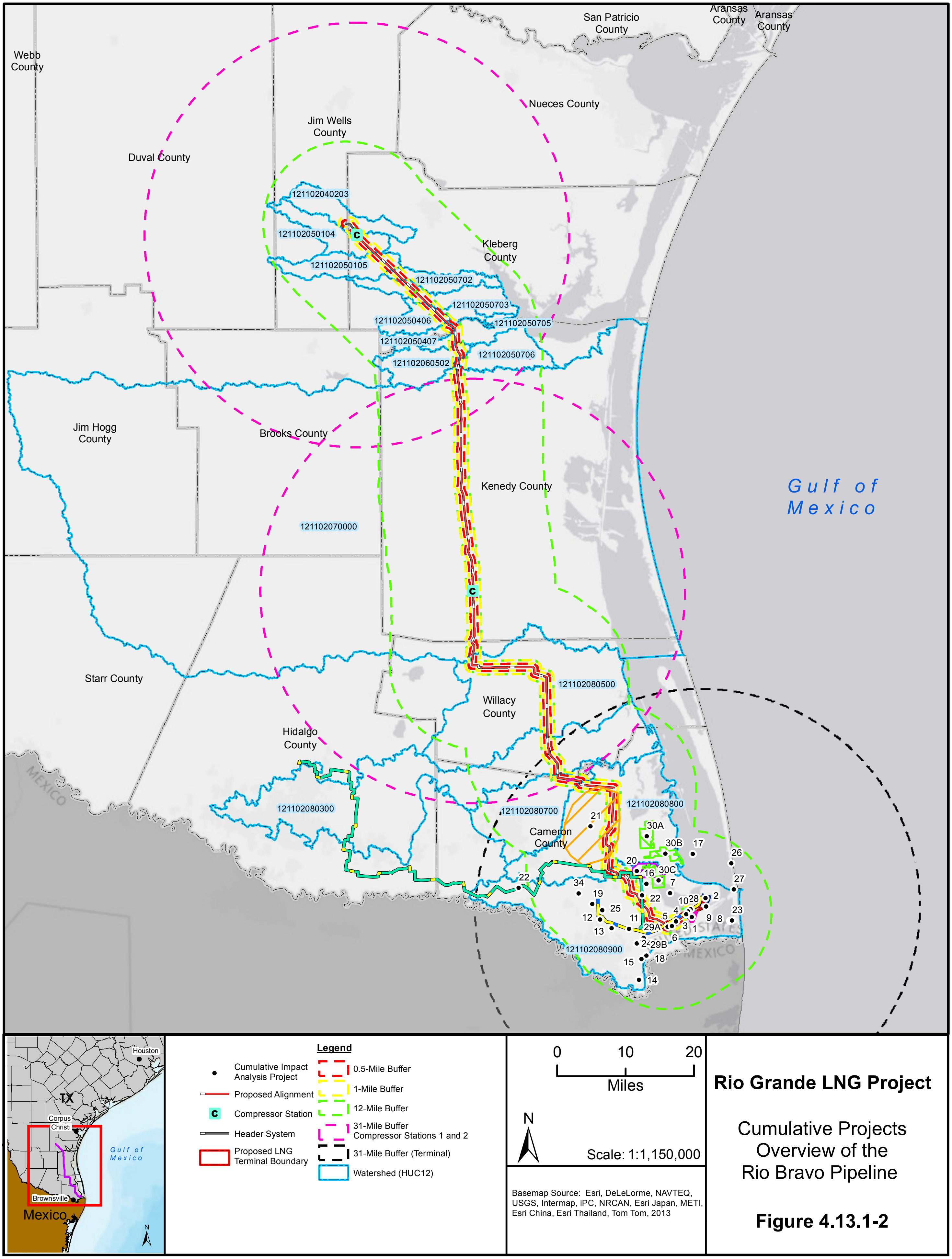
Miles

Scale: 1:250,000

Rio Grande LNG Project

Cumulative Projects Overview of the Rio Grande LNG Terminal

Figure 4.13.1-1



Rio Grande LNG Project

Cumulative Projects Overview of the Rio Bravo Pipeline

Figure 4.13.1-2

Table 4.13.1-2
Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project

Project / Activity (Mapped #, figures 4.13.1-1 and 4.13.1-2)	Developer	Estimated Timeframe (Con / Op)	Project Size	Closest Distance from Facilities[a]	Workforce (Con / Op)	Included in Cumulative Impact Analysis	Resources Potentially Affected within the proposed Project's Geographic Scope[a]
Future Liquefaction and LNG Export Projects							
Annova LNG Brownsville Project (#1)	Annova LNG Common Infrastructure, LLC, Annova LNG Brownsville A, LLC, Annova LNG Brownsville B, LLC, and Annova LNG Brownsville C, LLC	2018 / 2021	491 acres	T - 0.3 mile P – 0.6 mile	700-1,200 / 165	Yes	T - All resources less geology, soils, and cultural P - All resources less geology, soils, visual, cultural, and noise
Barca and Eos LNG Project (#3&4)	Barca LNG, LLC and Eos LNG, LLC	Unknown	Unknown	T - 2 miles P - Adjacent	Unknown	No; the lease option with BND has expired	--
Gulf Coast Liquefaction Project (#5)	Gulf Coast LNG Export, LLC	Unknown	500 acres	T - 4 miles P - Adjacent	3,000 / 250	No; in May 2016 Gulf Coast LNG Export, LLC filed a request to withdraw its application and vacate its authorization	--
Texas LNG Terminal Project (#2)	Texas LNG Brownsville, LLC	2018 / 2022	311.5 acres	T - Adjacent P – 2.5 miles	1,312 / 80	Yes	T - All resources less cultural P - Water resources, vegetation and wildlife, aquatic resources, T&E, land use, socioeconomics, air quality

Table 4.13.1-2 (continued)
Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project

Project / Activity (Mapped #, figures 4.13.1-1 and 4.13.1-2)	Developer	Estimated Timeframe (Con / Op)	Project Size	Closest Distance from Facilities[a]	Workforce (Con / Op)	Included in Cumulative Impact Analysis	Resources Potentially Affected within the proposed Project's Geographic Scope[a]
Non-jurisdictional Facilities Associated with the Rio Grande LNG Project							
LNG Trucking (#10)	Unknown	Unknown	12 to 15 tanker trucks / day	T - Within P - Varies	Unknown	Yes	T - Socioeconomics P - Socioeconomics
Potable Water, Sewer Services, and Fiber Optic Telecommunication Line (#10)	BND	2018 / 2019	estimated 5-6 miles within a 35-foot right-of-way (3.3 acres)[b]	T - Adjacent P - Adjacent	Unknown	Yes	T - All resources P - All resources
Electric Transmission Line (#10)	AEP	2019 / 2020	12.7 miles of 100-foot construction right-of-way (142 acres); an additional 11 miles (121 acres) is associated with the Texas LNG Project	T - Adjacent P - Adjacent	Unknown	Yes	T - All resources P - All resources
Road Widening (SH-48) (#28)	TxDOT	anticipated 2018 / 2019	estimated 3 miles (estimated 36.9 acres, including 0.5 acre associated with the Texas LNG Project)	T - Adjacent P - Adjacent	Unknown	Yes	T - All resources P - All resources
Pipeline Facilities							
Potable Water Supply Pipeline associated with Annova LNG (not mapped)	BND	2019 / 2021	6 miles	T – 0.3 mile P – 0.6 mile	Unknown	Yes	T – All resources, less geology, soils, and cultural P - All resources less geology, soils, visual, cultural, and noise

Table 4.13.1-2 (continued)
Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project

Project / Activity (Mapped #)	Developer	Estimated Timeframe (Con / Op)	Project Size	Closest Distance from Facilities[a]	Workforce (Con / Op)	Included in Cumulative Impact Analysis	Resources Potentially Affected within the proposed Project's Geographic Scope[a]
Kingsville to Brownsville Pipeline[c] (Not mapped)	Unknown	2021 / 2021	130 miles (estimated 1,576 acres)	T - 3.3 miles P – 2.5 miles	Unknown	Yes	T – All resources less geology, soils, cultural, and noise P – All resources less geology, soils, visual, cultural, and noise
New Intrastate Pipeline for Texas LNG[d] (#11)	Unknown	2019 / 2020	10.2 miles (108.3 acres)	T - Adjacent P - Adjacent	Unknown	Yes	T - All resources P - All resources
VCP[e] (also known as Nueces-Brownville Pipeline) (Not mapped)	VCP / Comisión Federal de Electricidad	Underway / October 2018	estimated 2,545.8 acres	T - Adjacent P - Appears to be crossed	Unknown	Yes	T - All resources P - All resources
Tuxpan Project (Not mapped)	Comisión Federal de Electricidad	Underway / late 2018	estimated 7,576.8 acres	T - Unknown P – Unknown	Unknown	No, since this project would be located entirely within Mexico	--
Electric Transmission and Generation Projects							
New Electric Transmission Line associated with Annova LNG (Not mapped)	South Texas Electric Cooperative	2019 / 2021	15 miles	T - 0.3 miles P – 0.6 miles	Unknown	Yes	T – All resources less geology, soils, air, and noise P - Water resources, vegetation, wildlife, aquatic resources, T&E, and socioeconomics

Table 4.13.1-2 (continued)
Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project

Project / Activity (Mapped #)	Developer	Estimated Timeframe (Con / Op)	Project Size	Closest Distance from Facilities[a]	Workforce (Con / Op)	Included in Cumulative Impact Analysis	Resources Potentially Affected within the proposed Project's Geographic Scope[a]
Tenaska Brownsville Generating Station (#19)	Tenaska	2018 / 2019	270 acres	T - 13.8 miles	700 / 23	Yes	T - All resources less geology, soils, and visual
				P - 7 miles			P - Water resources, vegetation, wildlife, aquatic resources, T&E, and socioeconomics
San Roman Wind Farm (#20)	Acciona Energia	Operational	156 acres	T - 8 miles	80 / 7	Yes	T - Water resources, vegetation, wildlife, T&E, land use, visual, and socioeconomics
				P - 0.9 mile			P - Water resources, vegetation, wildlife, T&E, land use, and socioeconomic
Cameron Wind Farm (#21)	Apex Clean Energy	Operational	15,000 acres[f]	T – 14.0 miles	140 / 18	Yes	T – Water resources, vegetation, wildlife, T&E, land use, and socioeconomics
				P - Crossed			P - Water resources, vegetation, wildlife, T&E, land use, visual, socioeconomics, and noise

Table 4.13.1-2 (continued)
Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project

Project / Activity (Mapped #)	Developer	Estimated Timeframe (Con / Op)	Project Size	Closest Distance from Facilities[a]	Workforce (Con / Op)	Included in Cumulative Impact Analysis	Resources Potentially Affected within the proposed Project's Geographic Scope[a]
Bruenning Breeze Wind Farm[g] (Not mapped)	E.ON	Operational	15,000	T – 35 miles	200 / 20	Yes	T – Socioeconomics
				P – 0.25 mile			P - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, visual, socioeconomics, and noise
Stella Wind Farm[g] (Not mapped)	E.ON	Underway / late 2018	Unknown	T – 65 miles	Unknown	Yes	T – None
				P – 12 miles			P – Water resources, vegetation, wildlife, aquatic resources, T&E, and socioeconomics
Cross Valley Project (#22)	Electric Transmission Texas and Sharyland Utilities	Operational	96 miles (estimated 1,745.7 acres)	T – 6.2 miles	Unknown	Yes	T - All resources less geology, soils, cultural, and noise
				P – Parallel / Crossed			P - All resources
Transportation Projects							
East Loop (State Highway 32) (#14)[h]	TxDOT	Unknown	6.7 miles (126.9 acres)	T - 15 miles	Unknown	Yes	T - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, socioeconomics, air quality
				P - 10 miles			P - Water resources, vegetation, wildlife, aquatic resources, T&E, socioeconomics, air quality

Table 4.13.1-2 (continued)
Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project

Project / Activity (Mapped #)	Developer	Estimated Timeframe (Con / Op)	Project Size	Closest Distance from Facilities[a]	Workforce (Con / Op)	Included in Cumulative Impact Analysis	Resources Potentially Affected within the proposed Project's Geographic Scope[a]
South Padre Island Second Access (#17)	TxDOT and FHWA[a]	2020 / 2021	17.6 miles (240.6 acres)[i]	T - 7 miles	Unknown	Yes	T - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, socioeconomics, air quality
				P – 8.7 miles			P - Water resources, vegetation, wildlife, aquatic resources, T&E, socioeconomics, air quality
SH-4 Upgrade Project (#15)	TxDOT	2022 / Unknown	Unknown	T - 15 miles	Unknown	Yes	T - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, socioeconomics, air quality
				P - 5 miles			P - Water resources, vegetation, wildlife, aquatic resources, T&E, socioeconomics, air quality
SH-100 Wildlife Crossing Project (#16)	TxDOT	2016 / Unknown	0.1 mile	T – 7.4 miles	Unknown	Yes	T – Water resources, vegetation, wildlife, aquatic resources, T&E, land use, socioeconomics, air quality
				P – 0.3 mile			P - Water resources, vegetation, wildlife, aquatic resources, T&E, socioeconomics, air quality

Table 4.13.1-2 (continued)
Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project

Project / Activity (Mapped #)	Developer	Estimated Timeframe (Con / Op)	Project Size	Closest Distance from Facilities[a]	Workforce (Con / Op)	Included in Cumulative Impact Analysis	Resources Potentially Affected within the proposed Project's Geographic Scope[a]
SH-550 Connector and Toll Project (#13)	TxDOT and CCRMA[a]	Operational	Unknown	T – 11.2 miles	Unknown	Yes	T - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, visual, socioeconomics, air quality
				P - 5 miles			P - Water resources, vegetation, wildlife, aquatic resources, T&E, socioeconomics, air quality
Port of Brownsville Projects							
Brownsville Liquids Terminal (#29A)	Port of Brownsville and Howard Midstream Energy Partners	Operational	Unknown	T - 7.5 miles	Unknown	Yes	T - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, visual, socioeconomics, air quality
				P – 3.6 miles			P - Water resources, vegetation, wildlife, aquatic resources, T&E, socioeconomics, air quality

Table 4.13.1-2 (continued)
Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project

Project / Activity (Mapped #)	Developer	Estimated Timeframe (Con / Op)	Project Size	Closest Distance from Facilities[a]	Workforce (Con / Op)	Included in Cumulative Impact Analysis	Resources Potentially Affected within the proposed Project's Geographic Scope[a]
Bulk Liquids Terminal Facility (#29B)	Port of Brownsville and Mavericks Terminal, LLC	Operational	Unknown	T - 7.1 miles P – 3.2 miles	Unknown	Yes	T - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, visual, socioeconomics, air quality P - Water resources, vegetation, wildlife, aquatic resources, T&E, socioeconomics, air quality
GEOTRAC Industrial Hub (#12)	OmniTRAX	Operational	1,400 acres	T- 13 miles P – 7.2 miles	Unknown	Yes	T - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, visual, socioeconomics, air quality P - Water resources, vegetation, wildlife, aquatic resources, T&E, socioeconomics, air quality
Port of Brownsville Marine Cargo Dock 16 and Storage Yard (#24)	Port of Brownsville	Operational	600-foot marine cargo dock	T - 6 miles P – 4.2 miles	Unknown	Yes	T - Water resources, vegetation, aquatic resources, T&E, land use, visual, socioeconomics, air quality P - Water resources, vegetation, aquatic resources, T&E, socioeconomics, air quality

Table 4.13.1-2 (continued)
Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project

Project / Activity (Mapped #)	Developer	Estimated Timeframe (Con / Op)	Project Size	Closest Distance from Facilities[a]	Workforce (Con / Op)	Included in Cumulative Impact Analysis	Resources Potentially Affected within the proposed Project's Geographic Scope[a]
Centurion Brownsville Terminal Processing and Storage Facility (Not mapped)	Centurion Terminals	Operational	280 acres[j]	T – 6 miles	500/35	Yes	T - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, visual, socioeconomics, air quality
				P – 2.2 miles			P - Water resources, vegetation, wildlife, aquatic resources, T&E, socioeconomics, air quality
Waterway Improvement Projects							
Brazos Island Harbor Channel Improvement (#6)	COE	Underway	Deepen the BSC from 42 to 52 feet	T - Adjacent	Unknown	Yes	T - All resources less vegetation
				P - Adjacent			P - All resources less vegetation and visual
Bahia Grande Channel Restoration (#7)	FWS, NOAA, TxDOT, Laguna Atascosa NWR, Cameron County, and BND	Unknown	250-foot wide channel	T - Adjacent	Unknown	Yes	T - All resources
				P - Crossed			P - All resources
BSC and Turning Basin Maintenance Dredging (#9)	COE	Underway / Ongoing	Unknown	T - Adjacent	Unknown	Yes	T - All resources less vegetation
				P - Crossed			P - All resources less vegetation and visual

Table 4.13.1-2 (continued)
Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project

Project / Activity (Mapped #)	Developer	Estimated Timeframe (Con / Op)	Project Size	Closest Distance from Facilities[a]	Workforce (Con / Op)	Included in Cumulative Impact Analysis	Resources Potentially Affected within the proposed Project's Geographic Scope[a]
Bend Easing BSC Improvement Project (#27)	BND	Unknown	Unknown	T - 5.5 miles P – 7.7 miles	Unknown	Yes	T - All resources less vegetation, cultural resources, and noise P - Water resources, wildlife, aquatic resources, T&E, socioeconomics
Port Isabel Maintenance Dredging (Not mapped)	COE	Underway / 2018	Unknown	T - 2 miles P – 5.5 miles	Unknown	Yes	T - Water resources, wildlife, aquatic resources, T&E, land use, socioeconomics, visual, air quality P - Water resources, wildlife, aquatic resources, T&E, socioeconomics
Gulf Intercoastal Waterway Maintenance Dredging (Not mapped)	COE	Underway / 2019	423 miles	T - 4 miles P – 7.5 miles	Unknown	Yes	T - Surface water, aquatics, vegetation, wildlife, T&E, socioeconomics, and land use P - Water resources, wildlife, aquatic resources, T&E, socioeconomics

Table 4.13.1-2 (continued)
Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project

Project / Activity (Mapped #)	Developer	Estimated Timeframe (Con / Op)	Project Size	Closest Distance from Facilities[a]	Workforce (Con / Op)	Included in Cumulative Impact Analysis	Resources Potentially Affected within the proposed Project's Geographic Scope[a]
Other Projects and Activities Considered							
SpaceX Commercial Spaceport Project (#8)	Space Exploration Technologies Corporation	Underway / 2018	70 acres	T - 5.5 miles	150 / 47	Yes	T - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, socioeconomics, and noise
				P – 6.5 miles			P - Water resources, vegetation, wildlife, aquatic resources, T&E, and socioeconomics
Stargate Facility (#23)	Center for Advanced Radio Astronomy, University of Texas Rio Grande Valley and SpaceX	Underway / late 2018 or early 2019	2.3 acres	T - 5.5 miles	Unknown	Yes	T - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, and socioeconomics
				P – 6.7 miles			P - Water resources, vegetation, wildlife, aquatic resources, T&E, and socioeconomics
Mobile Border Check Point (#18)	U.S. Customs and Border Patrol State Highway	Operational	N/A[a]	T - 8 miles	Unknown	No, since the facility is mobile, no permanent facilities are proposed; also, the facility is operational	--
				P – 5.1 miles			

Table 4.13.1-2 (continued) Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project							
Project / Activity (Mapped #)	**Developer**	**Estimated Timeframe (Con / Op)**	**Project Size**	**Closest Distance from Facilities[a]**	**Workforce (Con / Op)**	**Included in Cumulative Impact Analysis**	**Resources Potentially Affected within the proposed Project's Geographic Scope[a]**
South Padre Island Beach Re-nourishment (#26)	COE, TGLO, and City of South Padre Island	Complete	0.8 miles	T - 6 miles	Unknown	Yes	T – Land use and socioeconomics
				P – 9.9 miles			P - Socioeconomics
Palo Alto Battlefield Cultural Landscape Restoration (#25)	NPS and Palo Alto Battlefield National Historical Park / National Historic Landmark	Ongoing	Unknown	T- 13 miles	Unknown	Yes	T - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, and socioeconomics
				P – 4.9 miles			P - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, and socioeconomics
Bahia Grande Coastal Corridor Project (Current Proposal) (#30A, B, C)	FWS and TPWD	Ongoing	2,129 acres[k]	T - 5 miles	Unknown	Yes	T – Water resources, vegetation, wildlife, aquatic resources, T&E, land use, and socioeconomics
				P – 2.5 miles			P - Water resources, vegetation, wildlife, aquatic resources, T&E, land use, and socioeconomics

Table 4.13.1-2 (continued)
Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project

Project / Activity (Mapped #)	Developer	Estimated Timeframe (Con / Op)	Project Size	Closest Distance from Facilities[a]	Workforce (Con / Op)	Included in Cumulative Impact Analysis	Resources Potentially Affected within the proposed Project's Geographic Scope[a]

Note: Unless otherwise noted, data were provided by the Project Applicant in its FERC Application and associated supplemental filings available for viewing on the FERC website, eLibrary, under Docket Nos. CP16-454-000 and CP16-455-000.

a T = Rio Grande LNG Terminal site; P = Pipeline System; T&E = threatened and endangered species; and CCRMA = Cameron County Regional Mobility Authority.

b The potable water supply line would also extend to serve the Texas LNG Terminal site; impacts are included with the new interstate pipeline for Texas LNG since the projects would be installed in the same corridor.

c Details on this project were provided by Annova LNG, which is under review by FERC at Docket Number CP16-480.

d Details on this project were provided by Texas LNG, which is under review by FERC at Docket Number CP16-116.

e The permanent rights-of-way for the VCP pipeline and proposed pipelines would be collocated with the BND utility corridor (25 feet).

f Apex Clean Energy 2016.

g Kimley-Horn 2017, Windpower Engineering 2018.

h TxDOT 2016.

i Cameron County Regional Mobility Authority 2015.

j Smith 2017.

k The total acquisition goal is 7,000 acres.

Texas LNG Terminal Project

Texas LNG Brownsville LLC (Texas LNG) has proposed a liquefaction and LNG export terminal on the BSC in Cameron County, bordering the northeast boundary of the Rio Grande LNG Terminal site (see figure 3.3.2-1). The Texas LNG Terminal Project (Texas LNG Project) would impact 311.5 acres of land and would include two LNG trains with an overall LNG capacity of approximately 4.0 MTPA, two 210,000 m^3 LNG storage tanks, and a marine berth to accommodate one LNG carrier. The Agua Dulce hub would supply feed gas to the terminal via a new, 150-mile-long intrastate natural gas header pipeline.

Texas LNG's request to enter the FERC pre-filing process was approved on April 14, 2015, under Docket No. PF15-14; its formal application was filed with the FERC on March 30, 2016, under Docket No. CP16-116. Texas LNG anticipated that construction would begin in 2018 with an in-service date of 2022. However, this timeline no longer appears feasible. Other non-jurisdictional facilities, including electricity and water, would be provided by AEP and BND, respectively. These are discussed in section 4.13.1.2.

4.13.1.2 Non-jurisdictional Facilities Associated with the Rio Grande LNG Project

As described in section 1.4, the proposed Rio Grande LNG Terminal, which is a FERC-jurisdictional facility, would require power, potable water, and sewer services. However, these services do not fall under the jurisdiction of the FERC. RG LNG has also proposed LNG truck-loading facilities and modifications to SH-48. Each of these projects has been included in our cumulative impacts analysis.

LNG Trucking

The proposed LNG trucking infrastructure within the Rio Grande LNG Terminal would be jurisdictional to FERC; however, LNG trucking activities that take place after the LNG truck has departed from the LNG Terminal do not fall under FERC jurisdiction. During operation of the Rio Grande LNG Terminal, a portion of the LNG would be loaded onto trucks for road distribution to refueling stations in Texas and the surrounding states. While no agreements have been executed for the transportation of LNG in trucks, RG LNG is proposing to construct four loading bays designed with a maximum load rate per bay of 300 gpm. Each bay would be able to accommodate up to 15 tanker trucks per day, for trucks with a maximum carrying capacity of 13,000 gallons. LNG trucks calling on the Rio Grande LNG Terminal are expected to deliver the LNG to any of the 30 LNG fueling stations currently in operation in south Texas, or to additional LNG refueling stations currently under development.

Tie-in to Potable Water, Sewer, and Telecommunication Services

BND is planning to construct a freshwater supply system to serve various customers of the Port of Brownsville. RG LNG would connect the LNG Terminal site to the anticipated 16-inch-diameter water supply header that would be installed along the northern boundary of the Rio Grande LNG Terminal site south of SH-48. As part of the same expansion effort for the Port of Brownsville customers, BND is planning to construct a new sewage header that would connect to an existing treatment plant. RG LNG would connect the LNG Terminal site to the anticipated 12-inch-diameter sewage header that would be located in the same corridor as the

BND's planned freshwater supply system. The potable water line would also extend to serve the Texas LNG Terminal site. Telecommunication service for the LNG Terminal would be accommodated by a new 4-inch-diameter fiber optic cable buried within BND utility corridor to accommodate the water and sewer service.

RB Pipeline is currently evaluating the utility needs for Compressor Stations 1 and 2, as well as for the booster stations. Compressor Station 3 would be constructed within the Rio Grande LNG Terminal site; therefore, it would be served through the power sources discussed above.

Power Supply

RG LNG anticipates that power for operation of the Rio Grande LNG Terminal would be supplied through planned upgrades to AEP's existing system. AEP would build a double-circuit 138 kV overhead power line that would connect the AEP Union Carbide and Loma Alta substations. The power line would run south of SH-48 along the northern boundary of the Rio Grande LNG Terminal site. The power lines would continue beyond the Rio Grande LNG Terminal to provide power to the Texas LNG Terminal site.

RB Pipeline is currently evaluating the utility needs for Compressor Stations 1 and 2, as well as for the booster stations. Compressor Station 3 would be constructed within the Rio Grande LNG Terminal site; therefore, it would be served through the power sources discussed above.

Road Widening (SH-48)

TxDOT is currently planning to update portions of SH-48 along the Rio Grande LNG Terminal site to accommodate access. Modifications were identified during RG LNG's coordination with TxDOT and include the addition of land for acceleration, deceleration, and turning lanes, as well as traffic lights. RG LNG anticipated that construction would begin in 2018 and the modifications were expected to be completed in 2019. While some modifications to SH-48 are documented by TxDOT as underway or beginning soon (texturizing the road shoulder), the additional land and installation of traffic lights that would support access to the Project site are not documented as ongoing (TxDOT 2018). Similar modifications to SH-48 would also be completed adjacent to the proposed Texas LNG Project site.

4.13.1.3 Intrastate Pipeline Facilities

Kingsville to Brownsville Pipeline

Annova LNG plans to receive natural gas supply from a third-party-owned and operated intrastate pipeline running from Kingsville to Brownsville (Kingsville to Brownsville Pipeline), which Annova LNG anticipates would be in constructed in 2021. The pipeline would be an approximately 130-mile-long, 36-inch-diameter pipeline and would transport natural gas from the Agua Dulce hub near Kingsville to various delivery points between Kingsville and Brownsville, ending at the Annova LNG facility. Because the developer of the pipeline has not yet been identified, the exact location of the pipeline is unknown.

Intrastate Pipeline to the Texas LNG Project

A new non-jurisdictional 30-inch-diameter intrastate pipeline would be constructed to supply natural gas to the Texas LNG Project. Texas LNG anticipates that the pipeline would be approximately 10.2 miles long and would interconnect with the proposed Cross Valley Pipeline Project. Texas LNG also anticipates that an additional 15,000 hp of compression would be needed to move the incremental gas destined for Texas LNG in Agua Dulce at the same compressor station constructed for the Cross Valley Pipeline Project, with an additional 50,000 hp compression also needed about halfway between Agua Dulce and Brownsville. Construction of the 10.2-mile-long intrastate natural gas pipeline would likely require a 100-foot-wide construction right-of-way and would be primarily collocated with other non-jurisdictional facilities associated with the Texas LNG Project, south of SH-48. The intrastate pipeline would originate about 5 miles west of RG LNG's Rio Grande LNG Terminal site within the BND utility corridor (described above for the non-jurisdictional facilities) following a northeastern route to the Texas LNG Terminal site. Texas LNG anticipates that construction on the intrastate natural gas pipeline would begin in 2019 and take less than 1 year to complete.

Valley Crossing Pipeline (also known as the Nueces-Brownsville Pipeline)

VCP, a subsidiary of Enbridge, Inc., is constructing a 165-mile-long intrastate pipeline to supply gas to Comisión Federal de Electricidad, Mexico's stated-owned utility (Enbridge 2018). The VCP, which originates near the Agua Dulce Hub in Nueces County is currently under construction. The terminus of the pipeline would be about 9 miles offshore of the BSC and it is expected to be operational in October 2018. The VCP would be adjacent to the Rio Bravo Pipeline Project between MPs 35.6 and 70.0, would cross the Project at MPs 69.3 and 131.5, and would be collocated with the Project's permanent right-of-way between MPs 132.3 and 135.4. In addition, the pipeline would cross the Rio Grande LNG Terminal site outside the boundary of the facility.

4.13.1.4 Oil and Gas Facilities

In section 4.1.2 we identified 57 active and producing oil or gas wells within 0.25 mile of the Pipeline System, as well as 15 permitted wells that have not yet been drilled. No active or producing wells were found near the Rio Grande LNG Terminal site. Given the presence of known mineral resources in the area and expected development in the oil and gas industry, it is likely that new wells will become active in the future and potentially concurrent with the construction and operation of the Rio Grande LNG Project.

4.13.1.5 Electric Transmission and Generation Projects

There are two proposed electric generation projects, as well as one currently under construction and four already in operation in the vicinity of the proposed Rio Grande LNG Project. The South Texas Electric Cooperative is expected to begin constructing a new, 15-mile-long, 138 kV electric transmission line in 2019. This transmission line would provide electricity to the Annova LNG Project described above. According to Annova LNG, the 15-mile-long transmission line would be constructed in a 100-foot-wide right-of-way that originates at the existing Farm-to-Market Road 511 Substation and would terminate at a switchyard to be constructed within the proposed Annova LNG site. The connection and transmission system would be permitted, constructed, owned, and operated by the South Texas Electric Cooperative, and would include:

- modifications of the existing Farm-to-Market Road 511 and Waterport Electric Substations to provide interconnection to the new 138-kV line;
- a new 138-kV switchyard on the Annova LNG Terminal site; and
- a new 138-kV line between the existing and new switchyard.

The transmission line would run from the Annova LNG site southwest towards Brownsville and would be about 0.3 mile from the Rio Grande LNG Terminal site.

The Tenaska Brownsville Generating Station is proposed for construction on 270 acres in Cameron County, about 7 miles west of the Pipeline System near MP 128. Tenaska anticipates the facility will be placed in service in 2019.

The Stella Wind Farm is currently under construction. Construction of E.ON's 201-megawatt Stella Wind Farm began in January 2017, and its 67-turbine facility is anticipated to be operational by the end of 2018.

There remaining projects that are currently in operation include the San Roman, Cameron, and Bruenning Breeze Wind Farms, and the Cross Valley Project. Acciona Energia acquired the San Roman Wind Project from the former developer, Pioneer Green Energy (2016). The project became operational in 2016 and includes 31 wind turbines along the proposed Pipeline System route between MPs 122.0 and 124.0.

The Cameron Wind Farm was built by Apex Clean Energy in 2015. The 165-megawatt facility includes 55 turbines on 15,000 acres of leased agricultural land that would be traversed by the Pipeline System between MPs 107.1 and 116.1. In December 2017, E.ON commissioned the Bruenning Breeze Wind Farm in Willacy County; this 228-megawatt facility has 76 turbines. The Cross Valley Project has been operational since 2016 and includes a 345-kV electric transmission line routed from Edinburg to Palmito. This transmission line would be crossed by the proposed Pipeline System route at MPs 122.0 and 128.0.

4.13.1.6 Transportation Projects

In addition to the modifications of SH-48 associated with access to the Rio Grande LNG Terminal site, TxDOT has plans to construct four projects and recently completed one project, as presented in table 4.13.1-2. These projects could contribute to cumulative impacts within the geographic scope for many resources, as noted in section 4.13.2. None of the TxDOT projects would be crossed by the Rio Grande LNG Project. The closest TxDOT project would be one of the planned wildlife crossings under SH-100, which would be about 0.3 mile from MP 123 of RB Pipeline's proposed pipeline facilities.

Construction of a second access roadway and bridge to Padre Island is scheduled to begin in 2020 (Cameron County Regional Mobility Authority [CCRMA] 2015). TxDOT and the Federal Highway Administration, in cooperation with the CCRMA, are planning the 17.6-mile-long project that would be about 7 miles northeast of the Rio Grande LNG Terminal site.

TxDOT is planning an East-Loop of SH-32, which includes a four-lane highway that would run from the Port of Brownsville to Veterans Bridge at Los Tomates (CCRMA 2015). The goal of the loop is to improve traffic flow in the area around and near the Port of Brownsville. This project would be 15 miles southwest of the Rio Grande LNG Terminal site, with an unknown construction schedule. TxDOT is also planning a 1.4-mile-long upgrade to SH-4, which includes a 2-lane, undivided highway to a planned entrance to the Port of Brownsville (TxDOT 2016). This project would be 15 miles southwest of the Rio Grande LNG Terminal site, and construction is expected to begin in 5 to 10 years.

The SH-550 Connector and Toll project became operational in June of 2015, based on a collaborative effort between TxDOT and the CCRMA (TxDOT 2016). Although the project is operational, it was identified during the agency review process as potentially contributing to impacts with the proposed Project; therefore, it is identified here. This limited access toll road provides access to the BSC and is about 5 miles west of the Rio Grande LNG Terminal site.

4.13.1.7 Port of Brownsville Projects

Five projects associated with strategic development efforts associated with the Port of Brownsville's proximity to Mexico and the international movement of goods, were identified as having the potential to contribute to cumulative impacts. The Brownsville Liquids Terminal was completed in 2014 and is composed of 21 tanks that can accommodate up to 221,000 barrels of liquid storage (Howard Midstream 2015). The Bulk Liquids Terminal Facility, which was completed in 2015, includes four tanks and the potential for capacity up to 700,000 barrels of liquid storage with future expansions (Howard Midstream 2015). These facilities are on either side of the BSC from one another, 7.5 and 7.1 miles southwest of the Rio Grande LNG Terminal site, respectively.

Dock 16 became operational in 2015, increasing the Port of Brownsville marine cargo holding capacities and versatility to maintain the pace of growing demand (Global Trade 2015). The 600-foot dock can accommodate cargo vessels with drafts up to 39.5 feet and is the second heavy-load capacity dock in Brownsville. Dock 16 is about 6 miles west of the Rio Grande LNG Terminal site.

One of America's largest private railroad and transportation management companies, OmniTRAX, developed a large-scale industrial park on 1,400 acres of BND-owned land (GEOTRAC Industrial Hub). The park provides opportunities for light and heavy manufacturing, logistics, energy services, technology development, and export/import warehousing. Centurion Terminals recently constructed the Brownsville Terminal Processing and Storage Facility with over 1.5 million barrels of crude storage capacity, including a liquid cargo dock, three-track rail spur, 10-truck lease automatic custody transfer skids, and an initial two processing towers to process condensate to 50,000 barrels per day to produce products for local markets or export.

4.13.1.8 Waterway Improvement Projects

Seven dredging and waterway maintenance projects were identified as having the potential to contribute to cumulative impacts. Four of these projects are associated with the COE's ongoing maintenance efforts and include maintenance dredging of the BSC, Port Isabel, the Brazos Island Harbor Channel, and the Gulf Intercostal Waterway to facilitate movement of vessels trough these waterways (COE 2015a). All of these efforts, less the Bahia Grande Channel Restoration, are currently underway, and similar efforts are expected in the future as needed to safeguard these waterways.

As discussed throughout section 4.0, the Bahia Grande Channel was constructed in 2005 to connect the BSC to the Bahia Grande to restore tidal exchange to the Bahia Grande (FWS 2016). As part of a comprehensive restoration plan, the Bahia Grande Channel would be expanded from about 34 feet wide to 250 feet wide to increase tidal exchange (Ocean Trust 2009, FWS 2010a). The project was issued an individual permit by the COE under permit number SWG-2003-01954 in 2016; however, the timing of restoration efforts is currently unknown. The existing channel is adjacent to the Rio Grande LNG Terminal site, and widening efforts would result in the dredging of an area along the western extent of the property. The channel would be crossed by the Pipeline System via HDD.

The BND is investigating the need to modify the entrance to the BSC to provide greater flexibility, accommodate the deeper draft of the largest vessels that transit the expanded Panama Canal, and allow for safe navigation of deep draft vessels, especially in inclement weather. The timing of these improvement activities is currently unknown. The area of improvement is about 5.5 miles east of the Rio Grande LNG Terminal site.

4.13.1.9 Other Projects and Activities Considered

Five other projects and activities were identified as having the potential to contribute to cumulative impacts. In early 2016 the Galveston District of the COE completed a beach renourishment project in collaboration with the City of South Padre Island (COE 2015b). About 651,000 yd^3 of dredged material from the BSC was placed across 0.8 mile of shoreline along South Padre Island about 6 miles northeast of the LNG Terminal sites.

The Bahia Grande Coastal Corridor Project is a multi-stage project currently underway, with the goal of acquiring land for conservation purposes. The Nature Conservancy, Conservancy Fund, FWS, and TPWD are working to identify parcels for acquisition, through purchase or easement, to connect the Lower Rio Grande Valley NWR, Laguna Atascosa NWR, Boca Chica State Park, and other privately held land to provide protection for various threatened and endangered species, as discussed in section 4.7. These lands to be acquired are 2.5 or more miles from the proposed LNG Terminal (see figure 4.13.1-2). An existing easement on BND land, which is associated with this project, is held by the FWS and acts as a wildlife corridor for ocelots and other wildlife to cross SH-48 to habitat on either side. This corridor would be crossed by the Pipeline System between MPs 134.5 and 134.7; however, as the crossing would be constructed by HDD, direct impacts would be avoided. To date, the conservation sponsors noted above have acquired 2,129 acres out of a total acquisition goal of 7,000 acres (The Nature

Conservancy 2017). The lands recently acquired and identified for future acquisition are included in this analysis.

The NPS and Palo Alto Battlefield National Historical Park/National Historic Landmark developed an Integrated Vegetation Management Plan with the goal of restoring and maintaining the landscape and vegetation within the battlefield for cultural and historic preservation (NPS 2014). The project aims to remove the invasive woody and cacti vegetation from the battlefield and reintroduce gulf cordgrass. In addition to mechanical, cultural, chemical, and biological treatments to maintain the cultural landscape of the battlefield, prescribed fires will be utilized to promote the development of the cordgrass as well as prevent the re-establishment of the invasive woody and cacti vegetation. Maintenance of the landscape in accordance with the Integrated Vegetation Management Plan is ongoing; the Palo Alto Battlefield National Historical Park/National Historic Landmark is about 13 miles northwest of the Rio Grande LNG Terminal site.

Development of a commercial space launch facility, SpaceX, about 5.5 miles southeast of the Rio Grande LNG Terminal site, began in September 2014, and the first launch is anticipated as soon as late 2018 (SpaceX 2014). A related “Stargate Facility” would be located on a 2.3-acre parcel adjacent to the SpaceX facilities. The Stargate Facility would accommodate a 12,000-square-foot research center, currently being designed, where students and professors of the University of Texas, Rio Grande Valley can track spacecraft (University of Texas Brownsville 2015). Construction of the facility began in 2016 and would be fully operational in late 2018/early 2019 (University of Texas-Rio Grande Valley 2018).

4.13.1.10Residential Developments

As of this writing, no planned residential developments have been identified within 0.25 mile of the Rio Grande LNG Project.

4.13.2 Potential Cumulative Impacts by Resource

The following sections address the potential cumulative impacts of the activities identified within the geographic scope on specific environmental resources, as identified in table 4.13.1-2. The projects considered in each section that are most likely to contribute to cumulative impacts with the Project are those that would occur within the same timeframe as the proposed Project.

4.13.2.1 Geologic Resources and Soils

The geographic scope for geologic resources and soils was defined as the area that would be affected by, or immediately adjacent to, the Rio Grande LNG Project. Large projects with ground-disturbance and excavation associated with construction and permanent aboveground facilities would have the greatest impacts on geologic resources and soils. The Texas LNG Project and associated intrastate pipeline, non-jurisdictional facilities, the Cameron Wind Farm, VCP, Cross Valley Project where it is parallel to the proposed Rio Bravo Pipeline, three of the waterway improvement projects, and the active and producing oil or gas wells have the greatest potential to contribute to cumulative impacts on geologic resources and soils.

Projects that would be constructed in close proximity to one another, and require evacuation or considerable grading, would generally have greater impacts on geological resources and soils than projects with limited ground disturbance or those projects that are separated by time and space. Therefore, the potential increase for erosion and impact on geological hazards would be highly localized and limited primarily to the period of construction.

LNG Terminal

Geologic Resources

Construction of the LNG Terminal would permanently modify topographic contours present at the site. Similarly, the Texas LNG Project, which would be adjacent to RG LNG's site, would permanently alter topographic contours through cut and fill activities, import of fill, and dredging of a marine berth. The Brazos Island Harbor Channel Improvement Project would deepen the BSC from -42 feet to -52 feet, which would also alter topographic contours near the proposed Project. The BSC and Turning Basin Maintenance Dredging waterway improvement project involves ongoing dredging to maintain sufficient depths for deep-draft vessels (see table 4.13.1-2). The non-jurisdictional facilities associated with the proposed Project consist of modifications to SH-48 as well as the installation of water and electric transmission lines, which would cross between SH-48 and the LNG Terminal. Natural topography was likely altered in this area during the initial construction of SH-48; however, it is anticipated that existing contours would be restored following construction of the water line and electric transmission lines.

Fuel and non-fuel mineral resources are not anticipated to be impacted by the LNG Terminal, as no active mining operations or oil and gas wells are located within 0.25 mile of the LNG Terminal site. Therefore, cumulative impacts on mineral resources due to the construction and operation of the proposed LNG Terminal are not anticipated.

As described in section 4.12.1, the potential for impacts on or by the proposed LNG Terminal related to geologic hazards is low. Hurricanes and/or storm surge are the geologic hazards with the greatest potential to affect the Project. Both RG LNG and Texas LNG have designed their respective facilities to withstand predicted maximum hurricane force winds and storm surge. The non-jurisdictional facilities are not anticipated to exacerbate potential impacts associated with a hurricane or storm surge; however, aboveground components, such as the electric transmission lines could be damaged. The deepening of the BSC associated with the Brazos Island Harbor Channel Improvement Project is not anticipated to affect storm surge during hurricanes or other large storms; therefore, no cumulative impacts on geologic hazards would occur from this project (COE 2014).

Overall, cumulative impacts on geologic resources resulting from the construction and operation of LNG Terminal and other projects identified in the geographic scope would primarily consist of permanent modification to existing contours. No mineral resources would be affected by the LNG Terminal and potential effects associated with geologic hazards have been acceptably mitigated for through facility design. Therefore, we have determined that RG's LNG Terminal, along with other projects, would contribute to minor cumulative impacts on geologic resources.

Soils

Cumulative impacts on soils may occur when adjacent projects increase the area of soil disturbance, resulting in greater potential for the adverse impacts identified above, or when projects disturb the same area in succession. In the latter circumstance, soil disturbance may be prolonged and revegetation delayed, so that soils are not sufficiently stabilized, resulting in increased potential for runoff and erosion. None of the other projects identified in table 4.13.1-2 would overlap the same footprint as the proposed LNG Terminal site; however, the non-jurisdictional facilities associated with the proposed Project and the Texas LNG Project are adjacent to the LNG Terminal. Collectively, the Texas LNG and Rio Grande LNG terminal sites would encumber a contiguous disturbed area totaling about 1,375.4 acres. The Brazos Island Harbor Channel Improvement Project and the Bahia Grande Channel Restoration projects would also be adjacent to the site; however, because all activities would take place within the BSC or the Bahia Grande Channel, no impacts on soils would occur.

Soil impacts resulting from the Texas LNG Project would be similar to those described above for the proposed Project. Construction of the proposed LNG Terminal, the Texas LNG Project, and the non-jurisdictional facilities are anticipated to occur concurrently; therefore, soils would be disturbed and exposed at the same time. The majority of soil impacts associated with the 311.5-acre Texas LNG Project would be permanent. The SH-48 modifications would result in permanent impacts on soils associated with the addition of the paved auxiliary lane. Impacts on soils would also occur during construction of the water line and electric transmission line; however, these impacts are anticipated to be temporary. The Texas LNG Project is also regulated by the FERC and would implement the measures in the FERC Plan and Procedures to minimize erosion and offsite transit of soils and ensure successful stabilization of soils through revegetation. While not FERC-regulated, it is anticipated that the construction of the non-jurisdictional facilities associated with the proposed Project would also implement erosion controls in accordance with applicable permit requirements. The Rio Grande LNG Terminal, and other projects within the geographic scope for cumulative impacts on soils, would contribute to moderate, permanent impacts on soils.

Pipeline Facilities

Cumulative effects on geology and soils would be limited to the impacts of the Pipeline System combined with other projects that have been recently completed, or would be concurrently constructed, within the same footprint as the Pipeline System. The facilities associated with the Pipeline System are expected to have a temporary, but direct impact on near-surface geology and soils. The soil stabilization and revegetation requirements included in RG Developers' Plan would prevent or minimize impacts on soils, including erosion and off-site sedimentation. Projects that require considerable excavation or grading would also have temporary, direct impacts on soils, although like the proposed pipeline facilities, the duration and effect of these projects would be minimized by the implementation of erosion control and restoration measures. No active oil and gas wells are within the construction workspace for the Pipeline System, and therefore the Project will not impact the development of mineral resources in the geographic scope. Therefore, the proposed pipeline facilities, with other projects in the geographic scope, would not contribute to significant cumulative impacts on geology and soils.

Conclusion

The Rio Grande LNG Project would result in permanent modification to existing topographic contours at the LNG Terminal site; impacts from the Pipeline System would be temporary and limited to the period of construction. No mineral resources would be affected by the LNG Terminal and potential effects associated with geologic hazards have been acceptably mitigated for through facility design. Therefore, we have determined that the Rio Grande LNG Project, along with other projects, would contribute to minor cumulative impacts on geologic resources. The cumulative impacts of the Project on soils, when considered with other projects, would be temporary (during construction of buried or temporary project components) to permanent (within aboveground facility footprints), and moderate.

4.13.2.2 Water Resources

The geographic scope established for water resources was considered to be the HUC-12 subwatersheds crossed by the Rio Grande LNG Project. Any projects listed in table 4.13.1-2 involving ground disturbance within HUC-12 subwatersheds crossed by the Rio Grande LNG Project could result in cumulative impacts on water resources. This includes the Brownsville LNG terminals and associated non-jurisdictional facilities, the VCP, waterway improvement projects, and the majority of the current, proposed, and reasonably foreseeable projects identified in table 4.13.1-2.

Projects that involve dredging, modification of surface water resources, or operational vessel traffic would result in permanent, operational impacts on surface water resources and have the greatest potential to contribute to cumulative impacts with the LNG Terminal. Generally, impacts resulting from pipeline construction across waterbodies are localized and short-term. Cumulative impacts would therefore only occur if more than one project crossed the same waterbody within a similar period of time.

LNG Terminal

Groundwater

Cumulative impacts on groundwater may occur through construction activities, including clearing and grading, dewatering, contamination through fuel and other hazardous material spills, and groundwater withdrawal. As discussed in section 4.3.1.4, the majority of potential impacts on groundwater resources associated with the proposed Project would be short-term and localized, primarily associated with clearing, grading, excavating, filling, and placement of piles and foundations, with groundwater effects limited to water table elevations in the immediate vicinity of the LNG Terminal site. The majority of the other projects considered for cumulative impacts on groundwater would involve similar ground disturbing activities that could temporarily affect groundwater levels.

RG LNG would not directly withdraw groundwater during construction or operation of the Project and would instead obtain water from the Brownsville Public Utilities Board; however, water sourced from the Brownsville Public Utilities Board would include both surface water from reservoirs along the Rio Grande River and groundwater from wells located west of Brownsville. Because the Brownsville Public Utilities Board has stated that it has sufficient capacity to meet the construction and operational needs of the LNG Terminal without affecting water availability for other uses, and no new groundwater wells would be required for construction and operation of the LNG Terminal, the LNG Terminal is not expected to affect the quantity of available groundwater. Proposed groundwater use is not known for the majority of the other projects considered; therefore, a quantitative analysis of anticipated groundwater withdrawals is not feasible. However, because groundwater is not the primary source of potable water in the region, and the proposed Project would not directly withdraw groundwater, cumulative impacts on groundwater are anticipated to be minor.

Shallow groundwater areas could be vulnerable to contamination caused by inadvertent surface spills of hazardous materials (e.g. fuels, lubricants, and coolants) used during construction and operation of the LNG Terminal and other projects within the HUC-12 subwatershed. However, RG LNG would implement its Plan and Procedures, as well as its SPCC Plans, to minimize the risk of occurrence and potential impacts. As described in section 4.3.1.2, groundwater impacts resulting from construction or operation of the Project are not anticipated and, should they occur, would be localized and would not affect other groundwater users. Therefore, the Project would not contribute to significant cumulative impacts on groundwater with other projects in the geographic scope.

Surface Water and Wetlands

Surface Water

Several of the projects listed in table 4.13.1-2 could be under construction at the same time as the Rio Grande LNG Terminal, including the non-jurisdictional facilities, the Annova LNG and Texas LNG Projects, multiple pipelines, electric transmission and generation projects, transportation projects, and the Stargate Facility. Thus, there is the potential that cumulative impacts on water quality of the BSC could result if the Rio Grande LNG Terminal was constructed during the same time period as these other projects.

In-water activities, such as dredging and open-cut pipeline crossing techniques have the greatest potential to contribute to cumulative impacts on surface water resources. In addition, pile-driving, hydrostatic test water withdrawal and discharge, stormwater runoff, potential spills of hazardous materials, and increased vessel traffic within the BSC could also contribute to cumulative impacts on surface water. If dredging associated with the proposed Project were to occur concurrently with other in-water activities, especially those requiring dredging (Annova LNG Project, Texas LNG Project, and waterway improvement projects), adverse impacts on water quality associated with increased turbidity and sedimentation could be exacerbated. Pipeline projects may also impact surface water resources through increases of turbidity and sedimentation if upstream waterbodies are crossed via an open-cut crossing technique; however, these impacts are typically minor due to the short duration of in-water activities and would be unlikely to reach the BSC. Further, it is anticipated that larger waterbodies, such as the BSC would be crossed via HDD for pipeline projects including the Kingsville to Brownsville Pipeline and VCP, thereby avoiding direct impacts on the waterbody.

Concurrent dredging of the proposed Project, Annova LNG, Texas LNG, and the Brazos Island Harbor Channel Improvement Projects would result in the greatest cumulative impacts on surface water resources. All of these projects currently have similar proposed construction schedules that could overlap if all regulatory approvals and authorizations are obtained as currently foreseen by the Project proponents. Dredging associated with the proposed Project would occur over an approximately 3-year period. It is anticipated that timelines for dredging of the other LNG projects would occur over approximately 1 year. All three LNG projects are proposing to utilize hydraulic cutterhead dredges that would minimize turbidity to the extent practicable; however, if conducted concurrently, dredging of the Brazos Island Harbor Channel Improvement Project and the Brownsville LNG projects would further contribute to cumulative increases in turbidity and sedimentation within the BSC. Further, the concurrent dredging and thus concurrent placement of dredged material in confined dredged material placement areas would also result in increased effluent discharge into the BSC. Increased effluent discharge would likely result in increased turbidity and suspended solids in the vicinity of the discharge structures.

Annova LNG evaluated the potential cumulative impact on sedimentation from dredging during construction; this assessment considered the potential for contributions from the Rio Grande LNG and Texas LNG Projects, as well as other projects occurring within the BSC.[65] The majority of expected sedimentation due to construction is attributed to the LNG projects, which results in an estimated maximum sedimentation of 0.3, 0.4, and 0.2 inches for the Annova, Rio Grande, and Texas LNG Projects, respectively. The Bahia Grande Channel Restoration Project could also contribute an estimated 0.5 inch of additional sedimentation. The Brazos Island Harbor Channel Improvement Project is not expected to result in long term net sediment accumulation as the purpose of the project is to deepen the main channel. During operation, although sedimentation patterns may be impacted by the LNG projects, overall accumulation is expected to be minor. Increased accumulation during operation will be driven by any changes in hydrodynamic characteristics associated with the Brazos Island Harbor Channel Improvement Project and would be limited to 0.4 inch within the main channel of the BSC based on Annova LNG's assessment.

Similar to the Rio Grande LNG Project, each of the projects would be required to comply with water quality standards and cumulative impacts on water quality would be temporary, with turbidity and sedimentation levels returning to pre-dredging conditions following the cessation of dredging activities. Therefore, the Project, with other projects in the vicinity, would contribute to minor to moderate, but temporary, impacts on water quality within the BSC.

The Brazos Island Harbor Channel Improvement Project and the three proposed Brownsville LNG projects may use Port of Brownsville PA 5A for placement of dredged material during construction and maintenance dredging. Preliminary analysis indicates that Port of Brownsville PA 5A would not have the capacity, even if the perimeter containment levees were raised to the maximum effective/acceptable height, for all construction- and maintenance-dredged material from the three proposed LNG projects. However, alternative dredged material

---

[65] Annova LNG's assessment is available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-480 and accession number 20170731-5180.

placement areas could accommodate some or all of the material, and the final management of dredged material will be determined by the BND and COE, in consultation with other federal, state, and local resource agencies.

Concurrent construction of other projects involving clearing, grading, or other earthwork within the HUC-12 subwatershed may also increase the potential for cumulative impacts on water quality from increased stormwater runoff. Several of the projects identified in table 4.13.1-2 would require hydrostatic testing of storage tanks and/or pipelines. All project proponents would be required to adhere to state and federal regulations regarding hydrostatic, construction, and industrial stormwater and wastewater discharges. Compliance with these regulations by RG Developers and the other project proponents, and implementation of BMPs in the Project-specific Plan and Procedures, would minimize potential cumulative impacts on surface water resources from stormwater runoff and wastewater discharges.

Surface water could be subject to contamination caused by inadvertent surface spills of hazardous materials (e.g., fuels, lubricants, and coolants) used during construction and operation of the LNG Terminal and other projects within the HUC-12 subwatershed. However, RG LNG would implement its Plan and Procedures, as well as its SPCC Plan, to minimize the risk of occurrence and potential impacts. Similarly, all projects considered in the cumulative impacts analysis for surface water resources would likely use equipment and or materials that could be hazardous to the environment in the event of a spill. However, it is anticipated that these projects would prepare and implement spill prevention and response procedures to prevent spills of hazardous materials from reaching surface water resources, as well as the measures to be implemented if such a spill occurs. Therefore, overall cumulative impacts on surface water resources as a result of stormwater runoff, hydrostatic test water withdrawals and discharges, as well as spills of hazardous materials are anticipated to be minor and incidental.

Current vessel traffic in the BSC is estimated to be 1,059 vessels annually. The operation of all three proposed Brownsville LNG projects would result in an increase in the number of large, ocean-going vessels transiting the BSC (estimated to be about 512 LNG carriers per year combined; see section 4.13.2.7), which equates to a 48 percent increase in vessel traffic within the BSC. Other industrial projects located along the BSC (i.e., the Port of Brownsville projects identified in table 4.13.1-2) are also anticipated to result in increased ship traffic within the BSC, although the exact number of additional vessels is unknown.

Increased vessel traffic would result in a significant cumulative impact on surface water resources during operations from increases in turbidity and shoreline erosion. Impacts on turbidity would be limited to the duration of each vessel's transit time in the BSC, and would be greater for larger ships, such as the LNG carriers. It is anticipated that the water quality could return to baseline conditions once each LNG carrier docks or leaves the BSC. Shoreline erosion would primarily occur while the LNG carriers, or other large vessels requiring the assistance of tug boats, are maneuvering at each of the LNG terminals or other project docks. Each of the three LNG projects has designed its respective facilities to minimize shoreline erosion through placement of rock rip-rap along the shoreline, or similar measures. It is anticipated that other projects along the BSC would implement similar measures to protect the shoreline. Each project would also be responsible for maintaining shoreline protection to prevent future erosion. Further, the use of waterways by LNG carriers, barges, and support vessels during construction and operation of the LNG Terminal would be consistent with the planned purpose and use of the BSC, an active shipping channel. However, given the substantial increase in large vessel traffic within the BSC related to the three Brownsville LNG projects, and other projects, it is expected that cumulative impacts on surface water resources associated with shoreline erosion and turbidity from increased vessel traffic would be significant and relatively persistent throughout the life of the projects, particularly along unarmored portions of the BSC.

Increased vessel traffic would also result in increased cooling and ballast water exchanges. Cooling water exchanges would result in minor changes in water temperature at the point of discharge, but these impacts are not anticipated to extend beyond the immediate vicinity of the vessel, with temperatures quickly returning to ambient temperatures. Therefore, cumulative impacts as a result of cooling water are anticipated to be minor. The Coast Guard requires that all vessels carry out an open-ocean ballast water exchange prior to calling at U.S. ports. Ballast water can affect water quality by discharging water that differs in the physiochemical properties of the ambient water, including pH, salinity, and temperature. Based on the anticipated volumes and frequency of ballast water discharge that would occur as a result of the proposed Project, any changes in the physiochemical properties of water within the BSC would be localized and negligible. Similarly, it is anticipated that ballast water and cooling water impacts associated with LNG carriers calling on the Annova LNG and Texas LNG terminals would also be localized and minor. As the discharges of these vessels for each project are generally not anticipated to comingle, cumulative impacts on water quality as a result of the ballast and cooling water exchanges associated with the Project and other projects in the vicinity are anticipated to be minor.

Wetlands

Wetlands that would be affected by the Rio Grande LNG Terminal include 182.4 acres of estuarine emergent marsh, estuarine scrub-shrub (mangrove) marsh, and estuarine unconsolidated shore wetlands. In addition, about 233.8 acres of land, including 103.5 acres of wetlands and mudflats, are present outside the boundary of the Rio Grande LNG Terminal site. Of that area, about 10.5 acres would be dredged for a planned expansion of the Bahia Grande Channel for wetland restoration that is not related to the Rio Grande LNG Project, as discussed in section 4.3.2.2. The remaining areas would not be directly affected by Project construction, but would be retained as natural buffer.

Construction of the potable water, sewer, and power linear non-jurisdictional facilities associated with the Rio Grande LNG Project would impact about 54 additional acres of wetlands. The widening of SH-48 would also likely impact wetlands.

Any of the other projects within the HUC-12 subwatershed that impact wetlands, including the other two LNG projects and associated non-jurisdictional facilities, would contribute incrementally and cumulatively when added to the impacts from the Rio Grande LNG Terminal. In its filing with FERC, the Annova LNG Project indicated that about 57.7 acres of wetlands would be permanently converted to uplands for its terminal. Similarly, the Texas LNG Project would affect about 45.2 acres of wetlands. Other applicable projects with available wetland data include the SpaceX Commercial Spaceport (16 acres affected), Cross Valley Pipeline Project (24 acres affected), and the GEOTRAC Industrial Hub Phases I and II (62 acres and 19 acres affected, respectively.) In addition, the Kingsville to Brownsville and VCP gas pipelines would impact wetlands, although the acreage within the geographic scope is not known. The COE issues permits under Section 404 of the CWA for construction in jurisdictional Waters of the United States, including wetlands, and requires mitigation or compensation to ensure there is no net loss of wetlands or wetland functions. All projects and activities would be required to comply with the CWA by avoiding, minimizing, or mitigating wetland impacts.

Development of the Bahia Grande Channel Restoration Project would expand the Bahia Grande Channel, increasing tidal exchange and improving estuary function, resulting in positive cumulative impacts on estuarine wetlands within the HUC-12 subwatershed. In addition, projects such as the Bahia Grande Coastal Corridor Project are focused on maintenance or enhancement of the natural environment; as such, these projects may result in positive effects on wetland resources in the Project area.

The total known wetland impacts associated with the other projects, as identified above, is 564.9 acres. The Rio Bravo Pipeline, discussed in detail below, would affect about 79 acres of wetlands in the HUC-12 subwatershed. The HUC-12 subwatershed has a total area of 234,353 acres of land. Based on NWI data developed by the FWS, approximately 65,495 acres of wetlands are present within the Bahia Grande-BSC HUC-12 subwatershed; therefore, it is anticipated that less than 1 percent of the wetlands within the subwatershed would be affected by construction of the projects considered in our cumulative impacts analysis. In addition, while RG LNG would avoid impacts on wetlands within onsite buffer areas as described above, the buffer area on the eastern side of the LNG Terminal site would be between the Rio Grande LNG Terminal and the proposed Texas LNG Project, thereby reducing the contiguous wetland area. Additionally, while direct impacts on the wetlands between the Texas LNG and Rio Grande LNG Projects would not occur, the proximity of the two projects would result in fragmentation of the wetland habitat along the northern bank of the BSC. In addition, some of these wetlands could be disturbed during construction of the VCP. Wetland hydrology and the quality of wildlife habitat provided by these areas could become degraded.

Wetlands provide important ecosystem functions due to their ability to retain water, minimizing flooding and improving water quality by filtering contaminants before reaching surface waterbodies. Therefore, conversion of wetlands to uplands or developed land can affect water quality, as well as flooding, within a subwatershed. Wetlands also provide valuable wildlife habitat. Several of the projects identified in table 4.13.1-2 are not anticipated to result in significant permanent impacts on wetlands. For example, the majority of pipeline and electric transmission projects would only temporarily impact wetlands during construction. These types of projects may result in a permanent conversion of cover type within wetlands such as forested or scrub shrub to herbaceous; however, following completion of construction, areas affected by these types of projects typically maintain their functionality as a wetland. In addition, all projects and activities would be required to comply with the CWA by avoiding, minimizing, or mitigating wetland impacts. Therefore, while the proposed LNG Terminal would contribute to cumulative impacts on wetlands, along with other projects in the area, this impact would not be significant.

Pipeline Facilities

Groundwater

Of the projects identified above, the proposed pipeline facilities, the intrastate pipeline for the Texas LNG Project, the Kingsville to Brownsville Pipeline, and the SH-100 Wildlife Crossing Project have yet to be constructed. The VCP is currently under construction. These projects would be expected to implement similar mitigation measures on land where construction of aboveground facilities occur; however, areas that are permanently converted from vegetated land to industrial uses with impervious cover would result in a localized reduction in groundwater infiltration. This relatively small amount of new impervious surface is not expected to affect overall groundwater recharge rates in the area. Further, all major projects (such as the other FERC projects and wells and gathering lines) would be required to obtain water use and discharge permits and would implement their various SPCC Plans as mandated by federal and state agencies. Projects that require large amounts of excavation or grading could also have temporary impacts on groundwater quality and infiltration rates, although like the proposed pipeline facilities, the duration and effect of these projects would be minimized by the implementation of erosion control and restoration measures. For these reasons, we anticipate that the proposed pipeline facilities in conjunction with other projects within the geographic scope would only contribute to minor and temporary cumulative impacts on groundwater.

Surface Water and Wetlands

The proposed pipeline facilities would contribute little to the long-term cumulative impacts on wetlands and waterbodies because the majority of the potential impacts would be temporary and short-term. The Stella Wind Farm Project and non-jurisdictional facilities would likely follow BMPs similar to those proposed by RB Pipeline so as to minimize impacts on waterbodies and avoid or minimize impacts on wetlands in accordance with Section 404 of the CWA. Other FERC-regulated projects would be required to adhere to our Procedures, with approved deviations, which minimize impacts on waterbodies and wetlands. In addition, all projects affecting wetlands and waterbodies would be subject to the permitting and mitigation requirements of the COE. Therefore, most of the impacts on wetlands would be of short duration. Consequently, the cumulative effect on wetland and waterbody resources from the proposed Rio Bravo Pipeline in combination with other projects would be temporary and minor.

Conclusion

Groundwater

In summary, the Rio Grande LNG Project would result in temporary, minor impacts on groundwater during construction. Impacts would be localized and would not affect other groundwater users. Other projects in the geographic scope built at the same time as the proposed Project could contribute to minor cumulative impacts on groundwater recharge and quality with the Project. However, because groundwater is not the primary source of potable water in the region and the proposed Project would not directly withdraw groundwater, the cumulative impacts of the Project and other projects in the geographic scope on groundwater use would be minor. Where aboveground facilities are proposed, the relatively small amount of new impervious surface is not expected to affect overall groundwater recharge rates in the geographic scope. Overall, the cumulative impacts on groundwater of the Project when considered with other projects would be minor given the area of the HUC-12 subwatersheds within the geographic scope.

Surface Water and Wetlands

The Rio Grande LNG Project would result in temporary, short-term, and permanent impacts on existing surface water quality and temporary and permanent impacts on wetlands. For other projects in the geographic scope built at the same time as the proposed Project, cumulative impacts on surface water and wetlands would be additive. However, certain projects such as the Bahia Grande Channel Restoration and Bahia Grande Coastal Corridor Project are focused on maintenance or enhancement of the natural environment; as such these projects may result in positive effects on surface water and wetland resources in the geographic scope. Overall, the cumulative impacts on surface waters and wetlands of the Project when considered with other projects would be temporary (during construction of the buried or temporary project components) to permanent (within aboveground facility footprints), and minor given the area of the HUC-12. Temporary, moderate to significant impacts on surface water quality specifically within the BSC could occur during concurrent dredging for the Brownsville LNG terminals due to increases in turbidity and sedimentation, and from the potential erosion of shorelines along unarmored portions of the BSC due to the increase in large LNG carriers persistently transiting the BSC. However, the Rio Grande LNG Project and other projects would be required to comply with the CWA to minimize impacts on surface water quality and to avoid, minimize, or mitigate wetland impacts.

4.13.2.3 Vegetation and Wildlife

The geographic scope for vegetation and wildlife was determined to be the HUC-12 subwatershed affected by the Rio Grande LNG Project. The projects listed in table 4.13.1-2 would disturb thousands of acres of habitat. As identified in table 4.13.1-2, projects with the potential to contribute to cumulative impacts on vegetation and wildlife with the proposed Rio Grande LNG Project include the Brownsville LNG facilities and associated non-jurisdictional facilities, VCP, Kingsville to Brownsville Pipeline, intrastate pipeline for the Texas LNG Project, Cross Valley Project, five transportation projects, four Port of Brownsville projects, SpaceX Commercial Spaceport Project, Stargate Facility, Palo Alto Battlefield Cultural Landscape Restoration, electric transmission and generation projects (including the San Roman, Cameron, Bruenning Breeze, and Stella Wind Farms), SH-100 Wildlife Crossing Project, Bahia Grande Channel Restoration Project, and the Bahia Grande Coastal Corridor Project.

Projects with permanent aboveground facilities (such as the Brownsville LNG terminals), wind energy projects, and roads would have greater impacts on vegetation and wildlife habitat than buried utilities, which allow for restoration of vegetation following construction. Therefore, with the exception of aboveground facilities and the permanent right-of-way, pipeline projects typically only have temporary impacts on vegetation and wildlife. The majority of long-term or permanent impacts are associated with vegetation clearing and maintenance of the pipeline right-of-way.

LNG Terminal

Vegetation

As described in section 4.5.2, a total of 562.9 acres of vegetation would be cleared during construction of the Rio Grande LNG Terminal, most of which would be converted to developed land. Offsite facilities associated with the Rio Grande LNG Terminal would result in impacts on 28.6 acres of vegetation, which would be restored after construction is complete. Construction and operation of several of the projects listed above would also result in the permanent conversion of vegetated habitats to industrial land. Other projects, such as pipeline or transmission line projects would result in temporary impacts on vegetation during construction and could result in the conversion of wetlands or shrubland to upland or herbaceous vegetation; however, permanent conversion of vegetation to developed land associated with these types of projects is typically limited to associated aboveground facilities. Based on publicly available information, we know or can estimate the amount of vegetation that would be disturbed by all of the projects listed above, with the exception of the transportation projects, and three of the five Port of Brownsville Projects, as indicated in table 4.13.2-1.

Several linear projects included in the cumulative impacts analysis extend outside of the HUC-12 subwatershed, including the VCP, Kingsville to Brownsville Pipeline, Rio Bravo Pipeline, Cross Valley Project, and South Padre Island Second Access Project. While information is available for the total impacts associated with each project, data are not presented for impacts within individual HUC-12 subwatersheds (with the exception of the Rio Bravo Pipeline). Therefore, we calculated the percent of the project impacts in the HUC-12 subwatershed based on the length of each project within the subwatershed. We then applied this percentage to the total project impacts to estimate the acres of vegetation that would be impacted by each project in the HUC-12 subwatershed.

Overall, an estimated total of approximately 5,725 acres of vegetation would be impacted by the projects identified above within the HUC-12 subwatershed (Bahia Grande-BSC), including the Rio Grande LNG Project components. This accounts for approximately 2 percent of the total subwatershed area (234,353 acres). Certain projects such as the South Padre Island Beach Re-nourishment, the Palo Alto Battlefield Cultural Landscape Restoration, and the Bahia Grande Coastal Corridor Project are focused on maintenance or enhancement of the natural environment; as such, these projects may result in positive effects on vegetation in the geographic scope.

Vegetation plays an important role in an ecosystem, providing wildlife habitat, stabilizing soils, assisting in drainage, and providing filtration of stormwater within the subwatershed. Removal of vegetation can lead to loss or degradation of wildlife habitat, increased stormwater runoff, decreased water quality, increased erosion, and increased flooding. In addition, the proposed Project, Annova LNG Project, and Texas LNG Project would all impact rare or unique plant communities, including those associated with the loma landforms.

While sufficient information is unavailable to accurately quantify the extent that all projects considered for cumulative impacts on vegetation would impact rare plant communities, it can be reasonably assumed that at least some of the projects, in addition to the FERC-regulated projects for which information is available, would impact these resources. Impacts would be permanent within the operational workspaces of the LNG terminals and other aboveground facilities

All projects potentially contributing to cumulative impacts on vegetation would be required to adhere to applicable federal, state, and local regulations regarding water quality, erosion control, and construction within floodplains. In addition, the majority of the projects considered for cumulative impacts on vegetation are within the eastern portion of the HUC-12 subwatershed (see figure 4.13.1-1), where coastal processes have a greater impact on the vegetation communities, as well as the soil characteristics and revegetation potential. Due to dry conditions and saline soils characteristic of the region (see section 4.2.1) revegetation is anticipated to be difficult for the proposed Project, as well as the majority of other projects considered. However, linear utilities may be required to meet restoration requirements per agency consultations. As discussed above, several of the projects considered for cumulative impacts on vegetation consist of large industrial developments that would result in the permanent loss of vegetation.

Due to the relatively large proportion of the HUC-12 subwatershed that would be affected by the projects considered, as well as the low revegetation potential and presence of rare plant communities in the HUC-12 subwatershed, we have determined that the proposed LNG Terminal would contribute to moderate cumulative impacts on vegetation with other projects in the geographic scope.

<u>Wildlife</u>

Impacts on wildlife associated with the Rio Grande LNG Terminal include the disturbance, loss, and/or conversion of approximately 562.9 acres of terrestrial wildlife habitat within the LNG Terminal site, and an additional 28.6 acres within offsite facilities associated with the Rio Grande LNG Terminal. It is anticipated that the majority of the projects identified above that were considered for cumulative impacts on wildlife would result in similar impacts to those described for the proposed LNG Terminal. The waterway improvement projects are anticipated to directly impact aquatic wildlife, as further discussed in section 4.13.2.4; however, the impact on other wildlife is anticipated to be more indirect, likely associated with temporary increases in noise and light. As detailed in table 4.13.1-2, construction and/or operation of most of the projects identified above are anticipated to be concurrent with the proposed LNG Terminal.

Habitat (vegetation) loss and conversion associated with the projects identified above account for much of the direct impact on wildlife species. Increased development and loss of habitat within the HUC-12 subwatershed 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. Further, the projects considered are within the Central Flyway bird migration route, as described in section 4.6.1. Development, construction activities, and removal of habitat could require migrating birds to travel greater distances to locate suitable stopover habitat or stop in less suitable habitat. Depending on the additional distances traveled and/or quality of habitat found, this could result in increased energy expenditure, competition, and/or predation.

Alternatively, conservation and restoration projects, such as the Bahia Grande Coastal Corridor Project, Palo Alto Battlefield Cultural Landscape Restoration, and ongoing management and acquisition of NWRs and state preserve land, would have a positive cumulative impact on wildlife habitat. Conservation of these areas in perpetuity ensures that no future development would occur. Thus, these areas will continue to serve as suitable wildlife habitat in the area. Nevertheless, as discussed above, given the number of large-scale developments in the area, cumulative impacts on wildlife habitat (i.e., vegetation) from the Project and other projects in the geographic scope are anticipated to be moderate.

Cumulative impacts on wildlife as a result of increased noise, lighting, road traffic, and human activity, would be greatest during the concurrent construction of the proposed LNG Terminal and other projects considered; however, due to operation noise and permanent facility lighting associated with the LNG Terminal and several of the other projects that have permanent aboveground facilities, permanent cumulative impacts would also occur. While portions of the HUC-12 subwatershed are already developed and characterized by industrial activities, such as those projects closer to Brownsville, other areas, such as the northern and eastern portions of the HUC-12 subwatershed, including the proposed LNG Terminal site, are less developed (see figure 4.13.1-1). In general, projects located in areas characterized by more extensive existing development are anticipated to have less of an impact on wildlife than projects in areas where there is less development. Wildlife inhabiting developed areas typically includes human commensal species or individuals that have otherwise become acclimated to human activity.

Cumulative impacts on wildlife resulting from noise would be greatest during the concurrent construction of the projects considered, but would also occur during operation. Quantitative cumulative noise impacts are further discussed in section 4.13.2.9. While noise contributions from the proposed Project would not directly impact wildlife beyond the geographic scope for cumulative noise impacts, an overall increase in noise associated with projects located throughout the HUC-12 subwatershed could limit the available habitat not affected by noise to which disturbed wildlife can relocate. Wildlife that cannot relocate away from noise emitting sources could be adversely affected by increasing stress levels and masking auditory cues necessary to avoid predation, hunt prey, and find mates.

Construction lighting requirements likely vary among the projects considered; however, it can reasonably be assumed that several of the larger industrial projects, waterway improvement projects, and transportation projects could require nighttime construction lighting. The majority of the projects considered are not anticipated to require operational facility lighting, with the exception of the industrial developments (e.g., the proposed Project, Texas LNG Project, Annova LNG Project, and Port of Brownsville projects). Increased lighting can cause more mobile wildlife to become disoriented, such as migrating birds, and can increase predation on prey species by making them more visible to predators. Artificial lighting can also adversely affect wildlife behavior by causing individuals to avoid the area or alter sleep/activity patterns. RG LNG and the other FERC-regulated projects would minimize impacts on wildlife as a result of lighting by implementing project-specific facility lighting plans that incorporate the use of shielded, down-facing lights, to the extent practicable (see section 4.6.1.2). It is anticipated that other facilities would utilize similar methods to minimize the impacts of lighting on wildlife.

Elevated structures such as storage tanks, communication towers, flares, and transmission lines would also contribute to cumulative impacts on migratory birds. RG LNG has indicated that it would minimize the likelihood of bird strikes by minimizing the amount of lighting at the terminal and by designing the Project to include ground flares. It is anticipated that other projects with elevated structures would implement similar measures to minimize impacts on migratory birds; however, bird strikes with elevated structures could still occur.

Increased road traffic associated with the projects considered would result in cumulative impacts on wildlife as a result of increased noise and wildlife-vehicle collisions. The effects of increased noise and light on wildlife are discussed above. However, wildlife in the area are currently exposed to traffic along SH-48. Further, because the traffic associated with construction and operation of the Project and other projects within the geographic scope and would be within the capacity of existing roadways, including SH-48, cumulative impacts on wildlife due to increased road traffic would not be significant.

Overall, cumulative impacts on wildlife would be greatest during the concurrent construction of the projects considered, and would continue, to a lesser extent during operation. Cumulative impacts on wildlife would occur as a result of habitat disturbance and loss and increased noise, light, and road traffic. While most projects considered are anticipated to implement BMPs to ensure restoration of temporarily impacted wildlife habitat and minimize noise and lighting, we have determined that cumulative impacts on wildlife would be moderate.

Pipeline Facilities

Vegetation and wildlife habitat in the vicinity of the proposed pipeline facilities have been affected by ongoing ranch, cattle, and agricultural practices, and construction and maintenance of existing roads, railroads, natural gas and oil pipelines and wells, utility lines, and electrical transmission line rights-of-way. In addition, several future projects could be constructed and/or operational at the same time as the Rio Bravo Pipeline, as described above and in table 4.13.1-2. Cumulative impacts on vegetation and wildlife would result if these projects were constructed concurrently.

Construction and operation of the pipeline facilities would affect a total of 2,466.0 acres of vegetation. Of this total, 1,155.5 acres would be in temporary work areas that would be allowed to revert to pre-construction condition after construction is completed. About 1,211.4 acres would be within the permanent easements for the Pipeline System, and 6.2 acres would be associated with permanent access roads. About 92.9 acres would be within the permanent aboveground facilities. Construction activities such as right-of-way and other workspace clearing and grading would result in loss of vegetation cover and soil disturbance, alteration of wildlife habitat, displacement of wildlife species from the construction zone and adjacent areas, mortality of less mobile species, and other potential indirect effects as a result of construction noise and increased human activity in the area. Overall impacts would be greatest where projects are constructed in the same timeframe and area as the proposed Project.

While the vegetation impacts of the projects discussed above and the proposed pipeline facilities would not be inconsequential, the overall impact of these projects would be considered minor in comparison to the abundance of comparable habitat in the HUC-12 subwatersheds crossed by the pipelines. FERC-jurisdictional projects, including the Annova LNG and Texas LNG Terminals, would be required to adhere to the measures in our Plan and Procedures for restoration of habitat as discussed above, where these projects fall within the geographic scope for the pipeline facilities. RB Pipeline would be required to restore vegetation in temporarily disturbed areas, and non-jurisdictional Project-related facilities would likely be held to similar standards by state permitting agencies. Wind energy projects, intrastate pipeline facilities, and non-jurisdictional Project-related facilities would also likely be required to implement mitigation measures designed to minimize the potential for long-term erosion and resource loss, increase the stability of site conditions, and revegetate disturbed areas, thereby minimizing the degree and duration of the impacts of these projects.

The aboveground facilities associated with the projects would result in some permanent impacts on wildlife habitat. The wind farms and VCP, as well as some of the transportation projects, would also have associated aboveground facilities or other permanent infrastructure associated with their projects; however, due to the limited size of these facilities relative to the geographic scope and the prevalence of similar habitats in adjacent areas, the permanent loss of this land would not be a significant impact on wildlife resources within the area of the proposed pipeline facilities. The operation of large turbines associated with the San Roman, Cameron, Bruenning Breeze, and Stella Wind Farm projects could potentially affect bird and bat species through collision-related fatalities.

Because impacts on wildlife species from construction and operation of any of the projects would be local, temporary, and minor considering the abundance of comparable habitat in the geographic scope, in conjunction with the TxDOT wildlife corridor project, which would aid in the safe movement of wildlife through the area, we have determined that impacts on wildlife species within the geographic scope for the Rio Bravo Pipeline would be short-term and would not be significant.

Conclusion

In summary, the Rio Grande LNG Project would result in temporary, short-term, and permanent impacts on vegetation and wildlife habitat. For other projects in the geographic scope built at the same time as the proposed Project, cumulative impacts on vegetation would be additive. Along the pipeline route, impacts on vegetation and wildlife habitat would be minor in comparison to the abundance of comparable habitat in the HUC-12 subwatersheds. However, due to the relatively large proportion of the Bahia Grande-BSC HUC-12 subwatershed that would be affected by the LNG Terminal and the projects considered, as well as the low revegetation potential and presence of rare plant communities in the HUC-12 subwatershed, the proposed Project would contribute to moderate cumulative impacts on vegetation with other projects in the geographic scope. However, certain projects such as the South Padre Island Beach Re-nourishment, the SH-100 Wildlife Crossing Project, the Palo Alto Battlefield Cultural Landscape Restoration, and the Bahia Grande Coastal Corridor Project are focused on maintenance or enhancement of the natural environment; as such these projects may result in positive effects on vegetation and wildlife in the geographic scope.

Overall, the cumulative impacts of the Project when considered with other projects would be temporary (during construction of the buried or temporary project components) to permanent (within aboveground facility footprints), and moderate given the relatively large proportion of the Bahia Grande-BSC HUC-12 subwatershed that would be affected by the projects considered, the low revegetation potential and presence of rare plant communities in the HUC-12 subwatershed, and increased noise, light, and road traffic.

4.13.2.4 Aquatic Resources and EFH

The geographic scope established for aquatic resources was considered to be the HUC-12 subwatersheds crossed by the Rio Grande LNG Project. Any of the projects listed in table 4.13.1-2 that would involve ground disturbance or excavation could result in cumulative impacts on water resources, which in turn could impact aquatic resources through sedimentation and turbidity, habitat alteration, stream bank erosion, fuel and chemical spills, water depletions, or impingement/entrainment due to water withdrawals or construction crossing operations. This includes the Brownsville LNG projects and associated non-jurisdictional facilities, the Kingsville to Brownville Pipeline, the intrastate pipeline for the Texas LNG Project, the VCP, the Stella Wind Farm, the Cross Valley Project, transportation projects, waterway improvement projects, Port of Brownsville Projects, the SpaceX Commercial Spaceport Project, the Stargate Facility, the Palo Alto Battlefield Cultural Landscape Restoration, the Bahia Grande Coastal Corridor Project, and the SH-100 Wildlife Crossing Project.

LNG Terminal

While all upstream projects in the HUC-12 subwatershed have the potential to contribute to incremental impacts on water quality in the BSC (as discussed in section 4.13.2.2), the potential for cumulative impacts on aquatic resources would be greatest for those projects that would be directly impacting the BSC and adjacent waterways through dredging, increased vessel traffic, pile-driving, or other in-water activities. The projects identified in table 4.13.2-1 that are anticipated to contribute the most to potential cumulative impacts on aquatic resources include the Annova LNG Project, Texas LNG Project, Port of Brownsville projects, and the waterway improvement projects, especially the Brazos Island Harbor Channel Improvement Project.

As discussed in section 4.13.2.2, the other Brownsville LNG projects, as well as the Brazos Island Harbor Channel Improvement Project, could be constructed concurrently with the proposed Project. This would result in active dredging of a large portion of the BSC for an extended duration. In addition to the increases in turbidity affecting water quality (see section 4.13.2.2), dredging would decrease dissolved oxygen levels and result in a cumulative impact on the amount of benthic habitats and species that are directly affected. This would reduce the overall prey availability for predators in the area that feed on these species. In addition, more mobile species would also have to travel further to relocate to suitable habitat where dredging is not occurring, or be forced to occupy less suitable habitat, both of which could reduce the overall fitness of the individual and affect behaviors, such as foraging and mating. Therefore, cumulative impacts on aquatic resources as result of dredging activities would be moderate, but temporary.

Similarly, concurrent dredging of the projects identified above would result in cumulative impacts on EFH. However, the proposed Project's long-term impacts on EFH may be offset by preservation of aquatic habitats and through any adopted mitigation identified in the MSFCMA consultation process. The Brazos Island Harbor Channel Improvement Project would require the deepening of the BSC through dredging of the existing channel; therefore, impacts on EFH are anticipated to be temporary, as there would be no change in the type of EFH available following completion of the project and the macroinvertebrates and worms inhabiting these areas would be expected to recolonize quickly. In addition to soft bottom and pelagic (water column) EFH, the Annova LNG and Rio Grande LNG Projects would also permanently impact mangrove, emergent marsh, and sand/shell bottom EFH. However, all of the LNG projects would be required to mitigate for the permanent impacts on aquatic habitats, including EFH, as part of the Section 404 permit process; therefore, cumulative impacts on EFH would be minor.

Cumulative impacts on aquatic resources could also result from concurrent pile-driving activities. As discussed in section 4.6.3, in-water pile-driving can increase underwater sound pressures that can result in injury or mortality to fish and other wildlife (see section 4.13.2.5 for a discussion of cumulative impacts resulting from pile-driving on marine mammals and sea turtles). RG LNG would minimize impacts on aquatic resources from pile-driving by driving most piles into land rather than open water and utilizing vibratory hammers to drive the sheet pilings at the MOF. The only other projects considered for which pile-driving is anticipated to overlap with the proposed Project are the other two Brownsville LNG projects. Both of these projects are anticipated to implement measures similar to RG LNG to minimize impacts on fish associated with pile-driving. However, concurrent in-water pile-driving could limit the available habitat for fish avoiding the increased underwater sound pressure levels and increase density within those habitats. In-water pile-driving would be limited to an estimated 29 days, minimizing the duration during which cumulative impacts would occur. Therefore, cumulative impacts on aquatic resources as a result of pile-driving are anticipated to be minor.

In addition to cumulative impacts that would occur during construction of the proposed Project, operation of the Project would also affect aquatic resources. RG LNG anticipates that 312 LNG carriers would call on the LNG Terminal annually. Increased vessel traffic would result in increased impacts on aquatic resources associated with ballast and cooling water exchanges and potential fuel spills. The Annova LNG and Texas LNG Projects are anticipated to have the greatest contribution to cumulative impacts on aquatic resources from increased vessel traffic. As discussed further in section 4.13.2.7, the three Brownsville LNG projects would result in a cumulative increase in ship traffic in the BSC during operation. Combined, the three LNG projects would result in an approximate 48 percent increase in ship traffic within the BSC during operation.

Cooling water discharges that occur while LNG carriers are maneuvering to the LNG Terminal and while they are docked at the LNG Terminal would result in increases in water temperature. As discussed in section 4.13.2.2, increases in water temperature as result of cooling water discharges are anticipated to be localized, with water temperatures quickly returning to ambient levels. Mobile species may relocate to nearby suitable habitat during cooling water discharges; if LNG carriers are calling at the other LNG terminals in the area (Annova LNG and Texas LNG), suitable habitat available for fish to relocate to would be more limited; however, given that the discharges from concurrently loading vessels are not anticipated to comingle, these impacts would be temporary and negligible.

In addition, ballast water can be a source for introduction of non-native species, as discussed in section 4.6.2.2. The cumulative increase in vessel traffic within the BSC would create greater opportunity for the introduction of non-native species in ballast water. However, all LNG carriers and other ocean-going vessels utilizing the BSC would be required to adhere to the Coast Guard regulations regarding ballast water to minimize the potential introduction of non-native species; therefore, cumulative impacts on aquatic resources from ballast water would be negligible. In slight contrast, with regards to the physiochemical composition of the water within the maneuvering basin, ballast water discharges can result in localized changes. As discussed in section 4.13.2.2, these impacts would be localized and would quickly return to ambient levels. Impacts from changes in water quality on aquatic resources would be similar to those described above for cooling water.

Pipeline Facilities

Cumulative impacts on fisheries and aquatic resources could occur if other projects are disturbing the same segment of a waterbody at the same (or similar) time as the proposed pipeline facilities, or if there are permanent or long-term impacts on the same or similar habitat types. The non-jurisdictional facilities for the Rio Grande LNG Project and the intrastate pipeline facilities for the Texas LNG Project would likely cross two perennial waterbodies, the channels to San Martin Lake and the Bahia Grande. Potential cumulative effects on aquatic resources in these waters from clearing of bank vegetation and in-water disturbance have been reduced through the collocation of these facilities with the Pipeline System. We expect that the federal and state permitting agencies for the other projects would require applicable water quality protections for construction within waterbodies.

In addition, any impacts on waterbodies, and therefore fisheries and aquatic resources, would be temporary and limited to the construction periods of the projects. As such, the Rio Bravo Pipeline would not contribute to significant cumulative impacts on aquatic resources with other projects in the geographic scope since impacts would be temporary and due to the impact avoidance and mitigation measures that would be implemented. The ensuing operation of RB Pipeline's proposed facilities would not result in any impacts on waterbodies.

Conclusion

In summary, the Rio Grande LNG Project would result in temporary and permanent impacts on aquatic resources and EFH. For other projects in the geographic scope built at the same time as the proposed Project, cumulative impacts on aquatic resources would be additive. Overall, the cumulative impacts of the Project when considered with other projects would be temporary (during construction of the buried or temporary project components) to permanent (within the LNG Terminal site), and minor given the large area of the HUC-12 subwatersheds that comprise the geographic scope and available habitat for aquatic resources. The proposed Project's long-term impacts on EFH would be offset by the final Wetland Mitigation Plan (see section 4.6.3.3) and potentially through mitigation identified in the MSFCMA consultation process. Further, the Rio Grande LNG Project and other projects would be required to comply with the CWA to minimize impacts on surface water and to avoid, minimize, or mitigate wetland impacts. Therefore, while the proposed Project would contribute to cumulative impacts on aquatic resources along with other projects in the area, this impact would not be significant.

4.13.2.5 Threatened and Endangered Species

The geographic scope for threatened and endangered species was generally determined to be the HUC-12 watershed; however, due to the diversity in life history and range of threatened and endangered species potentially affected by the Rio Grande LNG Project, cumulative impacts were independently reviewed for each species or group of species. For example, threatened or endangered bird species are more mobile with larger ranges when compared to terrestrial reptiles that may not extend beyond a relatively small area. Discussions of cumulative impacts on threatened and endangered species are grouped by taxa and are limited to only those threatened and endangered species identified in section 4.7 as potentially affected by the Rio Grande LNG Project. Species that are not anticipated to be present at the Project site, or otherwise affected by the Project, due to a lack of suitable habitat or species range, are not discussed further with regard to cumulative impacts. Of the projects listed in table 4.13.1-2, those with the greatest potential for impacts include the non-jurisdictional facilities, the Brownsville LNG projects and associated non-jurisdictional facilities, the VCP, the San Roman, Cameron, Bruenning Breeze, and Stella Wind Farms, the SH-100 Wildlife Crossing Project, the waterway improvement projects, and the SpaceX and related Stargate Facility.

LNG Terminal

<u>Marine Mammals</u>

Whales and Dolphins

Other projects considered for cumulative impacts on marine mammals are those that would conduct activities within or otherwise affect the BSC. Projects considered for impacts on marine mammals include the Texas LNG Project, Annova LNG Project, VCP, Kingsville to Brownsville Pipeline, four waterway improvement projects, and four Port of Brownsville projects.

While there are several marine mammal species with potential to occur within the BSC, only bottlenose dolphins, which are protected under the MMPA (but not under the ESA), are considered common. Marine mammals are highly mobile and would likely avoid the Project area during construction. The greatest potential for impacts on marine mammals associated with the Project would be pile-driving and increased potential for vessel strikes during construction and operation.

The Annova LNG and Texas LNG Projects are the only other projects anticipated to require pile-driving, which could be concurrent with the pile-driving activities associated with the proposed Project. It is anticipated that these projects would implement similar measures to minimize impacts on marine mammals during pile-driving. If concurrent pile-driving were to occur, marine mammals in the area may have to travel greater distances to avoid underwater sound pressure levels that exceed the NMFS' thresholds (see section 4.7.1.1). However, because in-water pile-driving associated with the proposed Project would be limited to an estimated four days, cumulative impacts on marine mammals as a result of pile-driving is anticipated to be minor.

Increased vessel traffic during construction and operation of the proposed Project and other projects considered, would result in an increased potential for vessel strikes on marine mammals. RG LNG has indicated that it would provide the NMFS' *Vessel Strike Avoidance Measures and Reporting for Mariners* (2008) to all ship captains calling on the LNG terminal and would advocate compliance with the measures identified in the guidance document to minimize the likelihood of vessel strikes. It is anticipated that vessels calling on other Port of Brownsville facilities, including the Annova LNG and Texas LNG Projects, would similarly advocate for compliance with NMFS' measures to minimize vessel strikes. In addition, the BSC is an active industrial channel that is regularly transited by vessels; therefore, it is assumed that marine mammals in the area are accustomed to their presence. Therefore, although, the three LNG projects would result in an approximate 48 percent increase in ship traffic within the BSC during operation (see section 4.13.2.7), which would increase the potential of vessel strikes, the overall cumulative impact on marine mammals (and specifically to the highly mobile dolphins present in the BSC) would be minor.

West Indian Manatee

Other projects considered for cumulative impacts on West Indian manatees are those that would conduct activities within, or otherwise affect, the BSC. Projects considered for cumulative impacts on West Indian manatee include the Texas LNG Project, Annova LNG Project, VCP, Kingsville to Brownsville Pipeline, waterway improvement projects, and Port of Brownsville Projects.

Impacts on West Indian manatee resulting from the proposed Project are most likely to occur during dredging and pile-driving activities, as well as increased vessel traffic during construction and operation. However, due to the rarity of manatee occurrence in the Brownsville area, as well as the lack of suitable foraging habitat, impacts, while possible, are not anticipated.

Impacts on West Indian manatees resulting from the other two LNG projects considered (Texas LNG and Annova LNG) would be similar to those discussed for the proposed Project. While both the VCP and the Kingsville to Brownsville Pipeline would cross the BSC, it is anticipated that these crossings would be conducted via HDD and would not result in any direct impacts on the BSC. Therefore, these pipeline projects are not anticipated to affect the West Indian manatee. In addition, the four Port of Brownsville projects considered were all recently completed and would not overlap with construction of the proposed Project. Therefore, the Port of Brownsville projects are not anticipated to contribute to cumulative impacts on West Indian manatees.

Publicly available information regarding the current anticipated schedules for the projects discussed above indicate that it is possible that construction activities associated with several of the waterway improvement projects and both of the other LNG projects would be concurrent with the proposed Project. All projects operating within the BSC are anticipated to implement mitigation measures identified by the respective applicant, the FWS (during project-specific consultations), and/or the lead agency to minimize potential impacts on manatees. Due to the rarity of the West Indian manatee in the Project area, and recommended measures that would be implemented if a manatee were to occur within the BSC, the cumulative impacts of the Project when considered with other projects would be temporary (during construction) to permanent (due to increases in local traffic) but negligible.

Marine Reptiles

Other projects considered for cumulative impacts on sea turtles are those that would conduct activities within or otherwise affect the BSC. Projects considered for impacts on sea turtles include the Texas LNG Project, Annova LNG Project, VCP, Kingsville to Brownsville Pipeline, waterway improvement projects, and Port of Brownsville Projects.

Impacts on sea turtles associated with the proposed Project are most likely to occur as a result of dredging and pile-driving activities, as well as increased vessel traffic during construction and operation. Impacts on sea turtles resulting from the other two LNG projects considered (Texas LNG and Annova LNG) would be similar to those discussed for the proposed Project, as would the measures that would be implemented to minimize impacts. While both the VCP and the Kingsville to Brownsville Pipeline would cross the BSC, it is anticipated that these crossings would be conducted via HDD and would not result in any direct impacts on the BSC. Therefore, these pipeline projects are not anticipated to affect sea turtles. In addition, the four Port of Brownsville projects considered were all recently completed and would not overlap with construction of the proposed Project. Therefore, the Port of Brownsville projects are not anticipated to contribute to cumulative impacts on sea turtles.

Based on the biological opinion issued for the Brazos Island Channel Improvement Project, dredging activities in the BSC utilizing hopper dredges routinely result in the direct mortality of sea turtles (COE 2014). While the COE would implement numerous measures to reduce sea turtle mortality, such as pre-dredging trawls to safely remove sea turtles from the area, NMFS has conducted a jeopardy analysis and issued a take permit to the COE with limits on the number of sea turtles that can be taken during dredging activities. It is anticipated that the other four waterway improvement projects, all of which require dredging activities, would have the potential to similarly impact sea turtles.

Publicly available information regarding the current anticipated schedules for the projects discussed above indicate that it is possible that construction activities associated with several of the waterway improvement projects and both of the other LNG projects would be concurrent with the proposed Project. In general, sea turtles present in the area at the start of construction activities are anticipated to relocate to nearby suitable habitat or avoid the area. However, the concurrent construction activities within the BSC could limit the habitat available to which sea turtles could relocate. For instance, a sea turtle startled into moving from one project area may relocate to another project area, and so on until suitable habitat is found. During dredging activities in which hopper dredges are used, such as the Brazos Island Harbor Channel Improvement Project, this could cause sea turtles to move into the dredging area that might otherwise have been avoided.

Similar to the impacts discussed in section 4.13.2.3 for other wildlife species, increased disturbance and searching for available habitat could result in increased stress and energy expenditure for sea turtles in the area. Further, increases in sedimentation and turbidity (see section 4.13.2.3) as well as disturbance of benthic environments that serve as habitat for certain sea turtle prey species could also result in cumulative impacts on sea turtles by reducing water quality and prey/foraging habitat availability.

Concurrent pile-driving and dredging activities could result in cumulative increases in underwater sound pressure levels, as discussed in section 4.13.2.4. The only other projects considered for which pile-driving is anticipated to potentially overlap with the proposed Project are the other two LNG projects. Both of these projects are anticipated to implement measures similar to recommended or proposed for use at the Rio Grande LNG Terminal, including limiting in water pile-driving to the minimum extent practicable, and use of biological monitors within the area of potential injury. Further, given the long construction schedules for the projects, and the limited durations of in-water pile-driving, substantial overlap in the in-water pile-driving schedules would be unlikely.

In addition to impacts on sea turtles resulting from construction activities, increased vessel traffic associated with the LNG projects and the Port of Brownsville Projects could also affect sea turtles in the area. Vessel strikes are a common cause of sea turtle mortality; however, it is anticipated that most vessels would adhere to the NMFS Southeast Region's Vessel Strike Avoidance Measures and Reporting for Mariners (2008). Further, the BSC is an active vessel transit route to the Port of Brownsville and receives over 1,000 ships per year (BND 2017). Therefore, the increase in ship traffic could increase the likelihood of vessel strikes; however, this increase is not anticipated to be significant due to implementation of NMFS' guidance.

Based on the size and proximity of the projects considered, as well as the overlapping construction schedules, a cumulative impact on sea turtles is anticipated. All projects are subject to the requirements of the ESA and are thus required to consult with NMFS regarding potential impacts on sea turtles in marine habitats. Through this consultation process, the projects considered would be required to implement BMPs and/or other measures recommended or required by NMFS to minimize potential impacts on sea turtles.

In some instances, such as the Brazos Island Harbor Channel Improvement Project, take of sea turtles may still be likely and NMFS would issue a take permit. In other cases, such as the proposed Project, implementation of mitigation measures may result in a determination that the project is not likely to adversely affect sea turtles. Individually, the projects considered are not anticipated to have significant impacts on sea turtles; however, the density and nature of activities potentially occurring within the area would result in moderate cumulative impacts on resident sea turtles. However, these impacts are not anticipated to have population-level or significant effects.

<u>Birds</u>

Five bird species of concern have the potential to occur in the vicinity of the LNG Terminal. As discussed in section 4.7.1, we have determined that the Project would be unlikely to cause a trend towards federal listing for the red-crowned parrot (candidate for listing) due to the lack of nesting habitat at the LNG Terminal site. We have also determined that the LNG Terminal is unlikely to adversely affect the endangered whooping crane due to its transient nature in the area. Three federally listed birds with higher potential to use the LNG Terminal site are discussed further below.

Northern Aplomado Falcon

The geographic scope for cumulative impacts on the northern aplomado falcon was considered to be terrestrial projects located within the HUC-12 subwatershed affected by the proposed Project. Projects considered for impacts on the northern aplomado falcon include the Brownsville LNG projects and associated non-jursidctional facilities; VCP; Kingsville to Brownsville Pipeline; San Roman Wind Farm; Cross Valley Project; five transportation projects; four Port of Brownsville projects; SpaceX Commercial Spaceport Project; Stargate Facility; Palo Alto Battlefield Cultural Landscape Restoration; and Bahia Grande Coastal Corridor Project.

The proposed Project site provides suitable foraging habitat for the northern aplomado falcon, and adjacent areas may be used for nesting. As discussed in section 4.7.1.3, RG LNG would implement mitigation measures recommended by the FWS to avoid impacts on active nesting adjacent to the LNG Terminal site, and we have recommended that RG Developers provide preliminary plans to support falcon recovery. However, because active nesting occurs in the vicinity of the LNG Terminal and potential foraging habitat would be lost, we have determined that the proposed Project is likely to adversely affect the northern aplomado falcon. Consultations under Section 7 of the ESA have not been completed (see our recommendation in section 4.7.3).

For the majority of the other projects considered, impacts on northern aplomado falcons are not known; however, suitable habitat is also present on the Annova LNG and Texas LNG sites and would likely be crossed by the linear transmission and pipeline projects in the area. The Port of Brownsville projects are primarily located in an already industrialized area that likely does not provide suitable habitat for northern aplomado falcons. The San Ramon wind farm, LNG projects, and overhead transmission line projects include elevated structures and wires that could result in bird strikes. These impacts would be similar to those discussed in section 4.13.2.3 for migratory birds. Impacts on habitat associated with the pipeline and transmission lines are anticipated to be temporary with construction areas restored following the completion of activities.

Permanent aboveground facilities such as the LNG terminals would result in the removal of suitable foraging and nesting habitat for aplomado falcons. These cumulative impacts on habitat could prevent establishment of nesting pairs and would limit available habitat within the area; therefore, cumulative impacts on northern aplomado falcons are anticipated to be moderate. However, with implementation of the aplomado falcon BMPs, which identify mitigating actions for aplomado falcon recovery, the loss of foraging habitat at the LNG Terminal site would be minimized and, with implementation of any additional mitigation required by the FWS during Section 7 consultation, the Rio Grande LNG Project’s contribution to the cumulative impact would likely be minimal. We have recommended in section 4.7.1.3 that RG Developers provide their preliminary plans to support aplomado falcon recovery for our review.

Shorebirds

Other projects considered for cumulative impacts on threatened or endangered shorebirds (piping plover and red knot) are those that would conduct activities adjacent to the BSC. Projects considered for impacts on piping plover and red knot include the Texas LNG Project, Annova LNG Project, VCP, Kingsville to Brownsville Pipeline, waterway improvement projects, and Port of Brownsville Projects.

Suitable wintering habitat is present within the Project site for both species, and designated critical habitat for the piping plover is present directly across from the proposed LNG Terminal site. We have determined that the proposed Project is not likely to adversely affect the red knot, as discussed in section 4.7.1.3. However, given the noise created by the proposed Project and the proximity of the piping plover critical habitat, we have determined that the proposed Project is likely to adversely affect the piping plover and its critical habitat. Consultations under Section 7 of the ESA have not been completed (see our recommendation in section 4.7.3).

The other industrial development projects considered, including the LNG projects and Port of Brownsville projects, are anticipated to result in similar impacts on the piping plover and red knot. The proposed Project, other LNG projects, and some of the Port of Brownsville projects would result in the permanent conversion of the existing shoreline habitat to industrial land (about 5 linear miles); however, the dredging of the Texas LNG marine berth would likely restore tidal flats north of the Project site, potentially creating habitat for shorebirds. Texas LNG has also indicated that it would implement measures recommended by the FWS to minimize potential impacts on the piping plover and red knot by conducting preconstruction surveys. Further, based on consultations with the FWS, PA 5A may serve as habitat for the piping plover and red knot; however, PA 5A no longer contains the primary constituent elements for wintering piping plover critical habitat because the dredged material has raised the ground level and effectively cut off water flow that is required for a tidal flat.

Although the projects considered would result in a cumulative impact on the piping plover and red knot, there is abundant wintering habitat present throughout the southern Texas coast, including within the Laguna Atascosa NWR, Lower Rio Grande Valley NWR, and the Loma Ecological Preserve that would not be directly affected by the any of the projects considered. Further, critical habitat for wintering plovers is available throughout the southern Texas coast, including 5 units totaling 71,474 acres (TX-1, 2, 3A, 3B, and 4) that include coastal areas of Cameron County (74 Federal Register 23476, 66 Federal Register 36038). Therefore, cumulative impacts on piping plovers and red knots are not anticipated to be significant.

Although there is a large amount of critical habitat in the geographic scope that would not be directly affected by the projects, there is the potential that unmitigated noise impacts could reduce the suitability and/or conservation value of portions of the critical habitat (whether overlapping or contiguous to the area impacted by the proposed Project) in the vicinity, resulting in cumulative and adverse impacts on piping plover critical habitat. Although we have determined that the Rio Grande LNG Project would be likely to adversely affect piping plover critical habitat (and the piping plover itself), we expect that any impact on the adjacent critical habitat related to increases in ambient noise would be appropriately mitigated during Section 7 consultation, such that no permanent adverse modification of the critical habitat would occur; consequently, the proposed Project's incremental contribution to indirect impacts on critical habitat would be minimal.

Ocelot and Jaguarundi

The geographic scope for cumulative impacts on the ocelot and jaguarundi was considered to be terrestrial projects located within the HUC-12 subwatershed affected by the proposed LNG Terminal. As described above for the northern aplomado falcon, these include a majority of those projects identified in table 4.13.1-2.

Thorn scrub habitat associated with the lomas on the Project site provide suitable habitat for ocelot and jaguarundi, as discussed in section 4.7.1.4, and occupied habitat is known to be present in the adjacent Laguna Atascosa NWR. While suitable habitat is present on the Project site and is within the known range of ocelots and jaguarundi, the Project site likely serves only as stopover or temporary habitat for transient individuals rather than a breeding pair due to its size and lack of connectivity with larger more contiguous tracts, such as those present within the Laguna Atascosa NWR. If an ocelot or jaguarundi is present on the site at the start of construction activities it would be flushed from the property during pre-construction surveys and hazing, and would likely relocate to suitable adjacent habitat.

Given the lack of confirmed jaguarundi sightings in recent decades, we have determined that the Project is not likely to adversely affect the jaguarundi. However, we have determined that the loss of any suitable ocelot habitat, which are regularly sighted in the Project area, and potential indirect impacts on habitat within the lower Laguna Atascosa NWR (see section 4.7.1.4), could have potentially significant impacts on ocelots; and, in accordance with our Section 7 evaluation, we have determined that the proposed Project is likely to adversely affect the ocelot. Consultation under Section 7 of the ESA has not been completed (see our recommendation in section 4.7.3).

As discussed in greater detail in section 4.7.1.4, the primary threat to ocelot and jaguarundi populations in the United States is habitat loss, degradation, and fragmentation (FWS 2010b). Due to the large home ranges of ocelots and importance of corridor habitat to connect to Mexican populations, even incremental habitat loss could be significant. Also, the population size in Texas and growing isolation from loss of habitat connectivity with ocelot and jaguarundi populations in Mexico are contributing to a growing threat of genetic inbreeding in the Texas ocelot and jaguarundi populations. Moreover, the construction of roads through ocelot and jaguarundi habitat has resulted in high rates of road mortality, further inhibiting population growth and connectivity with adjacent populations (FWS 2010a). These are important factors to consider when addressing potential cumulative impacts on these species.

Not all of the projects listed above are anticipated to impact ocelot and jaguarundi habitat. This includes the wind farms, which are located in primarily agricultural and open land, and the four Port of Brownsville projects, which are located within densely developed, previously disturbed areas. In addition, several projects would result in beneficial impacts on ocelots and jaguarundis including the Bahia Grande Coastal Corridor Project, the purpose of which is to further conserve land, and the SH-100 Wildlife Crossing Project, which are intended to minimize impacts from road traffic. The other two LNG projects, as well as the pipeline projects proposed that cross eastern Cameron County (Cross Valley, VCP, and Kingsville to Brownsville), are anticipated to have the greatest impacts on ocelot habitat through removal and conversion to industrial uses and fragmentation. In addition, these projects along with several of the transportation projects could result in increased road traffic and/or additional roads for transiting ocelots and jaguarundis to cross. Direct mortality as a result of the projects considered in this cumulative impacts analysis for ocelots and jaguarundi are unlikely due to the mobility of the species; however, long-term impacts resulting from habitat loss and the potential for subsequent reduced genetic diversity from inbreeding could occur.

As discussed above, the past and continued development in and around Brownsville and across the border in Mexico has decreased the available corridor habitat necessary to connect ocelot and jaguarundi populations in Mexico and the United States. While relatively small barriers such as the BSC and SH-48 do not create a major impediment to individual movements, ocelots and jaguarundi require contiguous dense thorn scrub for cover over longer distances (TPWD 2017a, 2017b). In addition, ocelots and jaguarundis are elusive species with relatively large home ranges and low population densities that tend to avoid human development and activity (FWS 2010a). The current remaining habitat corridor in the region to connect U.S. and Mexico populations is located close to and within the proposed Texas LNG Terminal and proposed Rio Grande LNG Terminal sites north of the BSC and within the proposed Annova LNG Terminal site south of the BSC. A designated wildlife corridor easement, granted by the BND to the FWS for a 19-year term in 2004, is about 0.7 mile to the west of the proposed Rio Grande LNG Terminal site boundary (see figure 4.6.1-1). Annova LNG has been working closely with the FWS to configure its project to reduce potential impacts on ocelots and jaguarundis to the maximum extent practicable. This includes maintaining an approximately 1,500-foot-wide corridor to the west of the Annova LNG Terminal site, directly across from the existing wildlife corridor on the north side of the BSC.

While a travel corridor would be maintained to allow ocelots and jaguarundis to move between Mexico and the United States, the addition of three large industrial facilities in proximity to that corridor (i.e., Annova LNG, Rio Grande LNG, and Texas LNG), would create additional noise, light, and traffic, all of which could deter ocelots or jaguarundis from utilizing the corridor. However, in an effort to minimize impacts as a result of increased light pollution on all wildlife, including ocelots and jaguarundis, all three LNG projects have indicated that they would utilize down-facing lights. Other impacts, such as those associated with noise, would be minimized by the projects to the extent practicable; however, due to the proximity of the Annova LNG and Rio Grande LNG Projects to the wildlife corridors, facility-generated noise during construction and operation would result in minor increases in sound levels at the wildlife corridor. As depicted in figure 4.13.2-2, cumulative sound levels from operation of all three projects are estimated to be about 55 dBA L_{dn} at the wildlife corridor, which would result in less than a 1 dB increase over the ambient level of 68.9 dBA L_{dn} measured by RG Developers.

In addition, increased road traffic along SH-48 associated with the Annova LNG Project, Kingsville to Brownsville Pipeline, VCP, SpaceX Commercial Spaceport Project, and the Stargate Facility, as well as increased traffic along SH-48 associated with the proposed Project, Texas LNG Project, Kingsville to Brownsville Pipeline, VCP, and the Port of Brownsville projects could result in increased potential for vehicle strikes on ocelots and jaguarundis.

As described above, there is potential for the continued reduction of suitable ocelot and jaguarundi habitat to a single, narrow corridor among industrial facilities. This loss, degradation, and fragmentation of habitat have been cited by the FWS in its 2010 Recovery Plan, as the primary threat to U.S. ocelot and jaguarundi populations. The further narrowing of this corridor could result in decreased dispersal of individuals between U.S. and Mexico populations, resulting in decreased genetic diversity (inbreeding). Further, the projects assessed for cumulative impacts on ocelots and jaguarundis would increase road traffic, particularly during periods of concurrent construction (see table 4.13.1-2), which is the primary cause of direct mortality on U.S. ocelot and jaguarundi populations (TPWD 2017a, 2017b). Due to the past, present, and proposed future development throughout the geographic scope for assessing cumulative impacts on ocelots and jaguarundis, as well as the associated increases in road traffic, light, and noise, we have determined that cumulative impacts on ocelots and jaguarundis would be significant.

Pipeline Facilities

With the exception of the marine species (sea turtles and marine mammals), the species discussed in section 4.7 of this EIS could potentially be affected by construction and operation of other projects occurring within the same area as the proposed pipeline facilities. Impacts from the proposed pipelines in the Bahia Grande-BSC HUC-12 subwatershed are discussed above, where they fall within the geographic scope for the proposed LNG Terminal. Three projects, the Stella Wind Farm, the Kingsville to Brownsville Pipeline, and the VCP, have been identified within the geographic scope for the pipelines north of the Bahia Grande-BSC HUC-12 subwatershed boundary. The Rio Bravo Pipeline and all other projects within the geographic scope are required to consult with the appropriate federal, state, and local agencies to evaluate the types of species that may be found in the area of the projects; identify potential impacts from construction and operation of the projects to any species identified; and implement measures to avoid, minimize, or mitigate impacts on special status species and their habitat. Based on projected impacts and proposed mitigation measures, construction and operation of the proposed pipelines would not be likely to adversely affect federally listed species and would be unlikely to result in a trend towards federal listing for state listed species.

All federal projects are required by law to coordinate with the FWS, which will take into account regional activity and changing baseline conditions in determining the extent of impacts on a federally listed or proposed species. The VCP follows the same general path of the proposed pipelines and is immediately adjacent to the proposed route for about 34.4 miles. The FWS completed consultation for the VCP on June 19, 2017 (FWS 2017). The concurrence letter indicates that, with the additional mitigation recommended by the FWS, the VCP would have an insignificant and discountable impact on the jaguarundi, ocelot, northern aplomado falcon, piping plover, red knot, black lace cactus, slender rush pea, south Texas ambrosia, and Texas ayenia. Similar project-specific information is not yet available for the Kingsville to Brownsville Pipeline.

Non-federal projects, such as the Stella Wind Farm, are also required to adhere to the ESA, although the FWS has a different mechanism for evaluation and minimizing impacts. Consequently, we conclude that past and present projects in combination with the proposed pipeline facilities would have minor cumulative effects to special status species.

Conclusion

Given the extent of habitat modification associated with the proposed Project, and other projects in the geographic scope that would be built at the same time as the proposed Rio Grande LNG Project, moderate to significant cumulative impacts would likely occur for certain species, including:

- significant cumulative impacts would likely occur for the ocelot and jaguarundi, given the loss and/or decrease in suitability of habitat within and adjacent to the projects, as well as for the potential increase in vehicular strikes during construction;
- moderate cumulative impacts on the northern aplomado falcon due to loss of foraging habitat and potential disruption of nesting in the vicinity of the projects;
- cumulatively adverse impact on critical habitat for the piping plover due to increases noise levels adjacent to the habitat; and
- moderate cumulative impacts on sea turtles due to dredging, vessel traffic, and pile-driving.

Cumulative impacts associated with the Rio Bravo Pipeline on threatened and endangered species would be minor.

4.13.2.6 Land Use, Visual Resources, and Recreation

Land Use

The geographic scope established for land use was determined to be Cameron County for the Rio Grande LNG Terminal, and land within 1 mile of the Pipeline System (see table 4.13.1-1). The total available land in Cameron County, almost 630,000 acres of land which 37 percent (over 230,000 acres) is agricultural land. The projects listed in table 4.13.1-2 would or have disturbed thousands of additional acres of land affecting a variety of land uses, including the land uses impacted by the Rio Grande LNG Terminal and Pipeline System. The non-jurisdictional facilities for the proposed Project, the Annova LNG and Texas LNG Projects and associated non-jurisdictional facilities, the VCP, the San Roman, Cameron, and Bruenning Breeze Wind Farms, the Cross Valley Project, the SH-100 Wildlife Crossing Project, all of the waterway improvement projects, as well as the oil and gas facilities would all have the potential to contribute to cumulative impacts on land use.

Projects with permanent aboveground components (e.g., buildings), wind energy projects, roads, and aboveground electrical transmission lines would generally have greater impacts on land use than the operational impacts of a pipeline, which would be buried and thus allow most land use activities to resume land following construction. Therefore, with the exception of aboveground facilities and the permanent right-of-way, pipeline projects typically only have temporary impacts on land use. The majority of long-term or permanent impacts on land use are associated with vegetation clearing and maintenance of the pipeline right-of-way.

LNG Terminal

Ongoing and recently completed projects, such as the San Roman (156 acres within a 3,289-acre area) and the Cameron Wind Farms (15,000 acres) have contributed to the on-going conversion of the land in Cameron County from predominately open farmland to industrial use. Similarly, the planned Tenaska Brownsville Generating Station would impact about 270 acres of land in Cameron County. The existing and future Transportation Projects, such as the South Padre Island Second Access and State Highway 550 connector and Toll Project, also contribute to present and future cumulative impacts on land use within Cameron County. Other past, present and future Port of Brownsville projects within Cameron County noted in table 4.13.1-2 have resulted in land use impacts that would be considered in combination with the Rio Grande LNG Terminal. The non-jurisdictional facilities associated with the Rio Grande LNG Terminal would also result in about 182 acres of land impacted in Cameron County.

Although we do not have project-specific land use information for projects not under the jurisdiction of the FERC, we can estimate the total impact of each project based on the length of each project and industry standards on the right-of-way width for a given diameter pipeline. Assuming a construction right-of-way width of 125 and 150 feet, respectively, VCP would impact about 2,545.8 acres of land and the Cross Valley Project would impact about 1,745.7 acres of land, of which about 750.6 and 866.5 acres, respectively, would be in Cameron County; land crossed is assumed to be similar in cover type to that crossed by the Rio Bravo Pipeline System. Similarly, the Kingsville to Brownsville Pipeline is anticipated to affect about 1,576 acres of land, of which an estimated 480 acres would be located within Cameron County. Given the land use information that we have for all these other projects in Cameron County, we estimate the land use acreage impacts to total over 26,000 acres, in addition to the acreage associated with the Rio Grande LNG Project.

While the LNG Terminal would be consistent with BND's long-term plan, construction and operation of this project would result in permanent changes in land use. When considered with the land use impacts of other past, present, and reasonably foreseeable future projects within Cameron County, the Rio Grande LNG Terminal, which would be a new, 750.4-acre industrial facility along the BSC, would result in a minor contribution to cumulative impacts on land use in Cameron County.

If the Annova LNG and Texas LNG Projects are permitted and constructed, these projects would convert land in Cameron County from the current land use to industrial land. While impacts on land use would be permanent, these types of projects are also consistent with BND's long-term plan for the Port of Brownsville and the BSC, which identifies the area as intended for heavy industrial use. Further, the Annova LNG and Texas LNG Projects, as FERC-jurisdictional projects, would be required to adhere to the revegetation requirements of the construction and permanent workspaces in accordance with our Plan as applicable for each project, to minimize impacts on land use.

In total, the three Brownsville LNG terminals would affect 1,950.9 acres of generally undeveloped land, including a mixture of vegetated (herbaceous or scrub-shrub) and unvegetated land, 1,444.4 acres of which would be permanently converted to developed land. Construction and operation of all three FERC-jurisdictional LNG Projects would affect about 1,951 acres of land use, and when considered with the past, present, and reasonably foreseeable future projects, we do not anticipate that the three LNG Projects would contribute significantly to the cumulative impacts on land use within Cameron County.

Pipeline Facilities

In south Texas, several future projects could be constructed and/or operated concurrent with the Pipeline System, including the Annova LNG and Texas LNG Projects, associated non-jurisdictional facilities, as well as previously constructed oil or gas wells and associated pipelines that are in service. Impacts on land use could occur if these projects are constructed around the same time as the Rio Bravo pipelines.

As described above, the Annova LNG and Texas LNG Projects, as FERC-jurisdictional projects, would be required to adhere to our Plan to minimize impacts on land use. Associated intrastate pipeline facilities for the Texas LNG Project would involve activities similar to the construction of an interstate pipelines, although land requirements for construction and operation would be considerably less given they are typically smaller diameter pipeline (30 inches in diameter) and based on its shorter length (10 miles).

Of the total impact acreage for the Rio Grande LNG Terminal and other projects in the combined geographic scope for the LNG Terminal and Pipeline System (13,283 acres[66]), the Pipeline System would impact 2,507.2 acres of land during construction. This estimate includes impacts from the proposed pipelines and other projects in Cameron County as discussed above, where they fall within the geographic scope for the proposed LNG Terminal (a total of 7,517 acres). The proposed Pipeline System would affect predominantly open and agricultural land, including ranch lands, and would be temporary as these land uses would be allowed to revert to prior uses following construction. Any impacts would be minimized or mitigated to the greatest extent practicable through the use of Project-specific construction plans (for example, RG Developers' Plan) and consultation with federal agencies, state agencies, and landowners. We anticipate that other projects in the geographic scope would be required to implement similar construction and restoration practices to minimize impacts on land use.

Conclusion

The Rio Grande LNG Project would result in temporary, short-term, and permanent impacts on existing land use. For other projects in the geographic scope built at the same time as the proposed Project, cumulative impacts on land use would be additive. However, certain projects such as the South Padre Island Beach Re-nourishment, the SH-100 Wildlife Crossing Project, the Palo Alto Battlefield Cultural Landscape Restoration, and Bahia Grande Coastal Corridor Project are focused on maintenance or enhancement of the natural environment; as such these projects may result in positive effects on land use. Overall, the cumulative impacts of the Project when considered with other projects would be temporary (during construction of the buried or temporary project components) to permanent (within aboveground facility footprints),

[66] Total based on known project sizes reported in acres in table 4.13.1-2, less the Cameron Wind Farm, for which the actual acreage of conversion within these facilities is unknown but is expected to be minimal, and the area that would be restored for the Bahia Grande Coastal Corridor Project.

and minor given the large geographic scope (Cameron County alone comprises almost 630,000 acres of land). Further, the Rio Grande LNG Project would be consistent with BND's long-term plan, which identifies the area for the proposed LNG Terminal site as intended for heavy industrial use.

Recreation and Special Interest Areas

The geographic scope established for recreation and special interest areas was determined to be Cameron County for the Rio Grande LNG Terminal, and land within 1 mile of the Pipeline System (see table 4.13.1-1). The projects listed in table 4.13.1-2 would disturb lands and waterways which could be a disruption for recreationalists resulting in diminished or lost use of recreation and special interest areas. Projects with permanent aboveground components (including the proposed Project, Annova LNG and Texas LNG Projects, VCP, wind farm projects, and the Cross Valley Project) would generally have greater impacts on recreation and special use areas than the operational impacts of a pipeline, which would be buried and thus allow most land use activities to resume land following construction. Therefore, with the exception of aboveground facilities and the permanent right-of-way, pipeline projects (including the proposed Project, the VCP, Kingsville to Brownville Pipeline, and New Intrastate Pipeline for Texas LNG) typically only have temporary impacts on these areas. The majority of long-term or permanent impacts on recreation and special interest areas are associated with vegetation clearing and maintenance of the pipeline right-of-way, and the changes in the viewshed for recreationalists from the presence of aboveground components.

LNG Terminal

Based on the information currently available, the Annova LNG and Texas LNG Projects, and their associated new intrastate pipelines and non-jurisdictional facilities, could impact the recreation and special use areas that would be in proximity to the Rio Grande LNG Terminal (including the Lower Rio Grande Valley NWR; Laguna Atascosa NWR; and the Zapata boat launch; see table 4.8.1-3). Construction of these projects at the same time and at nearby locations as the proposed Rio Grande LNG Terminal would result in short-term impacts on the recreation and special use areas, including alteration of visual aesthetics by the presence of construction personnel and vehicles, removing existing vegetation and disturbing soils; generating dust and noise, and generally interfering with or diminishing the quality of the recreational experience by affecting wildlife movements or disturbing recreationalists.

Many of these recreation and special use areas are located on large parcels with multiple access points so as the distance to construction work areas increases, impacts would generally decrease. Where recreational use would be allowed to proceed near construction activities, RG Developers would implement mitigation measures similar to those described in section 4.8.1.3, and in consultation with land managers. Finally, Cameron County offers a variety of parks and recreation areas providing amble sites that are sufficiently removed from the proposed LNG Terminal site (Cameron County Parks and Recreation 2018, TPWD 2018). For the reasons state above, we anticipate that the Rio Grande LNG Terminal, if built at the same time and affect the same areas or features as other current and foreseeable future projects, would result in a minor contribution to cumulative impacts on recreation and special-interest areas.

Pipeline Facilities

Several recreation and special interest areas are in proximity to the proposed Pipeline System, including King Ranch, the Laguna Atascosa and Lower Rio Grande Valley NWRs, four Great Texas Coastal Birding Trails, and the Zapata boat launch. Recreation and special use areas are discussed in section 4.8.1.5.

Based on the information currently available, the non-jurisdictional facilities, the new intrastate pipeline for the Texas LNG Project, and the VCP could impact the recreation and special use areas that would be crossed by the proposed pipeline facilities. Construction of these projects at the same time as, and at locations proximal to, the proposed pipeline facilities would result in temporary cumulative impacts on the recreation and special use areas due to increased noise and dust, and limited access. While the Bruenning Breeze Wind Farm and the SH-100 Wildlife Crossing Project could affect some of the same recreation and special-use areas as the proposed pipeline facilities, any impacts would be separated by time, and would not occur concurrently.

Conclusion

The Rio Grande LNG Project would result in short-term impacts on recreation areas. For other projects in the geographic scope built at the same time as the proposed Project, cumulative impacts on recreation would be additive. However, certain projects such as the South Padre Island Beach Re-nourishment, the SH-100 Wildlife Crossing, the Palo Alto Battlefield Cultural Landscape Restoration, and Bahia Grande Coastal Corridor projects are focused on maintenance or enhancement of the natural environment; as such, these projects may result in positive effects on recreation use and experiences. Overall, the cumulative impacts of the Project when considered with other projects would be temporary (during construction of the buried or temporary project components) to short-term (as disturbed lands revegetate following construction), and minor given the large inventory of recreation areas with multiple access points.

Visual Resources

The geographic scope of analysis for cumulative impacts on visual resources was considered to be areas within the viewshed of the Rio Grande LNG Terminal site and proposed pipeline facilities (see table 4.13.1-1). For the Rio Grande LNG Terminal this was determined to be the distance at which the storage tanks, which would be the tallest features at the terminal, would be visible from neighboring communities (about 12.0 miles). For the Pipeline System, the tallest feature would vary as one moved along the proposed right-of-way, but the geographic scope for visual resources would generally be within 0.25 mile.

As described above for land use, projects with permanent aboveground components, such as the LNG terminals, wind energy projects, roads, and aboveground electrical transmission lines would generally have greater impacts on visual resources than subsurface projects (e.g., pipelines). The operational impacts of a pipeline, with the exception of aboveground facilities and (in some cases) the permanent right-of-way, would only have temporary to short-term impacts on the viewshed as a vegetation cover is re-established.

LNG Terminal

The area around the LNG Terminal is flat and relatively open with scrub-shrub vegetation. As described in section 4.9.8.2, the Port of Brownsville and the BSC support the shipping of domestic and foreign products, therefore the movement of these vessels contribute to the characterization of the existing viewshed. Visual receptors in the vicinity of the LNG Terminal site include recreational and commercial users of the BSC; land-based visual receptors would include motorists on SH-48, visitors to the Laguna Atascosa and Lower Rio Grande Valley NWRs, and other nearby recreation areas as discussed above.

The most prominent visual feature at the LNG Terminal site would be the four LNG storage tanks, which would be 275 feet wide and 175 feet in height. Based on our assessment of RG LNG's visual simulations and our evaluation of other sources and maps, we determined that the Rio Grande LNG Terminal would be most visible from the Bahia Grande Channel, SH-48, and the Zapata boat launch (see section 4.8.2.1). The proposed LNG Terminal would not be clearly visible or would difficult to see from the other eight KOPs, obscured in part or whole by existing vegetation, or appear as an undiscernible feature on the horizon. Existing vegetation, however, should not be a determining factor for visibility. A wildfire, road widening, or other actions may remove the vegetation screen making the Project clearly visible. Therefore, the projects that have the greatest potential to contribute to cumulative visual impacts would be within about 4.0 miles of the LNG Terminal, these would include the proposed Projects non-jurisdictional facilities, the Annova LNG and Texas LNG Projects and associated non-jurisdictional facilities, and the waterway improvement projects.

The visual impacts associated with waterway improvement projects would be limited to short-term impacts during active dredging and construction; similarly, contributions from the proposed new interstate pipelines would be limited to the period of active construction. Therefore, these projects would not weigh into the consideration of the cumulative visual impact of the LNG Terminal and other projects. Given the LNG Terminal site's proximity to residential areas, it may be possible to see the LNG Terminal from certain vantage points in Port Isabel and Laguna Heights, in particular elevated sites such as the Port Isabel Lighthouse; however, as discussed in section 4.8.2.1, the distance to the LNG Terminal site limits its visibility and as such it would not be a prominent feature in the viewshed for these residences.

The potential for cumulative visual impacts would be greatest if, in addition to the proposed LNG Terminal, the Annova LNG and Texas LNG Projects are permitted and built concurrently. In particular, motorists on SH-48 and visitors to the nearby recreation areas where two or three LNG terminals would be visible (including the NWRs, Zapata boat launch, and on San Martin Lake) would experience a permanent change in the existing viewshed during construction and operation of the projects.

Short-term impacts during construction would include the presence of equipment and workers, the increase in construction-related traffic (on land and in the BSC), and the installation of large structures at the terminal sites. For land and water-based mobile receptors this impact would be short, lasting only the duration of time for the vehicle or vessel to pass the site. To help mitigate these impacts RG LNG would construct a levee around the LNG Terminal site that, once complete, would obstruct most construction activities.

Following construction, permanent changes to the visual character of the area would result from the operation of the terminals due to the presence of aboveground structures. RG LNG would mitigate these impacts by the use of ground flares, strategic selection of color schemes for the storage tanks, horticultural plantings, and a levee that would obstruct low-to-ground operational facilities from view. The Annova LNG Project would also implement measures to screen visual receptors, including using materials colored and treated to blend in with the surrounding landscape and reduce glare; and designing lighting to minimize contrast with the night sky. Texas LNG has not proposed any measures for visual screening of the LNG terminal during operation and therefore may result in a significant cumulative impact on visual resources. Although the Rio Grande LNG Terminal would change the existing landscape, its operation, as well as the other proposed LNG terminal projects, would be consistent with BND's long-term plan, which identifies the area as intended for heavy industrial use.

Pipeline Facilities

As previously discussed, the geographic scope for visual resources along the Pipeline System is generally a 0.5-mile radius. The proposed Project's non-jurisdictional facilities, the Texas LNG Projects and associated intrastate pipeline, the VCP, the San Roman, Cameron, and Bruenning Breeze Wind Farms, the Cross Valley Project, the SH-100 Wildlife Crossing Project, as well as oil and gas facilities have the potential to contribute to cumulative impacts on visual resources.

The visual character of the existing landscape is defined by historic and current land uses such as recreation, conservation, and development. The visual qualities of the landscape are further influenced by existing linear installations such as highways, railroads, pipelines, and electrical transmission and distribution lines, as well as wind energy facilities. Within this context, the non-jurisdictional facilities, intrastate pipelines, wind farms, and electric transmission and power projects listed in table 4.13.1-2 would all have the potential to contribute to the cumulative impact on visual resources in the geographic scope.

As described in section 4.8.2.2, the existing viewshed is characterized by large parcels of land composed predominately of open land with existing easements for oil and gas pipelines. The proposed pipeline facilities would add incrementally to this impact, but the overall contribution would be relatively minor given that the majority of the pipeline facilities would be buried. To minimize visual impacts, portions of the right-of-way would be adjacent to existing permanent rights-of-way, including the VCP, which minimizes development of new corridor. This would also help to limit the extent of changes in the viewshed.

Additionally, disturbed areas would be revegetated as appropriate. Given the rural setting composed of large tracts of land where aboveground facilities would be located, visual receptors are predominately passing motorists with limited opportunity to view these facilities. The impact of wind farm and electric transmission development activities on visual resources would vary widely depending on the location of specific facilities and access roads, but would be minimized to the extent possible through the state's review and permitting process.

The assessment of visual importance of an object or area varies greatly between individuals. In particular, some may find alternate forms of energy infrastructure (i.e., windmills) appealing for their perceived economic value while others may take a tangible approach in their evaluations, making meaningful conclusions on visual resources subjective. Visual impacts associated with operation of the pipeline facilities and other natural gas development result from maintained rights-of-way for gathering lines and other pipeline facilities, oil and gas wells, compressor stations, and meter stations. The turbines associated with the San Roman and Cameron Wind Farms are visible from residences nearby the Pipeline System in Cameron County. In Willacy County, construction of the Bruenning Breeze turbines would require the presence of large equipment to transport and install turbines and blades, and large cranes would be brought on site to complete installation of the turbines, blades, and shaft.

Although the visual impact of the wind farms and the LNG terminals may be long-term, only a minor visual impact would result due to the operation of the pipeline facilities, primarily resulting from the clearing of scrub-shrub vegetation types. Project proponents for these developments and associated non-jurisdictional project-related facilities would restore disturbed areas in accordance with state permitting agency requirements, thereby limiting permanent visual impacts on those areas where previously existing vegetation would not be allowed to reestablish within the new permanent right-of-way. The locations of any aboveground facilities for the wind farms are not known and therefore visual impacts from these projects cannot be reliably estimated at this time.

As currently proposed, the Annova LNG and Texas LNG Projects would involve construction of gas pipeline laterals. Permanent visual impacts would also occur in developed areas where permanent aboveground structures (e.g., transmission line posts) would remain. Other recently completed or proposed project aboveground facilities would, for the most part, likely be located adjacent to an existing right-of-way (e.g., transmission line), at existing paved industrial/commercial sites, in remote locations, and/or within a permanent right-of-way. Whereas these permanent visual impacts may be locally noticed, generally they would not be inconsistent with the existing visual character of the area. Therefore, the Rio Bravo Pipeline's contribution to cumulative impacts on visual resources, along with impacts from the other projects identified above, would mostly be limited to the construction phase, and would be temporary and minor. Alternatively, the presence of the wind turbines and LNG terminals would result in a permanent change in the existing viewshed for nearby visual receptors.

Conclusion

The Rio Grande LNG Project would result in temporary to permanent impacts on the viewshed. Other Projects constructed within the geographic scope Rio Grande LNG Project could contribute to cumulative impacts on the viewshed with the Project. Although construction of the pipelines would contribute to cumulative impacts on the viewshed, they would generally be temporary to short-term in nature. Given the lack of visual receptors in the vicinity of aboveground facilities associated with the Pipeline System, their contribution to cumulative visual impacts would be permanent, but minor. Following construction, the areas associated with the Pipeline System would be restored in accordance with the Project-specific Plan and Procedures. The physical facilities of the LNG Terminal and the aboveground facilities associated with the Pipeline System would result in a permanent and moderate changes in the existing viewshed for nearby visual receptors. However, as the Texas LNG terminal has the potential to result in significant visual impacts, we conclude that cumulative impacts on visual resources from the Rio Grande LNG Project, when considered with other projects, would be potentially significant.

4.13.2.7 Socioeconomics

The geographic scope for the assessment of cumulative impacts for the LNG Terminal on socioeconomic resources includes Willacy, Cameron, and Hidalgo Counties (see table 4.13.1-1). As discussed in section 4.9, while none of the Rio Grande LNG Project facilities would be in Hidalgo County, it is included in the socioeconomic analysis because it would likely experience an influx in population from non-local workers relocating to the area during Project construction.

The geographic scope for the Pipeline System includes Jim Wells, Kleberg, Kenedy, Willacy, and Cameron Counties (see table 4.13.1-1). While many of the projects listed in table 4.13.1-2 have the potential to contribute to cumulative impacts on socioeconomic resources within the geographic scope of assessment, these impacts would be greatest during concurrent construction of projects with large construction workforces, such as the Annova LNG and Texas LNG Terminals, in close proximity to the Rio Grande LNG Project.

Population and Employment

<u>LNG Terminal</u>

RG LNG initially expected construction of the LNG Terminal to begin in 2018; however, the start of construction is dependent on receipt of necessary permits. Construction would occur over a 7-year period and construction workers would be on site throughout the duration. Several of the projects listed in table 4.13.1-2 would also require construction workers during the same period as the Rio Grande LNG Terminal, most notably the Annova LNG and Texas LNG Projects. If these projects were constructed concurrently, the construction labor requirements would be highest for the first 4 years, when all three projects are under construction. Based on the average construction workforce, these projects would be expected to employ about 4,350 construction workers in total, and at peak construction the combined workforces would be about 7,737 workers.

Following construction, the three LNG terminal projects would result in the addition of 545 or more permanent jobs. In addition to this direct employment, the projects would likely result in increased indirect employment based on the purchases of goods and services. Collectively, the three LNG terminals would spend an estimated $4.9 billion on direct expenditures. These expenditures and workforce associated with construction and operation of the LNG Terminals would result in cumulative positive, short-term and permanent impacts, respectively, on the local economy.

Other projects identified in table 4.13.1-2 would likely have staggered timelines for specific labor needs, so some construction personnel working within the geographic scope may be able to support multiple projects. This would have a cumulative effect of decreasing the overall labor force required to meet the needs for all projects, however based on the size and types of these other projects, as well as the temporary nature of construction, the overall impact would likely be negligible. Finally, some of the projects identified in table 4.13.1-2 may not be permitted and/or built, which would reduce the total labor need within the geographic scope of analysis.

Pipeline Facilities

The construction periods for the pipeline facilities would likely be concurrent with several of the projects identified in table 4.13.1-2. Simultaneous construction of those projects could require a large number of workers from the local and non-local labor pools. The cumulative effect of local hires would reduce unemployment in the area; however, that reduction in unemployment could require the import of more construction workers than typically required for any single project. Other positive benefits from the new jobs and workers in the area would include increasing revenue for local business owners and generating new tax revenue in the geographic scope.

Conclusion

The Rio Grande LNG Project would substantially reduce unemployment in the Project area and potentially could result in the need to hire and train construction workers from outside the Project area to meet the needs of all projects in the geographic scope. Positive benefits from the new jobs and workers in the area would include increasing revenue for local business owners and generating new tax revenue in the geographic scope of analysis. Expenditures and the workforce required for construction of the Rio Grande LNG Project, in combination with other projects in the geographic scope, would result in temporary cumulative impacts during the construction period; operation of the LNG Terminal and other projects would result in a positive, permanent impact on the local economy.

Housing and Public Services

LNG Terminal

The influx of non-local workers associated with construction of the Rio Grande LNG Terminal would affect the availability of housing in Cameron, Willacy, and Hidalgo Counties. The cumulative impact on local housing may result in increased rental rates and housing shortages for lodging if all of the proposed and planned projects in the geographic scope of analysis are implemented according to the expected timeframes. This would benefit the local housing market, but would adversely affect those seeking housing.

The anticipated construction workforce for the Rio Grande LNG Terminal would occupy between 2.7 and 4.9 percent of the available housing in Cameron, Willacy, and Hidalgo Counties throughout the duration of construction (see section 4.9.6.1). The Annova LNG and Texas LNG Project proponents have identified Cameron County as the geographic areas from which the respective local workforces would be sourced or where individuals would likely relocate during construction. If non-local workers for all three projects found housing in Cameron County, they would occupy between 8.1 and 15.4 percent of the available units; therefore, no significant impacts on the local housing markets are expected.

The combined construction workforces for the projects identified in table 4.13.1-2 would increase the need for some public services, such as police, medical services, and schools. The need for these services would generally be spread throughout the counties that house the workforce for the Rio Grande LNG Terminal (Cameron, Willacy, and Hidalgo Counties), but there may be an increased cumulative need for medical and emergency services in Cameron County where the proposed Rio Grande LNG Terminal and associated construction workers are expected to be concentrated. RG LNG would train a portion of the construction and operation workforces as emergency responders and provide access to first-aid kits. In addition, onsite security would be provided through a third-party contractor. The other Project proponents may also mitigate the impact by providing funding for temporarily increasing the staff and equipment of the public services affected.

With construction of the three LNG terminal projects lasting several years, it is likely that some non-local construction workers would relocate to the area with their families, including school-aged children. This would increase enrollment in some schools in counties housing the workers with families; however, as increased enrollments would likely be spread throughout many school districts, the cumulative effect on schools would be long-term, but minor.

Pipeline Facilities

The influx of non-local workers would affect the availability of housing in Jim Wells, Kleberg, Kenedy, Willacy, Cameron, and Hidalgo Counties. As described in section 4.9.7, there is an adequate amount of vacant temporary housing in the geographic scope. However, with concurrent construction of larger projects identified in table 4.13.1-2, transient housing could be limited and non-local workers unable to find acceptable housing in these counties would be forced to obtain housing in neighboring counties such as Brooks and Starr Counties resulting in longer commutes.

The cumulative impact on local housing may result in increased rental rates and housing shortages for lodging if all of the proposed and planned projects are implemented according to the expected timeframes. This would benefit the local housing market, but would adversely affect those seeking housing.

As described above for the LNG Terminal, the combined construction workforces of projects would increase the need for some public services; the need for those services would generally be spread throughout the counties that house the workforce. In section 4.9.1, we estimate that the change in the local population, due to the presence of the non-local workforce for the Pipeline System, would be 0.003 percent. Given this negligible population increase, the Pipeline System’s contribution to the cumulative impact on medical and emergency services in the geographic scope during construction would likely be occasional and minor.

As discussed for the LNG Terminal, some workers may bring their families, increasing enrollment at local schools. However, given construction of the Rio Bravo Pipeline would occur over a 12-month period and be separated by an 18-month gap, it unlikely that the non-local workers would be accompanied by family members. Therefore, cumulative impacts on schools from construction of RB Pipeline’s facilities would be negligible.

Conclusion

Based on the number of available rental units and motels/hotels in Project area, it is anticipated that there would be sufficient housing available for the anticipated peak Project workforce for the Rio Grande LNG Project when cumulatively considered with the other Brownsville LNG terminal projects. While the other LNG projects may be constructed concurrently with the proposed Project, and non-local workers for these projects are expect to find housing in similar areas, and specifically Cameron County, the county has sufficient temporary housing to accommodate the influx of workers. Similarly, the increased need for public services and school enrollment to support non-local workers and their families for the Rio Grande LNG Project and other projects would be spread across the geographic scope.

Further, with the expected increase in local taxes and government revenue associated with the proposed projects, we conclude that cumulative impacts on available housing and public services during construction of the LNG Terminal would be temporary and minor. Operation of the Project would require 128 new full-time workers and would, with other projects in the vicinity, contribute to minor cumulative impacts on housing resources and public services.

Land Transportation

LNG Terminal

The greatest potential for cumulative impacts on roadway traffic is associated with construction of the Rio Grande LNG Terminal. Due to staggered construction schedules and locations of many of the projects identified in table 4.13.1-2, cumulative impacts on area traffic may be substantial at times, but are expected to be intermittent, short term, and localized. The construction and operation of the three LNG terminal projects, however, would result in a substantial increase in daily vehicle trips on area roadways, as a result of material and equipment deliveries and commuting of construction personnel to and from the LNG terminal sites.

By the end of 2022, the three LNG facilities could be operational if they receive the necessary regulatory approvals. Each of the three project proponents commissioned studies to assess potential impacts of vehicular traffic associated with their respective projects, and to develop measures to mitigate impacts on local traffic (Aldana Engineering and Traffic Design, LLC 2016). Construction traffic associated with the Annova LNG Project is expected to primarily use SH-4, and would therefore not contribute to cumulative impacts on SH-48 with the Rio Grande LNG Project. However, the Texas LNG Project site is located along SH-48 near the Rio Grande LNG Project and concurrent construction would result in a cumulative traffic increase. RG Developers' commissioned study found that the existing roadway network which would provide access to the LNG Terminal (SH-48 between SH-550 and SH-100) has sufficient capacity to accommodate the expected peak hour traffic volumes associated with construction of the Rio Grande LNG Project. However, some improvements were necessary to safely accommodate peak hour traffic flows. As such, RG LNG has agreed to several improvements associated with access to its site, as fully discussed in section 4.9.9.1. Similar improvements to SH-48 would be made for access to the Texas LNG site. RG LNG has also committed to hiring off-duty police officers to direct traffic during peak commuting hours and would provide off-site parking for construction personnel.

The Texas LNG Project site would be accessed via two driveways off SH-48. Texas LNG anticipates that its proposed southern driveway would generate approximately 300 right turn (northbound) movements during peak times, exceeding the threshold for an auxiliary lane, and is proposing roadway improvements to accommodate the additional traffic. The traffic impact assessment conducted by Texas LNG recommends that an auxiliary lane with deceleration, storage, and taper be constructed at the state highway northbound approach to the southern driveway at the project site. Further, the study states that the auxiliary lane should be continued approximately 1,100 feet north of the northern proposed driveway to provide for acceleration with storage and taper.

Operation of the Rio Grande LNG Terminal would result in an average of 300 roundtrips to the site per day associated with worker commutes and truck deliveries. The traffic impact analysis determined SH-48 would continue to provide ample capacity with this increase in traffic (Aldana Engineering and Traffic Design, LLC 2016). Operation of the Texas LNG Project, which is also accessed by SH-48, would also contribute to an increase in traffic on that roadway (65 roundtrips per day). As the capacity of the roadway is 40,000 vehicles per day, and about 12,000 (winter season) to 17,000 (summer season) vehicles are estimated to travel on this roadway every day, the roadway has sufficient capacity available to accommodate the additional traffic generated for concurrent operation of the Rio Grande LNG Terminal and Texas LNG Project.

Pipeline Facilities

Construction of the Pipeline System could result in temporary impacts on road traffic in some areas and could contribute to cumulative traffic, parking, and transit impacts if other projects are scheduled to take place at the same time and in the same area. The local road and highway system in the vicinity of the Pipeline System is readily accessible by federal highways, state highways, secondary state highways, county roads, and private roads. However, portions of the proposed Pipeline System are routed through undeveloped land and would require the use of county or private roads in these areas. RB Pipeline has stated that it would provide adequate parking for workers to ensure that parking on the shoulders of major roads is avoided and install warning signs on roadways to notify travelers of construction activities. If traffic congestion occurs during construction, RB Pipeline would consider implementing additional measures, including, but not limited to, scheduling truck deliveries between peak commuting times, re-routing truck traffic to avoid busy roadways, and implementing temporary traffic signals.

The addition of traffic associated with construction personnel commuting to and from the right-of-way could also contribute to cumulative regional traffic congestion. However, any cumulative traffic impacts would be temporary and short-term. Workers associated with the Rio Bravo Pipeline would generally commute to and from the pipeline right-of-way, contractor yards, or aboveground facility sites during off-peak traffic hours (e.g., before 7:00 a.m. and after 6:00 p.m.). It is unlikely that other projects listed in table 4.13.1-2 would have similar commuting schedules or reach peak traffic conditions simultaneously.

Operation of the Pipeline System would not contribute to any long-term cumulative impact on the transportation infrastructure, because only a small number of new permanent employees, a maximum of 20, would be required to operate the pipeline facilities.

Conclusion

Based on the results of the commissioned studies for the proposed Project and other LNG terminal projects, in conjunction with RG LNG's proposed roadway improvements, the Rio Grande LNG Project and other projects would contribute to a moderate cumulative impact on roadways during the 7-year construction period. The greatest cumulative impacts would occur during concurrent construction of the Rio Grande LNG and Texas LNG terminals. The proposed Project would contribute to a permanent, but negligible impact on roadway transportation during operations with the Texas LNG Project, since the operational traffic associated with the projects will be within the capacity of existing roadways.

Marine Transportation

LNG Terminal

Current vessel traffic in the BSC is about 1,059 vessels per year, which equates to an average of about 88 vessels per month, including 61 barges (Port of Brownsville 2015b). RG LNG estimates that 880 barge deliveries would occur during the 7-year construction period for the Rio Grande LNG Terminal to supplement truck transport of construction materials. Similarly, the Annova LNG and Texas LNG Projects would include 144 and 109 deliveries, respectively, during their construction; the number of waterborne deliveries for other projects is not known. Concurrent construction of these projects would noticeably increase the number of barges transiting the channel; however, impacts from the increased barge traffic would be consistent with existing use of the waterway.

During operations, about 312 LNG carriers would call on the Rio Grande LNG Terminal per year; about 125 and 75 LNG carriers per year would call on the Annova LNG and Texas LNG Terminals, respectively. This would be about a 48 percent increase in operation traffic in the BSC. Based on RG LNG's anticipated number of port calls and its navigation simulation study, RG LNG determined that LNG carriers calling at the LNG Terminal would be transiting in the BSC for a combined duration of 30 hours per week (about 18 percent of the week). Because large vessel traffic in the BSC is one-way, and LNG carriers may be subject to a moving security zone during transit, LNG carriers in transit to the Rio Grande LNG Terminal, Annova LNG, and Texas LNG Terminals could cumulatively preclude other vessel traffic up to about 39 hours per week. To minimize impacts on other users of the BSC, it is anticipated that vessels would follow required mandates put forth in the LNG Terminal Manual, including the requirement to notify LNG Terminal managers and relevant authorities of the expected arrival of an LNG carrier about four days in advance to ensure that the timing of LNG carrier channel transits are aligned with other shipping schedules. The LNG carriers calling at the Annova LNG and Texas LNG Terminals would be subject to similar requirements.

Pipeline Facilities

RB Pipeline's facilities would not result in impacts on marine transportation; therefore, it would not result in an incremental increase in the cumulative effects on marine transportation.

Conclusion

As previously described, construction of the Rio Grande LNG Terminal and other projects are likely to temporarily increase barge and support vessel traffic in the BSC. Concurrent construction would likely result in a cumulative impact on vessel traffic in the waterway, primarily by increasing vessel travel times due to congestion. During operations, LNG carriers calling on the Rio Grande LNG Terminal and other LNG facilities along the BSC vessels would have moving security zones that would preclude other vessels from transiting the waterway. Mandates for prior notice of expected arrivals would minimize impacts on other vessels. As a result, we conclude that there would be a moderate cumulative impact on vessel traffic in the BSC during construction and operation of the Project.

Environmental Justice

The geographic scope for the assessment of cumulative impacts on socioeconomic indicators was defined as the counties in the Project areas. However, based on our analysis in section 4.9.10, we found that minority populations and low-income communities, as defined per EPA guidelines, are present within a 2-mile radius of the Project facilities. Therefore, sensitive populations are present within the geographic scope and may be subject to cumulative impacts from the Rio Grande LNG Project and other projects.

LNG Terminal

As discussed in section 4.9, the nearest residential areas are about 2.2 miles from the proposed LNG Terminal site and are within a census tract that contains containing sensitive populations. During the pre-filing process and application review, FERC and RG Developers have made documents and notices about the Project available to the public. In addition, FERC provided materials in both English and Spanish to accommodate the local Hispanic or Latino population during public scoping meetings. During the public scoping meeting in Port Isabel for the Rio Grande LNG, Annova LNG, and Texas LNG Projects, both English and Spanish-speakers were present to converse one-on-one with stakeholders in attendance. Impacts on the human environment from construction of the Rio Grande LNG Terminal would consist of traffic delays, increased enrollment at public schools, and displacement of recreational fishermen and other visitors to the public use areas near the LNG Terminal site. These impacts would be minor and short-term, as described above.

Several of the projects listed in table 4.13.1-2 could contribute to potential impacts on minority populations and low-income communities, most notably the Annova LNG and Texas LNG Projects given their size and potential cumulative impacts on socioeconomics and air quality. Contractors working on projects within the geographic scope would be required to comply with applicable equal opportunity and non-discrimination laws and policies. The criteria for all positions would be based upon qualifications and in accordance with applicable, federal, state, and local employment laws and policies. Like the Rio Grande LNG Terminal, tax revenues generated from construction of these projects could be used to offset impacts on public schools and infrastructure. These impacts would apply to everyone and not be focused on or targeted to any particular demographic group.

Potential air pollutant emissions from operation of the Rio Grande LNG Terminal would be below the thresholds for unhealthy air quality over Project-area counties, which have been established for criteria pollutants. Other projects that are permitted and built would be held to the same air quality standards. Further, the State of Texas requires a State Health Effects air quality analysis comparing predicted emissions with effects screening levels, which are used to evaluate potential effects as a result of exposure to air emissions of non-criteria pollutants. The results of RG LNG's State Health Effects modeling evaluation indicate that the Project emissions are below applicable effects screening levels, and therefore adverse health effects are not expected. Cumulative impacts on air quality are discussed in section 4.13.2.9. Therefore, the Rio Grande LNG Terminal's contribution to cumulative impacts on the low-income or minority populations in the Project area would be limited to minor and temporary traffic delays and potential impacts on public schools during construction.

Pipeline Facilities

As noted in section 4.9.2, all of the affected counties have higher poverty rates than the State of Texas, and therefore all of the projects listed in table 4.13.1-2 could contribute to potential impacts on these populations. Based on the generally rural setting across the affected counties, impacts from the other projects on communities would include temporary impacts on road traffic during the respective construction periods. The Pipeline System would cross predominantly undeveloped land with few residences, and no existing residences are closer than 50 feet from the proposed pipeline right-of-way and would have similar impacts on low-income residents in the counties crossed by the Project. These impacts would apply to everyone and not be focused on or targeted to any particular demographic group.

As discussed above, minority populations are also present in Cameron County. Most notably would be projects with aboveground facilities, including the three LNG terminals and RB Pipeline's proposed Compressor Station 3. Proponents of the proposed Annova and Texas LNG Projects have designed each project to minimize impacts on local populations by collocating new facilities with existing facilities or rights-of-way, siting projects on lands identified for industrial/commercial development or in remote locations, and maximizing the distance to or avoiding residences where practicable. Further, as these two projects are FERC-regulated, they would be required to implement similar mitigation measures as discussed above to minimize impacts on these populations due to traffic delays and potential impacts on schools during construction. While these projects could cause impacts on minority and low-income residents, these impacts would apply to everyone and not be focused on or targeted to any particular demographic group.

Conclusion

Minor and temporary traffic delays during construction of the LNG Terminal and pipeline facilities, and potential impacts on public schools during construction of the LNG Terminal, could affect minority and low-income residents in the geographic scope. These impacts would apply to everyone and not be focused on or targeted to any particular demographic group; therefore, the Rio Grande LNG Project is not expected to contribute to cumulative disproportionate, adverse effects on minority and low-income residents in the area.

4.13.2.8 Cultural Resources

The geographic scope for cumulative impacts on cultural resources was determined to be the area directly affected by the Rio Grande LNG Terminal site and pipeline facilities. Other projects that occur within the geographic scope for cultural resources include the non-jurisdictional facilities, the Cameron Wind Farm, and the VCP. Cultural resources within 12 miles of the LNG Terminal site were also assessed for potential cumulative effects on visual resources (see section 4.13.2.6).

LNG Terminal

Direct impacts on cultural resources are highly localized; thus, cumulative impacts would only occur if other projects are constructed in the same place or impact the same historic properties affected by the proposed Project. As described in section 4.10.1, cultural resources surveys are complete for the Rio Grande LNG Terminal site, and no new archaeological resources were identified. In addition, RG Developers have developed an Unanticipated Discovery Plan, which we reviewed and found to be acceptable. The SHPO concurred with the plan on November 10, 2016. With our recommendation in section 4.10.5, and because no intact archaeological deposits or cultural materials were identified during surveys, we find that the Rio Grande LNG Terminal would not contribute to cumulative impacts on cultural resources.

Pipeline Facilities

Cumulative impacts on cultural resources would occur if the Pipeline System and another Project were to result in overlapping effects on a cultural resource. RB Pipeline has initiated consultation with the SHPO; however, all the necessary cultural resource surveys are not complete along the Pipeline System. Therefore, consultation is not complete. About 30 miles of the pipeline route would cross the King Ranch National Historic Landmark. However, once cultural resources surveys are complete, if any historic properties would be adversely affected by the Pipeline System, a treatment plan would be prepared. In addition, RG Developers have developed an Unanticipated Discovery Plan, as described above. Because RB Pipeline would be required to implement the measures in the treatment plan(s), as applicable, impacts on cultural resources would be minimized and would not contribute to significant cumulative impacts on cultural resources.

Conclusion

Construction and operation of the LNG Terminal would not contribute to cumulative impacts on cultural resources. Further, while field surveys and consultation regarding cultural resources along the Pipeline System are not complete, RB Pipeline would be required to implement the measures in the treatment plan(s) for any historic properties that would be adversely affected by the Project. Therefore, impacts on cultural resources would be minimized and would not contribute to significant cumulative impacts on cultural resources.

4.13.2.9 Air Quality and Noise

Air Quality

Construction

The geographic scope for assessment of cumulative impacts on air quality during construction of the proposed Rio Grande LNG Project is the area within 0.5 mile of the proposed pipeline facilities and within 1.0 mile of the LNG Terminal,[67] because construction emissions would be highly localized (see table 4.13.2-1). The projects within the construction geographic scope that are most likely to contribute to cumulative air impacts include the Annova LNG and Texas LNG Projects, non-jurisdictional facilities associated with the Rio Grande LNG Project, and waterway improvement projects within the BSC.

LNG Terminal

Construction of the Rio Grande LNG Terminal would affect air quality due to emissions from combustion engines used to power construction equipment, vehicle emissions traveling to- and from the LNG Terminal site, marine deliveries of construction materials, and fugitive dust resulting from earth-disturbing activities and equipment movement on dirt roads.

Air emissions from projects in the vicinity of the Project would be additive. Because construction emissions would be temporary and limited to the construction period, standard EPA emission thresholds do not apply. General Conformity applicability thresholds do not apply at the LNG Terminal site because the Project area is in attainment for all the NAAQS. Table 4.13.2-3 estimates the total cumulative emissions from concurrent construction of the Rio Grande LNG, Annova LNG, and Texas LNG Projects. While construction emissions estimates from non-jurisdictional projects and waterway improvement projects within the BSC are not available, based on the intermittent and short-term nature of construction, these projects would have a minor impact on cumulative air emissions when considered with the proposed LNG terminals (including the Rio Grande LNG Terminal).

Cumulative impacts from construction would be limited to the duration of the construction period. However, with other projects in the vicinity, construction of the Rio Grande LNG Project would contribute to localized elevated emissions near construction areas during the period(s) when construction of these activities would overlap. Due to the magnitude of the combined emissions, the greatest potential for cumulative impacts would be during 2020 and 2021 (see table 4.13.2-1). When compared with the EPA's most recently available national emissions inventory data, cumulative construction emissions of NO_x, SO_2, PM_{10}, and $PM_{2.5}$, would represent greater than 5 percent of the 2014 inventory emissions levels (about 7.5, 52.4, 18.9, and 11.9 percent, respectively).

---

[67] Although the typical construction geographic scope for air quality is 0.25 mile, we expand this on a case-by-case basis for large projects like LNG terminals.

Table 4.13.2-1 Estimated Construction Emissions for the Brownsville LNG Projects (tons per year)[a,b]							
Facility and Year	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	CO_2e
Rio Grande LNG Terminal							
2018	12.0	18.6	2.0	589.4	60	0.7	653.8
2019	69.7	111.4	11.8	1,199.5	125.8	4.2	9,711.0
2020	127.8	174.3	23.5	1,146.6	125.8	6.4	15,835.2
2021	59.3	118.5	10.6	91.4	14.2	3.6	9,046.0
2022	45.0	106.7	8.0	56.1	9.2	2.9	7,532.0
2023	39.0	70.2	7.1	26.9	5.8	2.1	6,310.0
2024	1.2	10.4	<0.1	13.9	1.4	0.1	1,054.0
2025	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	13.8
Annova LNG							
2018	23	40	0.04	293	30	2.6	7,802
2019	172	220	0.3	158	25	22	56,316
2020	152	224	0.25	126	21	17	44,492
2021	131	202	0.22	65	14	13	39,619
2022	50	86	0.08	59	8	6	15,025
Texas LNG							
2018	1.1	0.6	0.1	3.0	0.5	0.1	147.4
2019	62.3	35.9	4.2	177.7	28.7	4.0	8,732.2
2020	284.9	164.4	19.2	812.9	131.0	18.4	39,939.6
2021	397.9	229.6	26.8	1,135.3	183.0	25.7	55,782.8
2022	243.3	140.4	16.4	694.4	111.9	15.7	34,118.2
2023	31.9	18.4	2.2	91.1	14.7	2.1	4,476.6
Total Annual Construction Emissions							
2018	36.1	59.2	2.14	885.4	90.5	3.4	8,603.2
2019	304	367.3	16.3	1,535.2	179.5	30.2	74,759.2
2020	564.7	562.7	42.95	2,085.5	277.8	41.8	100,266.8
2021	588.2	550.1	37.62	1,291.7	211.2	42.3	104,447.8
2022	338.3	333.1	24.48	809.5	129.1	24.6	56,675.2
2023	70.9	88.6	9.3	118	20.5	4.2	10,786.6
2024	1.2	10.4	<0.1	13.9	1.4	0.1	1,054
2025	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	13.8
The EPA National Emissions Inventory, Cameron County[c]							
2008	9,366.2	52,511.8	107.0	32,165.8	4,371.8	28,884.9	--[d]
2011	9,101.9	52,167.4	217.1	21,988.4	3,167.0	30,044.6	--[d]
2014	7,864.3	43,352.9	82.0	11,023.3	2,340.3	24,701.4	--[d]

Table 4.13.2-1 (continued) Estimated Construction Emissions for the Brownsville LNG Projects (tons per year)[a,b]							
Facility and Year	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	CO_2e

[a] Emissions estimates include construction emissions from on- and off-road vehicle activity, truck deliveries, vessel activity, worker commutes, and fugitive dust. RG LNG and the other Brownsville LNG applicants initially expected construction of the LNG Terminal to begin in 2018; however, the start of construction is dependent on receipt of necessary permits.

[b] RG LNG estimated annual fugitive emissions from use of the proposed temporary haul road; to estimate annual construction emissions, the total fugitive emissions were included for 2018, 2019, and 2020. In 2018, given that construction would not commence until about 6 months into the year, annual estimated fugitive emissions from the haul road were assumed to be half of those estimated for 2019 and 2020. We are evaluating alternatives to the haul road (see section 3.4).

[c] Due to refinements and modifications in the methods used to compile each inventory, the inventory results should not be used to describe year-to-year emissions trends.

[d] Given that CO_2 is not provided for all source categories in the emissions inventory data, and methane is not tracked, no value is presented here.

The EPA's national emissions inventory data include estimated emissions from on- and off-road mobile sources (vehicle travel), point sources (such as electric power generation facilities), and nonpoint sources (stationary sources that are individually small and numerous, such as residential heating and commercial marine vessels; EPA 2014). Previous national emissions inventories conducted in 2008 and 2011 documented greater total emissions for criteria pollutants than the 2014 data; however, we have presented data from 2014 as a conservative estimate and to present the most recent inventory data. Further, since the 2014 emissions inventory, economic growth in Cameron County may have resulted in increased air emissions. Given the high level of construction emissions estimated for the three LNG terminals relative to the most recently inventoried emissions in the Project area, simultaneous construction of these projects could result in a temporary, moderate to major increase in emissions of criteria pollutants during construction. Construction emissions are localized, and impacts would be greatest in the immediate vicinity of the LNG terminal sites. RG LNG, Annova LNG, and Texas LNG would implement mitigation measures to minimize construction impacts on air quality, including application of water to minimize fugitive dust, limit engine idling, and using recent models of construction of equipment manufactured to meet air quality standards.

Further, transport of construction materials associated with the Project could occur within the HGB area, which is a marginal nonattainment area for the 2015 8-hour ozone standard. Similarly, the Annova LNG and Texas LNG Projects would also receive deliveries of construction materials originating from or being transported through the HGB area. Although cumulative emissions are not subject to General Conformity, the cumulative construction emissions from the Rio Grande LNG, Annova LNG, and Texas LNG Projects occurring within the HGB area would not be expected to result in an exceedance of applicable general conformity thresholds for the HGB area.

Pipeline Facilities

Construction of the pipeline facilities and many of the other projects listed in table 4.13.1-2 would involve the use of heavy equipment that would generate air emissions (including fugitive dust). The majority of these impacts, would be temporary at a discrete location, because the construction activities would occur over a large geographical area and would be moving regularly. However, construction would occur over a longer timeframe at aboveground facilities and during HDD installation at the crossings of Resaca de los Cuates, the Channel to San Martin Lake and the Channel to the Bahia Grande, which could require 1 month or more to complete.

Air emissions resulting from diesel- and gasoline-fueled construction equipment and vehicle engines for the pipeline facilities would be minimized by federal design standards required at the time of manufacture of the equipment and vehicles, and would comply with the EPA's mobile and non-road emission regulations found in 40 CFR 85, 86, and 89. In addition, RB Pipeline would use the most fuel efficient construction equipment available, and would use buses where feasible to minimize emissions from worker commutes. While fugitive dust impacts would also be temporary and not be expected to affect local or regional air quality, dust suppression techniques would be implemented in construction work areas, when necessary, to reduce potential impacts of fugitive dust emissions. Therefore, construction of the Rio Bravo Pipeline, with other projects in the geographic scope, would contribute to minor, temporary impacts on air quality.

<u>Operations</u>

Cumulative impacts associated with the operation of the LNG Terminal are evaluated according to the significant impact area of the proposed facilities, determined through a significant impact modeling assessment. Projects that are most likely to result in and contribute to cumulative air impacts with construction of the Rio Grande LNG Terminal include the Annova LNG Project, the Texas LNG Project, non-jurisdictional facilities, Port of Brownsville projects, and waterway improvement projects. In addition, those projects within 31 miles of the aboveground facilities associated with the Rio Bravo Pipeline may contribute to cumulative impacts on air quality with the pipeline facilities.

LNG Terminal

Air pollutant emissions during operation of the Rio Grande LNG Terminal would result from operation of the various components of the LNG Terminal, marine traffic, and vehicles driven by personnel commuting to and from the site. The region in the vicinity of the LNG Terminal is currently in attainment with the NAAQS; however, increases in industrial point sources could affect local and regional air quality.

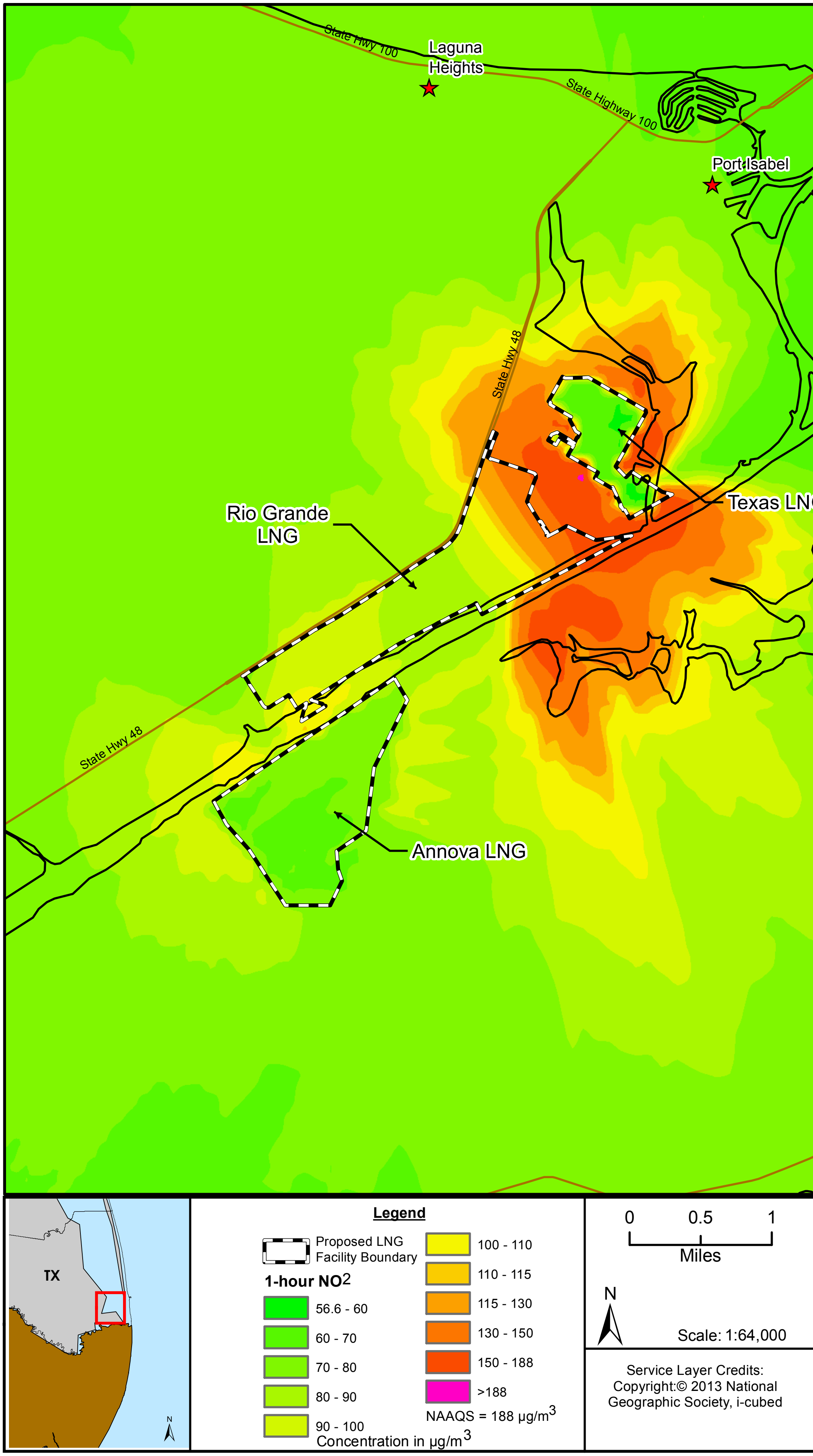
The Annova LNG and Texas LNG terminals have the greatest potential to contribute to cumulative impacts on air quality with the proposed Rio Grande LNG Terminal, given the proximity and similar operations of the projects. Emissions from currently operational facilities, such as the Brownsville Liquids Terminal and Port of Brownsville Marine Cargo Dock 16 and Storage Yard, are captured in ambient air quality monitoring data. While estimates of construction emissions from non-jurisdictional projects and waterway improvement projects within the BSC are not available, based on the intermittent and short-term nature of construction, these Projects would have a negligible impact on cumulative air emissions if they are concurrent with operations of the proposed Rio Grande LNG Terminal.

We assessed the air dispersion modeling results provided for the Rio Grande LNG, Texas LNG, and Annova LNG Terminals and used these models to estimate the cumulative air emissions during concurrent operation at all three facilities. Appendix O describes the methods used to conduct the cumulative assessment and provides the results of our analysis, including figures depicting the cumulative concentrations of each criteria air pollutant assessed (figures O-1 through O-8 in appendix O). Table 4.13.2-2, below, totals the modeled ambient pollutant concentrations for the Brownsville LNG terminals operating during full build-out, including LNG carriers and support vessels operating during LNG loading and unloading at the terminal sites. The estimated cumulative peak concentration is based on combining the predicted concentrations from each project at each receptor location regardless of the time when is occurs. Since the timing and location of the maximum predicted impacts from each terminal would differ, and because it is unlikely that all three terminals would be loading LNG carriers simultaneously, the method used to develop the peak cumulative concentrations is conservative.

Peak estimated concentration for criteria pollutants and averaging periods were compared to the NAAQS, which represent standardized air quality criteria and were therefore used as a benchmark for comparison against model results. For all pollutants, except for 1-hour NO_2, cumulative impacts are predicted to be below the NAAQS and would disperse before reaching population centers in Port Isabel and Laguna Heights (see appendix O). For 1-hour NO_2, the predicted maximum cumulative impact is estimated to exceed the short-term NAAQS of 188 $\mu g/m^3$. The predicted peak cumulative impact, however, is located between the fence lines of the Rio Grande LNG and Texas LNG Terminals. It is unlikely, but possible, that people may be exposed to the NO_2 concentrations above the 1-hour NAAQS, which would occur on property within the Port of Brownsville (see appendix O and figure 4.13.2-1). Concentrations of 1-hour NO_2 in residential areas in Port Isabel and Laguna Heights are estimated to be below 75 $\mu g/m^3$, which is well below the 1-hour NAAQS. While concurrent maximal operations of the LNG facilities would result in increased concentrations of air pollutants in the immediate vicinity of the facilities, the projects emissions are not expected to result in a significant impact on regional air quality, nor would any exceedance of the NAAQS occur in a populated area.

While the cumulative ambient modeling assessment does not account for concurrent construction, commissioning, and operations emissions, the greatest emissions from each LNG Terminal are associated with operations. We are aware that each LNG Terminal could be constructed within the same time period, and the concurrent construction, commissioning, and operations emissions of the Rio Grande LNG Terminal and the other proposed LNG Teminals could contribute significantly, potentially exceed the NAAQS in local areas, and result in cumulatively greater local air quality impacts. While these concurrent activities would result in greater ambient pollutant concentrations than those presented in table 4.13.2-2, emissions levels would not be expected to result in a long-term impact on regional air quality. Concurrent activities would be limited to the timeframe of construction and commissioning and start-up.

In addition to operation of the LNG Terminal and the vessel emissions described in section 4.11.1.3, air emissions from LNG carriers, considered mobile sources of air emissions, would occur along the entire LNG carrier route during operations. These emissions would be cumulative with the other ships using the ship channel. These mobile sources would be transitory in nature and emissions would occur over a large area, however the cumulative ship emissions would result in long term elevated emissions for the area.



Cumulative Impacts (Rio Grande LNG, Texas LNG, Annova LNG, and Background)

1-Hour NO_2
$\mu g/m^3$

Figure 4.13.2-1

Table 4.13.2-2
Peak Concentrations Estimated in Cumulative Air Dispersion Modeling for Stationary Source and LNG carriers for the Brownsville LNG Projects

Criteria Air Pollutant	Averaging Period	Background Concentration[a] (μg/m3)	Peak Concentration based on Modeled Results (μg/m3)[b]				NAAQS (μg/m3)
			Rio Grande LNG Terminal	Annova LNG	Texas LNG	Peak Cumulative Concentration c	
CO	1-hour	2,175.5	276.1	247.9	470.6	2,746	40,000
	8-hour	1,259.5	174.0	101.7	83.4	1,453	10,000
NO_2	1-hour	49.9	78.9	39.3	134.7	196	188
	Annual	6.1	2.7	0.5	1.8	9	100
SO_2	1-hour	10.6	2.0	3.8	10.3	23	196
PM_{10}	24-hour	62.0	1.4	0.7	2.3	64	150
$PM_{2.5}$	24-hour	22.9	1.3	0.7	2.0	25	35
	Annual	9.1	0.3	0.1	0.1	9	12

[a] Background concentrations retrieved from tables 4-1 and 4-2 of the dispersion modeling report provided for the Texas LNG Project (available on FERC's eLibrary website, located at http://www.ferc.gov/docs-filing/elibrary.asp, by searching Docket Number CP16-116 and accession number 20170928-5165).

[b] Modeled impacts include stationary sources and LNG carriers at the LNG terminal sites.

[c] Peak concentrations predicted for each of the three projects for each receptor location were conservatively combined without regard to day or time of occurrence, and include background concentrations. The peak cumulative concentration for each pollutant and averaging period does not equal the sum of the peak concentrations for each terminal and background, since peak concentrations associated with each terminal occur at different locations.

Pipeline Facilities

Operation of the proposed pipeline facilities would generate emissions from maintenance vehicles and equipment, as well as vented and fugitive emissions. While a majority of the projects in the geographic scope are included above in the assessment of cumulative impacts associated with the LNG Terminal and Compressor Station 3, the VCP is within 31 miles of the other aboveground facilities associated with the Rio Bravo Pipeline. Concurrent operation of Compressor Stations 1 and 2, the booster stations, and the VCP would result in a cumulative increase in combustion and fugitive emissions. The compressor stations would emit NO_x, CO, SO_2, PM, VOC, HAPs, and GHG emissions. However, no compressor or booster stations associated with the proposed Project would trigger PSD major source permitting requirements for any pollutant. Operation of aboveground facilities would not cause a NAAQS exceedance, and concurrent operations with the VCP is not expected to result in a NAAQS exceedance; therefore, emissions from operation of RB Pipeline's pipeline facilities are not expected to contribute to a significant cumulative impact on local or regional air quality.

Conclusion

In summary, the Rio Grande LNG Project would result in impacts on air quality during construction and long-term impacts during operations. Cumulative impacts from construction would be limited to the duration of the construction period. However, with other Projects in the vicinity, construction of the Rio Grande LNG Project would contribute to localized moderate elevated emissions near construction areas during the period(s) when construction of these activities would overlap.

Operational air emissions from the Rio Grande LNG Project would contribute to cumulative emissions with other projects in the geographic scope, and would be required to comply with applicable air quality regulations. Overall, impacts from the Rio Grande LNG Project along with the other facilities would cause elevated levels of air contaminants in the area and a potential exceedance of the 1-hour NO_2 NAAQS in an uninhabited area between the facilities. Therefore, cumulative impacts on regional air quality as a result of the operation of the Rio Grande LNG Project and other facilities would be long-term during the operational life of the Project, but minor. We are aware that each LNG Terminal could be constructed within the same time period, and the concurrent construction, commissioning, and operations emissions of the proposed Brownsville LNG terminals could contribute significantly, potentially exceed the NAAQS in local areas, and result in cumulatively greater local air quality impacts. In addition, emissions from LNG carriers would occur along vessel transit routes and would be cumulative with the other ships using the ship channel. These emissions sources would be transitory in nature and emissions would occur over a large area, however the cumulative ship emissions would result in long term elevated emissions for the area. Emissions from operation of RB Pipeline's aboveground facilities (including Compressor Stations 1 and 2 and the booster stations) would be long-term, minor, and are not expected to contribute to a significant cumulative impact on local or regional air quality.

Noise

The geographic scope for construction noise typically includes other identified projects within 0.25 mile of the proposed Project, or within 0.5 mile from HDD entry and exit locations. However, due to the duration of construction and similar timelines, we have included the Annova LNG and Texas LNG Projects in our cumulative construction noise impact analysis, even though the Annova LNG Project would be outside of the 0.25-mile distance. Cumulative noise impacts on residences and other NSAs are related to the distance from the disparate noise sources as well as the timing of each noise source.

The geographic scope for operational noise from long term projects includes any facilities that can cause an impact at NSAs within 1 mile of the proposed Rio Grande LNG Terminal and aboveground facilities along the Rio Bravo Pipeline. The Annova LNG and Texas LNG Projects have been included in the cumulative effect impact assessment, as well as other existing and proposed projects in the area (see table 4.13.1-1).

After construction is completed for the non-LNG projects, including the gas and water pipeline projects, electric transmission projects, channel improvements and maintenance dredging, and road projects, there would be minimal operational noise impacts. The non-jurisdictional SH-48 auxiliary lane and new driveways that would be developed for the Rio Grande LNG Project would have some long-term but minor noise associated with vehicle traffic entering and leaving the Project site. Therefore, these projects are not expected to have any significant long-term operational cumulative impacts.

Construction noise from the non-jurisdictional facilities associated with the Rio Grande LNG Project is expected to be localized and limited in duration. These projects are small compared to the scope of the proposed three LNG projects, and are generally linear activities with construction moving through the length of the right-of-way with limited durations near any given location. These projects are not expected to come within 0.25 mile of any of the Project NSAs; therefore, the construction activities associated with the non-jurisdictional facilities are not expected to result in cumulative impacts from noise at NSAs.

Maintenance dredging and channel improvement activities would result in periodic small increases in the sound level impacts due to operation of dredging equipment. Sound levels from the maintenance dredging are not expected to cause a significant impact at the NSAs.

The SpaceX Commercial Spaceport Project, located approximately 5.5 miles southeast of the Project, anticipates rocket launches starting as soon as late 2018. Once they commence, commercial spaceflight launches would be a significant noise source at the NSAs. However, spaceflight launches are not expected to cause a significant cumulative environmental noise impact because they are short-duration events lasting only a few minutes from start to finish, they are typically scheduled during the daytime, and each launch would be well publicized, so nearby residents would be ready for the short-term intense noise of the rocket launch. During the launches, noise from the launch would dominate the sound levels at the nearby residences and low-frequency noise would likely cause noise-induced-structural vibration. Project related noise contributions would not be significant during this brief period, as the sound field would be dominated by launch noise.

As significant cumulative noise impacts are not expected from the non-LNG projects considered, as discussed above, the cumulative assessment for noise impacts focuses on the two other LNG projects in the planning and permitting stages in the general vicinity of the Project: the Annova LNG and Texas LNG Projects. These projects are pending review by the FERC. The potential cumulative noise impact of these three LNG projects has been evaluated for construction and facility operations, for both airborne and underwater sound. Construction noise impacts would be cumulative only if construction activities occur simultaneously. Given the current schedule for the three Brownsville LNG projects, it is likely that there would be some overlap in construction activities because of the long duration of construction for the three projects. For the purposes of this analysis we have assumed that peak construction of all three projects would overlap; however, the construction phases may not coincide, so maximum construction sound levels may not occur at all projects simultaneously.

Construction

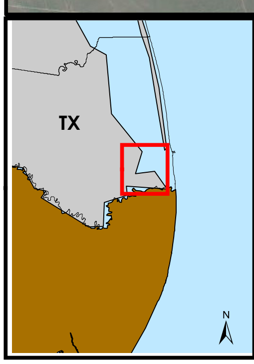
LNG Terminal

Airborne Noise

Construction activities for the three LNG projects would be similar, and would include heavy equipment operation, pile-driving, dredging, and other activities similar to those described in section 4.11.2.3. In order to evaluate the potential cumulative impact of construction activities, basic sound propagation calculations were used to estimate the combined construction sound levels at a set of standardized NSAs and calculation point (CP) locations.

The standardized NSA and CP locations were selected using the common NSAs for each of the three proposed projects. NSAs and CPs in close proximity were combined into single representative NSA or CP positions for the cumulative analysis. Three CP locations were included for each project: the Palmito Ranch Battlefield (CP-1), a central CP location in the Laguna Atascosa NWR (CP-2), and at the location in the Laguna Atascosa NWR at the closest approach to the given LNG project. CP-1 and CP-2 were the same for all projects.

In order to quantify the highest sound level contribution from each project in the Laguna Atascosa NWR, the closest location in the Laguna Atascosa NWR for each of the projects was specified as a CP. Each was given a unique designation: CP-TX, CP-AN, and CP-RG for Texas LNG, Annova LNG, and Rio Grande LNG terminals, respectively. Each project reported its operations sound level contribution at the project-specific CP. These three CPs have not been used to calculate impacts in the cumulative tables, rather, they are presented separately for each project to indicate the highest expected project-specific sound level contributions in the Laguna Atascosa NWR for operations and construction noise. A list of the standardized NSAs and CPs is presented in table 4.13.2-3. A map showing the location of the standardized cumulative NSAs and CPs is shown in figure 4.13.2-2.



Legend

- NSA Location
- Calculation Point
- Facility Property Line

0 0.5 1
Miles

N

Scale: 1:78,868

Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

Location of Cumulative Impact NSA's and Calculation Points

Figure 4.13.2-2

Table 4.13.2-3 Standardized NSAs and Calculation Point Locations for Cumulative Noise Analysis		
NSA / CP	**Location**	**Coordinates**
NSA		
NSA C1	Laguna Heights neighborhood, Lincoln Ave. and Pennsylvania Ave.	26.077312°; -97.249653°
NSA C2	Residences, mobile home park, on Port Rd., southeast of Woodys Ln.	26.067031°; -97.217732°
NSA C3	Residences, northwest end of West Scallop	26.063153°; -97.208717°
NSA C4	Residences, Weems Rd. and LBJ St.	25.993437°; -97.182485
NSA C5	Residences, north end of 199, north of Boca Chica Blvd.	25.965084°; -97.245563°
NSA C6	Residence located east of Palmito Hill Rd. on private drive	25.952706°; -97.289272°
CP		
CP-1	Palmito Ranch Battlefield	25.959536°; -97.303490°
CP-2	Laguna Atascosa NWR, calculation point	26.028053°; -97.265482°
CP-AN, CP-TX, CP-RG[a]	Laguna Atascosa NWR, closest location to given facility	Varies

CP = calculation point.
[a] The CP-AN, CP-TX, and CP-RG points represent the locations of the highest sound level contribution from each individual facility in the nearby Laguna Atascosa NWR.

Cumulative effects of construction noise were analyzed by combining the predicted construction sound levels for each project. Each of the three LNG projects used a slightly different methodology for calculating construction noise impacts. These variations were normalized during the cumulative assessment process and all predicted values were compared on an L_{dn} basis. For those cumulative NSAs at which the construction noise had not been calculated by a project in the FERC application, a hemispherical spreading calculation was used to estimate the construction contributions based on reported construction sound levels at other NSAs. The existing ambient sound levels for each NSA, as reported in table 4.13.2-3, were determined by using the lowest measured ambient level at a corresponding project NSA for the three projects. For example, if the measured ambient sound level at NSA C2 differed among FERC applications for the three projects, the lowest ambient sound level reported was used as the ambient for the cumulative analysis. The source of the ambient sound level data is provided in table 4.13.2-4.

There was some variation in the assumptions included in the three projects for construction activities. For example, Annova LNG assumed 24-hour construction activities, while RG LNG, and Texas LNG used 12-hour daytime shifts for general construction and pile-driving and 24-hour operations for dredging. These assumptions were carried into the cumulative assessment. Annova LNG and Texas LNG reported construction sound levels as 24-hour L_{dn} values, while RG LNG reported construction contributions as daytime L_{eq}. In order to directly compare the construction sound level contributions, the sound level metrics were standardized to the 24-hour L_{dn}, and the reported sound levels for Rio Grande LNG were adjusted to the 24-hour L_{dn}. A more detailed discussion of the sound level metric standardization is provided in appendix P.

Table 4.13.2-4 Summary of Cumulative LNG Construction Impacts at Standardized NSA and CP Locations, All Levels are dBA L_{dn}								
Location	**Predicted Construction Sound Level Contributions[a]**				**Existing Ambient**	**Ambient Data[b]**	**Combined Ambient plus Cumulative LNG**	**Predicted Increase over Ambient**
	Annova LNG	**Rio Grande LNG**	**Texas LNG**	**Cumulative LNG**				
NSA C1	49.0	49.2	**50.3**	54.3	56.0	AN NSA 1	58.2	2.2
NSA C2	47.1	43.1	**54.9**	55.8	50.2	TX NSAs 1 & 2	56.9	6.7
NSA C3	46.8	42.7	**54.6**	55.5	50.2	TX NSA 3	56.6	6.4
NSA C4	**48.0**	46.7	46.0	51.8	46.0	AN NSA 2	52.8	6.8
NSA C5	**54.0**	47.9	44.2	55.3	46.0	AN NSA 2	55.8	9.8
NSA C6	**49.8**	46.0	41.7	51.7	46.0	AN NSA 2	52.8	6.8
CP-1	**52.0**	39.9	41.6	52.6	43.0	AN NSA 4	53.1	10.1
CP-2	**56.9**	48.7	51.0	58.4	59.0	TX Laguna Atascosa NWR	62.1	2.7

AN = Annova LNG, RG = Rio Grande LNG, and TX = Texas LNG
[a] The **bold** values highlight the highest individual LNG facility contributions, as used in table 4.13.2-5.
[b] The existing ambient sound levels shown are the lowest reported levels at project NSAs near the standardized NSAs.

Table 4.13.2-4 shows the individual project and cumulative construction noise contributions of the three LNG projects at the NSAs and CPs. The individual sound level contribution predictions from all construction activities are lower than the FERC criterion of 55 dBA L_{dn} at all NSAs. However, the cumulative construction sound level from the three projects ranges from 51.7 to 55.8 dBA L_{dn}, and exceeds 55 dBA L_{dn} at NSAs C2, C3, and C5. The cumulative sound levels are also expected to exceed 55 dBA L_{dn} at locations in the Laguna Atascosa NWR, with cumulative sound levels at CP-2 of 58.4 dBA L_{dn}. Construction sound levels would be expected to exceed 55 dBA L_{dn} at locations in the Laguna Atascosa NWR within about 0.75 mile of SH-48. The predicted increase in the ambient sound levels is also shown in the table, and these range from 2.2 to 9.8 dBA at the NSAs, and from 3.1 to 10.1 at the two CP locations. An increase of greater than 10 dBA is typically perceived as a doubling of loudness.

The evaluation above is a very conservative estimate of the potential cumulative impact of construction noise, as it combines the maximum and simultaneous construction sound levels from the three projects. This would require that all three project schedules align so that pile-driving, dredging, and site preparation occur at full intensity at the same time. To obtain a more realistic and likely evaluation of the construction impact, an incremental analysis was made by comparing the increase in sound level at each NSA and CP due to only the highest predicted individual project contribution to the additional increase due to the other two projects. This analysis shows the potential cumulative impact of all three projects compared to the loudest single project. The impacts derived from this analysis represent for a more likely scenario in which the three project construction schedules do not align exactly.

Table 4.13.2-5 shows the incremental effect of cumulative construction noise at each NSA and CP, compared with the highest predicted *individual* project contribution affecting each NSA. This table shows that cumulative construction noise causes an incremental increase of between 0.7 and 2.7 dB at the NSAs and CPs, compared to the highest individual project construction noise. NSA C4, with an increase of 2.7 dBA L_{dn}, shows the largest cumulative effect. A three-decibel increase is generally considered perceptible to most people, so the cumulative impact of construction noise at NSA C4 would be perceptible. At other NSAs, the cumulative increases are 1.5 dBA L_{dn} or lower and would generally be considered imperceptible. At these NSAs, due to the distance between the projects, the *closest* construction activity sound levels would typically dominate the acoustical environment at the NSA.

The sound levels at the project-specific CPs during construction were an Annova LNG contribution of 60.6 dBA L_{dn} at CP-AN, a Rio Grande LNG contribution of 48.7 dBA L_{dn} at CP-RG (based on 12-hour per day construction and 51.7 L_{max} dBA), and a Texas LNG contribution of 63.5 dBA L_{dn} at CP-TX. This demonstrates that construction sound levels in the Laguna Atascosa NWR are dominated by contributions from Texas LNG.

Table 4.13.2-5
Calculation of the Incremental Impact of Cumulative LNG Construction Noise at Standardized NSA and CP Locations, All Levels are dBA L_{dn}

Location	Existing Ambient[a]	Highest Individual LNG Construction Contribution	Highest Individual LNG Contribution Plus Ambient	Increase over Ambient due to only the Single Highest LNG Contribution	Additional Increase Caused by Cumulative Construction Noise
NSA C1	56.0	50.3	57.0	1.0	1.2
NSA C2	50.2	54.9	56.2	6.0	0.7
NSA C3	50.2	54.6	55.9	5.7	0.7
NSA C4	46.0	48.0	50.1	4.1	2.7
NSA C5	46.0	54.0	54.6	8.6	1.2
NSA C6	46.0	49.8	51.3	5.3	1.5
CP-1	43.0	52.0	52.5	9.5	0.6
CP-2	59.0	56.9	61.1	2.1	0.6

[a] The existing ambient sound levels shown are the lowest reported levels at project NSAs near the standardized NSAs. See table 4.13.2-4 for the data source.

Vessel Traffic

During construction of the three LNG projects, the area would experience an increase in noise due to marine traffic delivering construction supplies. Rio Grande LNG estimates that barges would make 880 marine deliveries to the project site during construction. Marine deliveries to the Rio Grande LNG Terminal site would take place about 15 times per month during the first 5 years of construction; no deliveries are currently anticipated during the remainder of the construction period, though sporadic deliveries could occur as needed. Annova LNG estimates that a total of 24 to 36 barge deliveries to the project site per year would be required during construction. If these construction periods overlap, the total expected construction barge traffic is approximately 20 visits a month, or 1 barge visit every 1.5 days. This is only slightly more than the one barge visit every two days estimated for the Rio Grande

LNG Project and the cumulative effects would not be significant. The Texas LNG Project is not anticipated to contribute significantly to the cumulative noise impact because only a small amount of the anticipated construction supplies would arrive via barges or ships (109 deliveries over the 5-year construction period, which averages less than 2 per month).

Underwater Noise

Underwater noise would be produced by construction activities including in-water pile-driving and dredging, and increased vessel traffic associated with equipment delivery. Cumulative impacts for underwater construction noise would be limited due to the large distance between the various project marine facilities.

The marine facilities closest to each other are the proposed Rio Grande LNG and Texas LNG facilities, with a center to center distance of about 4,400 feet. As an example of the distance effects, underwater pile-driving sound levels would be expected to decrease by 32 decibels re 1 µPa at a distance of 4,400 feet compared to reference levels at 32 feet. The LNG sites are so far apart that pile-driving activities at any single facility would have a limited cumulative effect on underwater noise at locations close to either of the other construction areas.

Due to the short impulsive nature of pile-driving noises, it is very unlikely that the peak sound pressure levels from multiple pile-drivers would occur at exactly the same instant, so there would be no increase in the predicted pile-driving peak sound pressure levels. Rather, the number of pile-driving events would increase due to the multiple active construction areas.

At locations midway between two active pile-driving projects, the sound exposure levels would be expected to increase during simultaneous pile-driving activities. The threshold distances for permanent and temporary injury for marine mammals, fish, and sea turtles, as outlined for the Rio Grande LNG Project in tables 4.6.2-2 and 4.7.1-1, would not be expected to increase significantly in size. However, during simultaneous pile-driving at the three projects, the behavioral disturbance area for most species would increase. In some cases the behavioral disturbance distances for the projects would overlap and would likely encompass much of the BSC. Cumulative impacts on aquatic resources as a result of underwater noise are discussed further in section 4.13.2.4 and 4.13.2.5.

As an example of the potential overlap between adjacent behavioral disturbance areas, table 4.7.1-2 identifies the behavioral disturbance distances for pile-driving for the Rio Grande LNG project. As indicated, for cetaceans during vibratory pile-driving, the behavioral disturbance area extends about 4.6 miles from the LNG Terminal, encompassing much of the BSC and those areas adjacent to both the Texas LNG and Annova LNG sites. For impact pile-driving of the sheet pile (if required), the behavioral disturbance area for fish could extend up to 1.3 miles from pile-driving activities at the Rio Grande LNG Terminal site. Therefore, the behavioral disturbance areas would overlap with adjacent projects, and would increase the total continuous behavioral disturbance areas. The other behavioral disturbance areas: cetaceans (i.e., impact installation of traditional piles), sea turtles (i.e., impact pile and vibratory pile), and fish (i.e., vibratory pile), are much smaller, and would not likely overlap with the disturbance areas for other projects.

As a mitigating factor, the expected durations of the marine pile-driving activities for the three projects are limited. Rio Grande LNG expects that marine pile-driving would be required for sheet piling, which is anticipated to occur over 25 days and for installation of four in-water piles, which would take 4 days. Annova LNG expects to perform in-water pile-driving over the course of 5 days. Texas LNG plans to drive only 12 piles in-water. Due to the long construction schedules for the projects, and the limited duration of in-water pile-driving, it seems unlikely that there would be substantial overlap in the in-water pile-driving schedules. Even with complete overlap in pile-driving activity schedules, there could possibly be only 4 days in which all three projects would be driving (non-sheet) piles.

Dredging activities at all three projects would have the potential to produce underwater noise. The proposed dredging activities would be far enough apart that generally there would be no cumulative impacts expected for underwater dredging noise for species other than mid-frequency cetaceans. For mid-frequency cetaceans, the behavioral disturbance range would tend to overlap with dredging areas for the LNG Terminal site. If these activities occurred simultaneously, the expected area of potential auditory impact for mid-frequency cetaceans would extend from the mouth of the BSC to inland of the LNG Terminal site. However, the BSC is an active waterway that already has ongoing and regular maintenance dredging activities. The additional construction dredging activities associated with the projects are expected to be similar to the existing maintenance dredging and is not expected to cause a significant cumulative underwater noise impact in the BSC.

Pipeline Facilities

Construction of the pipeline facilities could contribute to cumulative noise impacts; however, the impact of noise is highly localized and attenuates quickly as the distance from the noise source increases; therefore, cumulative impacts are unlikely unless one or more of the projects listed in table 4.13.1-2 are constructed at the same time and location. Based on the schedule and proximity of these activities to the pipeline route, there may be some cumulative noise impacts. However, since the majority of noise impacts associated with the projects would be limited to the period of construction and most construction activities would occur during daytime hours and would be intermittent rather than continuous, the proposed contribution from the pipeline facilities to cumulative noise impacts would primarily be for only short periods of time when the construction activities are occurring at a given location.

Further, while the results of the HDD construction acoustical impact assessment indicated that sound levels for 24-hour operations would be above the FERC guidance of 55 dBA L_{dn} at NSAs in the vicinity of seven HDDs. Given our recommendation in section 4.11.2.3 that RB Pipeline prepare and implement a noise mitigation plan at each of these locations, and because HDD construction would only occur for periods up to 10 weeks at each site, impacts would be minor.

Operations

LNG Terminal

Airborne Noise

In order to consistently analyze the potential cumulative impact of airborne operational noise from the three proposed LNG projects, the noise models for each project were used to predict the sound levels due to facility operation at the standardized NSAs and at the three CPs located close to points of interest. The methodology behind the noise model development for the Rio Grande LNG Project is presented in section 4.11.2 of this EIS. The methodology for the other two LNG projects is described in their FERC applications.[68] Generally, each project used three-dimensional environmental noise modeling software to predict the sound levels from the respective project equipment. In order to combine the sound level predictions for operations noise, each project submitted the noise model results in a standardized grid format as outlined in the August 2, 2017 Environmental Information Request issued for the Rio Grande LNG Project.[69] The standardized grid results used the same spacing and nominally the same boundaries. The grid maps were overlaid and logarithmically summed and the overall cumulative impact of operations noise from the three projects was calculated. Figure 4.13.2-3 shows the predicted sound levels as 24-hour L_{dn} values for the three projects in simultaneous operation at full project completion. In addition to the grid map results, predicted operations sound levels were calculated by each project for the cumulative NSAs and CP locations described in table 4.13.2-6. The predicted sound levels were logarithmically summed for the cumulative NSAs and for CPs 1 and 2.

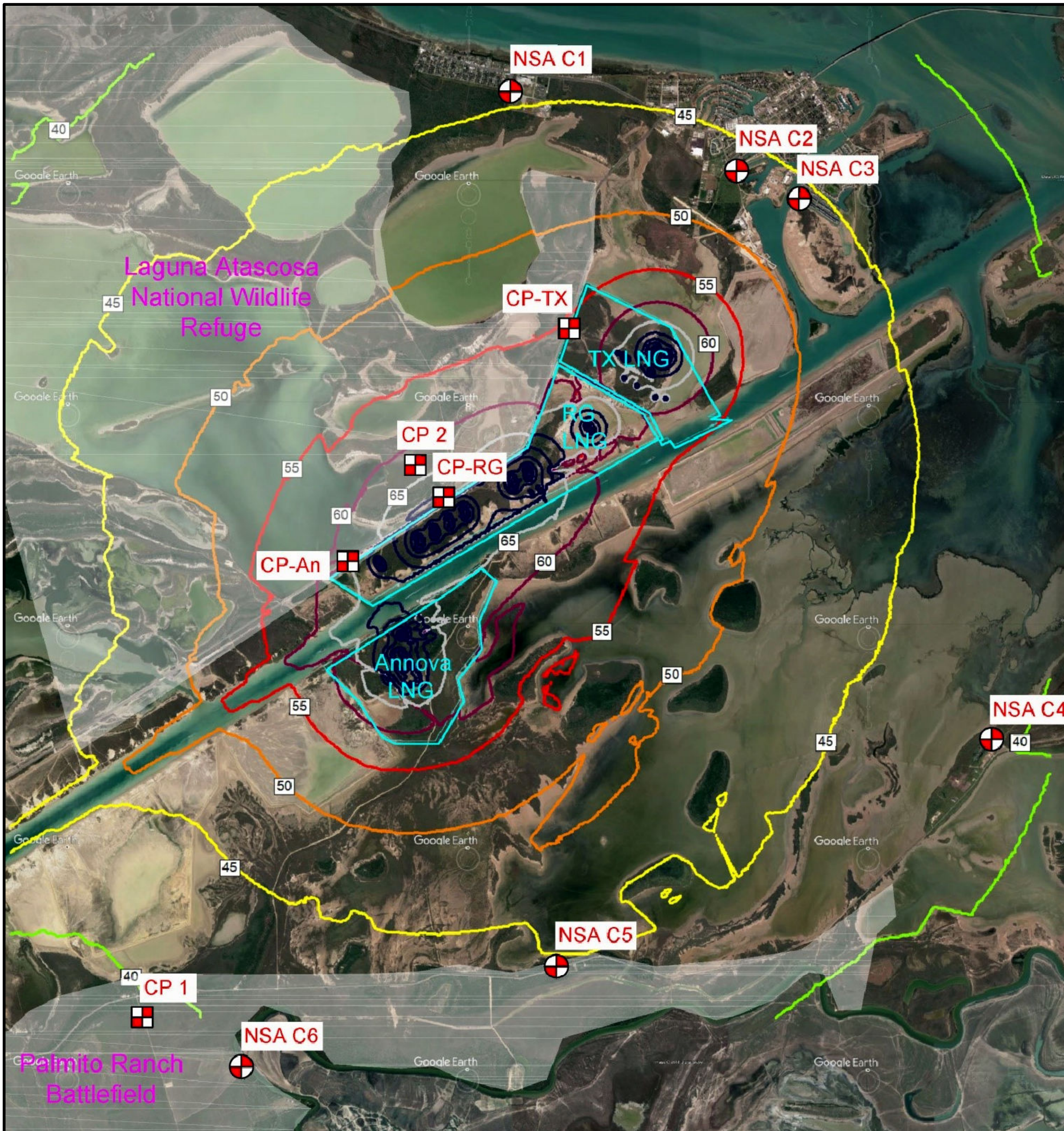
Each project also reported predicted sound levels at the location in the Laguna Atascosa NWR closest to the project, with these unique CPs labeled as CP-RG, CP-AN, and CP-TX, for the Rio Grande LNG, Annova LNG, and Texas LNG Projects, respectively. These project-specific calculation points were used to evaluate the highest predicted individual project sound level in the Laguna Atascosa NWR. Cumulative sound levels were not calculated for these points, as the levels were predicted by each project for only that respective project CP.

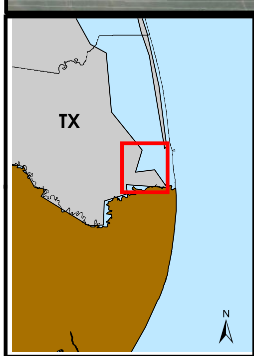
Table 4.13.2-6 presents a summary of the predicted operation sound levels at the cumulative NSA and CP locations for each of the individual LNG projects. As shown in this table, the expected increases in the sound levels at the standardized NSA locations range from 0.3 to 1.5 dB. These are very small increases and would be considered imperceptible to most listeners. The small difference in the overall cumulative increases and those increases predicted for each separate project is due to the large distances between the noise generating equipment at the project sites, and the small impact of the more distant projects to the overall sound levels at each NSA location.

---

68 Available online at www.ferc.gov. Annova LNG: FERC Docket No. CP16-480-000; Texas LNG: FERC Docket Nos., CP16-116-000.

69 Available online at www.ferc.gov. FERC Docket No. CP16-454 and CP16-455, Accession No. 20171011-5199.





Legend

- NSA Location
- Calculation Point
- Facility Property Line

0 0.5 1
Miles

N

Scale: 1:78,868

Service Layer Credits:
Copyright:© 2013 National Geographic Society, i-cubed

Cumulative Sound Levels, dBA Ldn, for TX LNG, RG LNG, and Annova LNG Operations

Figure 4.13.2-3

Table 4.13.2-6 Cumulative Operational Noise Impacts from LNG Facilities								
Location	Predicted Sound Level Contributions, dBA L_{dn}				Existing Ambient	Ambient Data[a]	Combined Ambient plus Cumul. LNG	Predicted Increase over Ambient
	Annova LNG	Rio Grande LNG	Texas LNG	Cumulative LNG				
NSA C1	31.4	41.9	40.2	44.4	56.0	AN NSA 1	56.3	0.3
NSA C2	30.4	40.2	44.8	46.2	50.2	TX NSAs 1 & 2	51.7	1.5
NSA C3	30.4	39.7	44.4	45.8	50.2	TX NSA 3	51.5	1.3
NSA C4	31.4	38.7	34.7	40.7	46.0	AN NSA 2	47.1	1.1
NSA C5	39.4	41.0	32.2	43.6	46.0	AN NSA 2	61.4	0.1
NSA C6	34.4	37.3	28.7	39.5	46.0	AN NSA 2	46.9	0.9
CP 1	33.4	36.1	28.5	38.4	43.0	AN NSA 4	44.3	1.3
CP 2	46.4	61.8	41.0	62.0	59.0	TX	63.8	4.8

[a] The existing ambient sound levels shown are the lowest reported levels at project NSAs near the standardized NSAs.

Sound levels at CP-1, representing the Palmito Ranch Battlefield National Historic Landmark, are predicted to have a cumulative increase of 1.3 dB, which would be imperceptible for most listeners. At CP-2 in the Laguna Atascosa NWR, the sound level impact is somewhat higher, with a predicted cumulative increase of 4.8 decibels and an overall cumulative sound level of 62 dBA L_{dn}. As shown on figure 4.13.2-3, there would be areas in the Laguna Atascosa NWR in which the cumulative sound levels exceed 55 dBA L_{dn}. The sound levels in the Laguna Atascosa NWR are generally dominated by contributions from the Rio Grande LNG Terminal.

The sound levels at the project-specific CPs during operation were a Rio Grande LNG contribution of 69.7 dBA L_{dn} at CP-RG, Annova LNG contribution of 55.4 dBA L_{dn} at CP-AN, and a Texas LNG contribution of 52.9 dBA L_{dn} at CP-TX. This demonstrates that operational sound levels in the Laguna Atascosa NWR are dominated by contributions from Rio Grande LNG, due to its proximity to the Laguna Atascosa NWR. As shown in figure 4.13.2-2, the area of the Laguna Atascosa NWR with sound levels exceeding 55 dBA L_{dn} extends to approximately 1 mile northwest of SH-48. Sound levels in this area are dominated by operational noise from the Rio Grande LNG Terminal, as the process area for that facility is directly across SH-48. Cumulative impacts resulting from increased noise on wildlife is further discussed in section 4.13.2.3.

Flaring

There would be flaring noise associated with all three projects. However, all three projects report that flaring would not be part of standard operations. The maximum sound levels predicted for flaring were 59 dBA, 52 dBA, and 43 dBA for Rio Grande LNG, Annova LNG, and Texas LNG Projects, respectively, at the worst-case NSAs for each project (NSA C1 for the Rio Grande LNG Project). Although possible, it is unlikely that flaring would occur simultaneously at all three projects. In the event of simultaneous flaring at all three projects, the highest predicted sound levels would be at cumulative NSA C1, with a predicted cumulative flaring sound level of 59.6 dBA, or 0.6 dBA higher than the individual impact of the Rio Grande LNG flare operating alone. This is not a noticible difference indicating that the cumulative impact of flaring events would be minimal. However, with three facilities in operation, the frequency of occurrence of flaring events would be approximately tripled, so flaring events would occur more often, though the overall sound level from each flaring event would be similar or lower than predicted by each project.

Maintenance Dredging

Occasional maintenance dredging would be required during the operational lifespan of the three LNG projects to maintain the channel, turning basin, and other marine facilities associated with the projects. Generally, the projects anticipate that maintenance dredging would be necessary every few years. Maintenance dredging activities would be substantially quieter than the sound levels reported with construction sound level predictions, as the predicted construction levels also include pile-driving, general construction, and dredging activities. The BSC is an active waterway that already has ongoing and regular maintenance dredging. The additional maintenance dredging activities associated with the projects are not expected to cause a significant cumulative airborne noise impact at the NSAs.

Pipeline Facilities

With the exception of planned projects in the vicinity of Compressor Station 3 (addressed above with the Rio Grande LNG Terminal), we are not aware of any other projects that would contribute overlapping noise impacts to NSAs in the vicinity of the pipeline facilities. Operation of RB Pipeline's compressor and booster stations would result in noise from the compressors, pumps, and cooling fans, and blowdown events. Based on the analyses conducted, we conclude that these compressor stations would not result in significant noise impacts on residents, or the surrounding communities during operation as noise levels are expected to be below the FERC criterion of 55 dBA L_{dn}, and are not expected to result in a perceptible noise increase at the nearest NSAs. In addition, operation of the pipeline facilities is not expected to result in a perceptible increase in vibration at any NSA. Therefore, operation of the pipeline facilities would not contribute to significant cumulative impacts on noise.

Conclusions

The cumulative noise impacts of reasonably foreseeable future actions have been reviewed. Of these actions, significant cumulative noise impacts would be expected only from the three LNG-related projects due to their size, extent, construction techniques, and long operational lifespan. In order to evaluate the potential cumulative impact of construction and operations noise from these LNG projects, the predicted sound levels for construction and for operations were combined at a standardized set of cumulative NSAs.

For simultaneous construction activities at all of the three LNG projects, the predicted sound level increase over the existing ambient ranges from 2.2 to 9.8 dBA L_{dn} at the NSAs and sound levels of slightly over 55 dBA L_{dn} are predicted for NSAs C2, C3, and C5. These noise level increases range between less than noticible increases in ambient noise to a doubling of noise at specific NSAs. For construction activities that are not simultaneous but incremental, the predicted sound level increase ranges from 1.0 to 8.6 dBA L_{dn} at the NSAs. These increases would be minor to moderate; however, all levels would be below the FERC criterion of 55 dBA $L_{dn.}$ For CP-1, the predicted cumulative construction increase was 10.1 dBA L_{dn} over the existing ambient which could result in periods of perceived doubling of noise. At CP-2 in the Laguna Atascosa NWR there is a higher ambient sound level so the predicted increase due to cumulative construction noise would be 2.7 dBA $L_{dn,}$ which would be a less than noticible increase.

The predicted sound level impacts for simultaneous operation of all three LNG projects are much lower than construction impacts, with potential increases over the existing ambient sound level between 0.3 and 1.5 dBA L_{dn} at NSAs, resulting in a negligible to minor impact. Construction and operation of the pipeline facilities would not contribute to significant cumulative noise impacts on nearby NSAs. Operational impacts are slightly higher at CP-1 and CP-2, with possible increases in sound levels due to operations of between 1.3 and 4.8 dBA L_{dn}. This is generally considered barely noticible to minor long-term impact. Construction and operation of the pipeline facilities would not contribute to significant cumulative noise impacts on nearby NSAs.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF THE ENVIRONMENTAL ANALYSIS

The conclusions and recommendations presented in this section are those of the FERC environmental staff. Our conclusions and recommendations are based on input from the COE, FWS, NPS, NMFS, FAA, Coast Guard, EPA, DOE, and DOT as cooperating agencies in preparation of this 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 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 conclude that construction and operation of the Rio Grande LNG Project would result in limited adverse environmental impacts. Most adverse environmental impacts would be temporary or short term during construction and operation, but long-term and permanent environmental impacts would also occur as part of the Project. 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. With the exception of certain cumulative impacts that the Project would contribute to (sediment/turbidity and shoreline erosion within the BSC during operations from vessel transits; federally listed ocelot and jaguarundi from habitat loss and the potential for increased vehicular strike during construction; and visual resources from the presence of new facilities), implementation of the mitigation proposed by RG Developers 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 Geologic Resources (Pipeline Facilities)

Construction and operation of the pipeline facilities would not significantly affect or be affected by geologic conditions in the area. Active mining and nonfuel mineral resources would not be affected by construction or operation of the pipeline facilities, and no active or permitted well sites are within or adjacent to the proposed Pipeline System right-of-way or compressor, booster, or meter station sites. In general, the potential for geologic hazards such as earthquakes, soil liquefaction, or landslides to significantly affect construction or operation of the pipeline facilities is low. To avoid potential damage to equipment by flooding, and to minimize the potential for contamination in the event of a flood, critical infrastructure and potential sources of contamination would be elevated. Additionally, Compressor Station 3 would be sited within a flood protection levee to mitigate potential flood hazard.

Subsidence could occur in the Project vicinity due to oil and gas extraction and groundwater withdrawal. Facilities would be within active oil and gas fields and within 200 feet of 13 water supply wells for groundwater withdrawals from the Gulf Coast Aquifer. However, water withdrawal and associated subsidence along the pipeline route would be minimal. The overall effect of the pipeline facilities on topography and geology would be minor. The primary impacts on geologic resources would be due to the permanent alteration of geologic conditions at the aboveground facilities. At the aboveground facilities, grading and filling may be required to create a safe and stable land surface to support the facility. Blasting is not anticipated during construction of the pipeline facilities.

Results of the geotechnical investigation concluded that a shallow foundation system would adequately support lightly loaded structures at the aboveground facilities; however, at the heavily loaded and settlement-sensitive structures at Compressor Station 1, deep foundations consisting of piles are recommended. The pipeline facilities must be designed and installed in accordance with DOT standards, including those in 49 CFR 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards. In addition, RB Pipeline would routinely monitor the geotechnical integrity of its facilities as part of its current operations and maintenance activities, and take any corrective actions necessary to repair damage during the life of the Project. Geotechnical investigations for Compressor Station 2, the booster stations, and proposed HDD locations are pending; therefore, we recommend that the results of these investigations, as well as any mitigation that RB Pipeline would adopt as part of the final engineering design, be provided prior to construction. Based on implementation of the Project-specific Plan and Procedures, and our recommended mitigation measures, we conclude that impacts on geological resources would be adequately minimized and the potential for impacts on the pipeline facilities from geologic hazards also would be minimal.

5.1.2 Soils

Project construction activities such as clearing, grading, excavation, backfilling, and the movement of construction equipment may affect soil resources. To reduce the impacts of construction on soils, RG LNG would implement measures outlined in its Plan and Procedures. Additional mitigation measures would include the installation and maintenance of temporary erosion and sedimentation controls to prevent sediment flow from construction areas into adjacent, undisturbed areas, and regular monitoring and inspection of disturbed areas until final stabilization is achieved. RG LNG would use timber mats and low ground pressure equipment to minimize potential rutting and compaction during wet soil conditions. In severely compacted areas on agricultural land, RB Pipeline would decompact soils by tilling in accordance with its Plan. RG Developers would implement their SWPPPs and SPCC Plans to reduce potential impacts on soils from spills of hazardous materials used during construction and operation; we recommend that these plans be finalized prior to construction. To account for agency input into fugitive dust control specifying that no chemicals may be used in Willacy and Cameron Counties, we recommend that prior to construction RG Developers file their final Fugitive Dust Control Plans for the LNG Terminal and pipeline facilities for review and written approval by the Director of OEP.

Preparation of the LNG Terminal site would include adding material such as cement or lime to stabilize soils, depositing fill to increase ground elevation, and installing aggregate material to provide a safe and level work surface. These activities would permanently alter the soils and increase the potential for erosion until the LNG Terminal is constructed and the remaining exposed soils are stabilized and revegetated. Dredging at the LNG Terminal site would be completed by RG LNG in accordance with permits issued by the COE; dredged materials placement would be conducted in accordance with the Dredged Material Management

Plan, as finalized in coordination with the BND and COE. RG LNG would implement its Unanticipated Contaminated Sediment and Soils Discovery Plan if contaminated materials were encountered. To minimize shoreline erosion, the LNG Terminal waterfront along the BSC would be stabilized from the MOF to the berths and turning basin. RG LNG would maintain the integrity of the shoreline protection throughout the operational life of the LNG Terminal. Given the impact minimization and mitigation measures described above, and our recommendation to provide final plans prior to construction, we conclude that impacts on soils due to construction and operation of the Project would be permanent, but minor.

5.1.3 Water Resources

The Rio Grande LNG Project is within the Gulf Coast Aquifer. Although not a sole-source aquifer, groundwater is the primary water supply source along the northern portion of the Pipeline System (Jim Wells, Kleberg, and Kenedy Counties); surface water is the primary source of drinking water in the southern Project counties. RG Developers anticipate that all water required for operations would be obtained from municipal sources and would not impact the quantity of available groundwater. In addition, for wells within 150 feet of Project workspaces RB Pipeline would offer to perform pre- and post-construction monitoring for changes in well water quality and yield, and to mitigate for any adverse effects due to Project activities. While construction of the Project could result in temporary impacts on groundwater quality and recharge, implementation of RG Developers' Plan and Procedures and SPCC Plans would reduce the potential for groundwater impacts.

The proposed LNG Terminal site is on the north shore of the BSC, a man-made, marine navigation channel that connects to the Gulf of Mexico. The BSC, along with its Entrance Channel and Jetty Channel, form the Brazos Island Harbor. Construction and operation of the LNG Terminal would result in permanent impacts on 174.8 acres of open water, including impacts on the BSC and an open water lagoon within the LNG Terminal site. RG LNG would be required to mitigate for the permanent loss of open water resources and proposes to preserve open water within an off-site wetland mitigation area about 1 mile south of the Project.

Dredging, which would be conducted by hydraulic cutter suction or mechanical dredge, would result in increased suspended solid and turbidity levels in the BSC. All dredging would be conducted using equipment designed to meet the Texas state water quality standards and in accordance with applicable COE permit requirements. Disposal of dredged material would be conducted in accordance with RG LNG's draft Dredged Material Management Plan, as finalized; however, the final management of dredged material would be determined by the BND and COE, in consultation with other federal, state, and local resource agencies and interested stakeholders, including the EPA, NMFS, FWS, and the TCEQ. Because the impacts on surface water quality would be adequately mitigated through adherence to applicable COE permits and the state water quality requirements for dredging and dredged material management, we conclude that dredging and dredged materials placement for construction of the LNG Terminal would have temporary and minor impacts on water quality.

Based on the results of hydrodynamic modeling conducted for the proposed widening of the BSC, the COE determined that the Brazos Island Harbor Project, a separate federal action not directly related to the proposed Project, would result in only negligible differences in surface water conditions (including tidal velocity, water surface elevations, and tidal range in the Laguna Madre). RG LNG's hydrodynamic model similarly indicated negligible changes on water conditions due to Project dredging, including modeled current speeds for both the current and deeper proposed depth of the BSC. RG LNG's hydrodynamic modeling also indicated that maintenance dredging would be required every 2 to 4 four years to maintain adequate depths.

RG LNG estimates that 880 barges and support vessels would deliver construction materials and equipment to the MOF and Port of Brownsville during LNG Terminal construction. During operation, about 312 LNG carriers would call on the LNG Terminal per year (about 6 LNG carriers per week). Vessel traffic during construction and operation could increase shoreline erosion and suspended sediment concentrations due to increased wave action. To minimize these impacts, the channel embankments and slope of the LNG Terminal site along the BSC, the marine loading berths, and the turning basin would be stabilized using rip-rap. Although FERC does not have jurisdiction over the transit of LNG carriers through the BSC, final permitting for the Brazos Harbor Channel Improvement Project should account for the impacts of these larger vessels on the stability of unarmored shorelines due to vessel passage and reflective wave energy.

During the 20- to 24-hour LNG loading period, each LNG carrier serving the LNG Terminal is anticipated to discharge about 10 million gallons of ballast water and withdraw/discharge up to 12 million gallons of water for engine-cooling and hoteling. Ballast water discharges at the LNG Terminal could impact water quality by changing the salinity, temperature, pH, and dissolved oxygen level of water within the BSC. Impacts on surface waters as a result of cooling water intake and discharge would be primarily limited to an increase in water temperature in the vicinity of the LNG carrier. As the volume of discharge per vessel would be negligible compared with the total volume of the BSC (estimated to be about 25 billion gallons), and because the LNG carriers would conduct ballast water exchanges in accordance with Coast Guard regulations, we conclude that impacts on surface water quality resulting from ballast and cooling water would be minor.

Before placing each component of the LNG Terminal into service, LNG tanks, non-cryogenic piping, and freshwater storage tanks would be hydrostatically tested. LNG tanks would be tested using about 30 million gallons of seawater each (120 million gallons total), which would be withdrawn from the BSC, and treated via filtration or use of a corrosion inhibitor, if needed, before use. Following each hydrostatic test, water would be transferred to the onsite stormwater ponds and tested for contamination prior to release in accordance with applicable discharge permits. RG LNG developed a draft LNG Tank Hydrostatic Test Plan for the use of water from the BSC for hydrostatic testing, which we recommend be finalized prior to construction. Hydrostatic test water used in the Pipeline System would be withdrawn from three waterbodies crossed by the pipelines (Los Olmos Creek, Arroyo Colorado, and Resaca De Los Cuates), and water would be re-used across different pipe segments to decrease the total volume of water required; about 45 million gallons of water would also be withdrawn from these waterbodies for dust suppression.

The Pipeline System would cross 62 waterbodies. One intermittent waterbody would be crossed by the Header System via an open cut crossing method. The centerline of Pipeline 1 would cross 62 waterbodies, including 21 perennial streams, 19 intermittent streams, 9 ephemeral streams, and 13 ponds and reservoirs. These waterbodies would be crossed using various crossing methods, including conventional bore and HDD. With minor differences in crossing methods, Pipeline 2 would affect the same waterbodies. RB Pipeline has also requested deviations to our Procedures (section V.B.2.a) to locate ATWS within certain ephemeral waterbodies, which would require grading the waterbodies to provide a level workspace. We do not find the justification for use of these ATWS to be adequate and recommend that RB Pipeline provide additional justification or updated Project information, as applicable.

One or more waterbodies that would be crossed via HDD may be regulated by the IBWC; we recommend that prior to the end of the draft EIS comment period, RB Pipeline consult with the IBCW to identify any regulated waterbodies and to determine whether the proposed crossing methods are sufficient to minimize impacts. No active surface water intakes for public water supply are within 3 miles downstream of the Pipeline System or LNG Terminal.

RB Pipeline would minimize potential impacts on surface waters by implementing its Procedures and utilizing trenchless crossing methods for 26 of the 34 waterbodies anticipated to be flowing at the time of construction. Following construction of each pipeline, waterbody contours would be restored to pre-construction conditions, and riparian areas would be revegetated using native grasses, legumes, and woody species, and allowed to return to pre-construction conditions. With implementation of RG Developers' Plan and Procedures, SWPPPs, SPCCs, additional mitigation measures included in the EIS, adherence to applicable permits, and our recommendations, we conclude that impacts on groundwater and surface water resources would be adequately minimized.

5.1.4 Wetlands

Construction of the LNG Terminal would result in the permanent loss of 182.4 acres of wetlands and special aquatic sites, including 114.9 acres of EEM, 19.8 acres of ESS (mangroves), and 47.7 acres of mudflats. RB Pipeline has proposed a 75-foot-wide construction right-of-way for the majority of wetland crossings less than 1,000 feet in length. For wetlands with crossing lengths greater than 1,000 feet, RB Pipeline has proposed a construction right-of-way width of 100 feet. Construction workspace for Pipeline 1 would impact a total of 134.7 acres of wetlands, including 9.6 acres of PFO wetlands, 3.2 acres of PSS wetlands, 115.6 acres of emergent (PEM and EEM) wetlands, and 6.2 acres of mudflats (EUS). About 18 months after the construction of Pipeline 1, Pipeline 2 would be constructed within the same right-of-way, which would impact the same wetlands in early successional stages of regrowth. Following construction, wetlands would be restored to pre-construction conditions and would be allowed to revegetate naturally, or by RB Pipeline's use of seed mixes in accordance with NRCS recommendations. Of the 104.8 acres of wetlands within the permanent footprint of the Pipeline System, 7.4 acres would be PFO and 3.2 acres would be PSS wetland.

RG Developers would implement their Procedures to control erosion and restore the grade and hydrology after construction in wetlands. In accordance with its Procedures, RB Pipeline would consult with the COE to develop a Project-specific wetland restoration plan. RG LNG is also developing a plan to mitigate for wetland impacts; its Conceptual Mitigation Plan identifies the potential to acquire and preserve a portion of the Loma Ecological Preserve in perpetuity, and to transfer the land to a land manager, such as the FWS. The COE has not approved RG LNG's Conceptual Mitigation Plan and is working with RG Developers, in conjunction with the FWS, NMFS, EPA, and TPWD to revise the proposed mitigation measures as appropriate.

The FERC Procedures (section VI.A.6) specify that aboveground facilities, with few exceptions, should be located outside of wetlands. Although RG LNG proposes to site the LNG Terminal (including Compressor Station 3) in wetlands, we determined that the proposed location is the most environmentally preferable and practical alternative that meets the Project's stated purpose. However, the placement of the LNG Terminal in wetlands must be approved by the COE prior to construction. RG Developers have requested additional alternative measures from our Procedures that we have reviewed and deem to be unacceptable; we recommend that, prior to the end of the draft EIS comment period, RG Developers file updated Project information, or updated justification for their proposed use of certain workspaces in wetlands and use of a proposed haul road that would be constructed through wetlands. RB Pipeline has also identified temporary workspace near once wetland that is inaccessible from the right-of-way; we recommend that, prior to construction, RB Pipeline reconfigure the right-of-way at this location (MP 36.5).

With adherence to measures contained in the Project-specific Procedures, applicable COE permits, and our recommendations, impacts on wetlands would be reduced, with the majority of adverse permanent impacts occurring at the LNG Terminal site. We anticipate that the COE's CWA Section 404/Section 10 permit for the Project would be conditioned to effectively offset the Project-related adverse impacts on waters of the United States by wetland mitigation, such that impacts would be reduced to less than significant levels.

5.1.5 Vegetation

RG LNG has leased a 984.2-acre property from the BND for placement of the Rio Grande LNG Terminal. The property is generally low-lying (elevations of less than 10 feet), with higher-elevation features (up to 25 feet high) including lomas (coastal clay dunes) and dredge spoil piles. The site itself is dominated by a lagoon, tidal flats, and marshes on the east; a mud/salt flat complex and mangroves on the west; and a terraced area in the center and along the banks of the BSC that was used as historic dredge spoil placement. A total of 750.4 acres of land would be cleared during construction at the LNG Terminal site, including 562.9 acres of vegetated land that would be permanently converted to industrial use associated with operation of the facility. This permanent conversion would result in the loss of 191.5 acres of upland herbaceous land, 189.1 acres of upland shrub/forest land, 162.5 acres of emergent wetlands, and 19.8 acres of shrub/forested wetlands. About 233.8 acres of land, including 103.5 acres of wetland habitat, is present outside the boundary of the proposed facilities, but within the larger parcel leased by RG LNG, and would generally be maintained as a natural buffer.

Construction of the Header System and Pipeline 1, including ATWS, would affect 1,990.7 acres of vegetation, including 841.3 acres of upland herbaceous land, 533.9 acres of agricultural land, 480.8 acres of upland shrub/forest land, 121.9 acres of emergent wetlands, and 12.8 acres of shrub/forested wetlands. Following construction, 500.3 acres of upland herbaceous land, 321.2 acres of agricultural land, 285.1 acres of upland shrub/forest land, 94.2 acres of emergent wetlands, and 10.6 acres of shrub/forested wetlands within the permanent easement would be restored to pre-construction conditions, but would be subject to routine maintenance. Shrub/forest land within maintained portions of the permanent right-of-way would be permanently converted to herbaceous or early successional-stage scrub-shrub land. Pipeline 2 would be installed within the same 125-foot-wide construction right-of-way affected by Pipeline 1. As such, all land disturbed by the construction of Pipeline 2 would have been previously disturbed during the construction of Pipeline 1. Aboveground facilities for the Pipeline System would permanently convert vegetation to a developed state.

RG Developers conducted noxious and invasive weed surveys at the LNG Terminal site and along accessible portions of the pipeline route. No state listed weeds were identified; however, additional surveys along the pipeline route would be conducted prior to construction, and RB Pipeline would implement its Noxious and Invasive Plant Management Plan to control the potential spread of weeds.

Two vegetation communities of concern occur within proposed Project workspaces, including lomas and south Texas salty thornscrub. Although neither community is a protected habitat, they are considered habitat for the federally endangered ocelot and northern aplomado falcon. Three lomas are within the LNG Terminal site, one of which would be lost during construction. As no special vegetation communities have been noted as occurring on these lomas, the loss of this habitat would be considered a permanent, but minor impact. Construction and operation of the LNG Terminal would result in the conversion of 138.4 acres of south Texas salty thornscrub habitat to developed land. No land classified as south Texas salty thornscrub was identified within the footprint of the pipeline facilities. As this habitat is particularly important to the federally listed ocelot, we recommend that RG LNG consult with the FWS to develop appropriate mitigation for its loss.

Overall, the Project would result in temporary to permanent impacts on vegetation. The Impacts of the Pipeline System would generally be temporary or short-term, although vegetated habitat would be converted to industrial/commercial land within the footprint of the aboveground facilities, and would be maintained as herbaceous or early successional scrub-shrub habitat within the permanent right-of-way. Construction and operation of the LNG Terminal would result in permanent impacts on vegetation within the footprint of the facility, although impacts on wetland vegetation would be mitigated as required by the COE under Section 404 of the CWA.

5.1.6 Wildlife and Aquatic Resources

Construction of the LNG Terminal site, including Compressor Station 3, would affect the vegetated wildlife habitat identified above, as well as 174.8 acres of open water onsite and in the proposed dredging areas. This habitat would be permanently converted to an industrial state, resulting in displacement, stress, and direct mortality of some individuals. To minimize the potential for direct mortality during initial clearing, RG LNG would conduct pre-construction surveys and hazing at the LNG Terminal property to flush wildlife from the site prior to completing the fencing. Impacts from construction and operation of the LNG Terminal from increased human activity, lighting, and noise are not anticipated to result in significant impacts on wildlife populations, given that local wildlife are likely acclimated to the increased noise and human presence associated with the adjacent SH-48 and BSC. However, the direct loss of habitat and the indirect effects associated with displacement indicate that the construction and operation of the proposed LNG Terminal would result in a minor to moderate, permanent impact on local wildlife.

The Header System and Pipeline 1 would affect 1,998.6 acres of wildlife habitat, including 841.3 acres of upland herbaceous land, 533.9 acres of agricultural land, 480.8 acres of upland shrub/forest land, 121.9 acres of emergent wetlands, 12.8 acres of shrub/forested wetlands, and 7.9 acres of open water. Following construction, 500.3 acres of upland herbaceous land, 321.2 acres of agricultural land, 285.1 acres of upland shrub/forest land, 94.2 acres of emergent wetlands, and 10.6 acres of shrub/forested wetlands within the permanent easement would be restored to pre-construction conditions but would be subject to routine maintenance; 6.4 acres of water within the permanent right-of-way would not be subjected to routine maintenance. Shrub/forest land within maintained portions of the permanent right-of-way would be permanently converted to herbaceous or early successional-stage scrub-shrub land. Pipeline 2 would be installed within the same right-of-way as Pipeline 1. Similar to impacts at the LNG Terminal, wildlife would experience displacement, stress, and direct mortality during construction of the pipeline facilities; however, most impacts would be restricted to periods of active construction and the habitat would re-establish over time after construction had been completed, with the exception of aboveground facilities and the permanent right-of-way, which would be periodically maintained.

The proposed Project is within the migratory bird Central Flyway, which generally covers the central portion of North America and into Central America. South Texas acts as a funnel for migratory birds as they try to avoid flying too far east (into open Gulf waters) or west (into desert habitat). RG LNG proposes measures to avoid or minimize impacts on migratory birds and has developed a MBCP outlining the measures that it would implement, as practicable, during construction of the Project; RB Pipeline would also implement measures in this plan if vegetation clearing along the Pipeline System would be conducted between March 1 and August 31. Because of the high use of habitat at the LNG Terminal by migratory birds (including birds of conservation concern), we agree that the measures in RG LNG's MBCP are appropriate and we recommend that the plan be finalized in consultation with the FWS. We have also determined that the overall increase in nighttime lighting during construction and operation of the proposed Project would result in permanent, but minor impacts on resident or migratory birds.

Sensitive or management wildlife habitat in the vicinity of the Project includes the Laguna Atascosa and Lower Rio Grande Valley NWRs. Operational noise at the LNG Terminal would increase ambient noise in adjacent areas of the Laguna Atascosa NWR, which could result in moderate impacts on wildlife through increased avoidance; however, no significant changes in general wildlife behaviors further within the NWR are anticipated, as noise attenuates over distance. Although the LNG Terminal would not be within 0.25 mile of the Lower Rio Grande Valley NWR, RB Pipeline is proposing to place three ATWS within its boundaries. Although RB Pipeline has indicated its intent to modify ATWS within the NWR subsequent to civil survey; we recommend that RB Pipeline provide updated information prior to construction that avoids surface impacts on the NWR. Further, we recommend that RB Pipeline provide ambient sound levels at an HDD location adjacent to this NWR at MP 115.6, and identify any necessary mitigation, prior to construction.

Loss or disturbance of vegetation decreases available habitat for pollinator species, including bats, bees, hummingbirds, butterflies, wasps, moths, and flies, that require plant pollen and/or nectar for food. RG Developers have consulted with the NRCS to develop preliminary seeding mixes for use during restoration that would enhance the habitat for pollinator species, which includes predominantly native grasses. However, native pollinators need a diversity of flowering (nectar-producing) plants and nesting sites to be successful and RG Developers have not indicated their intent to incorporate native flowering species into their seed mix, which could provide an energy source for local and migrating pollinators. Therefore, we recommend that, prior to construction, RG Developers consult with the NRCS and FWS to develop final seed mixes that incorporate native flowering plants.

Construction of the Rio Grande LNG Project would result in minor impacts on aquatic resources due to water quality impacts and direct mortality of some immobile individuals during dredging for the LNG Terminal and installation of the Pipeline System across waterbodies. During operations, the Project would have minor impacts on aquatic resources due to maintenance dredging and increased marine vessel traffic. Permanent impacts on aquatic habitat would occur where open water would be converted to industrial/commercial land within the LNG Terminal site and where dredging would convert existing wetlands and mudflats to open water. Impacts on aquatic resources due to increased turbidity and suspended solid levels would vary by species; however, the aquatic resources present within the Project area are likely accustomed to regular fluctuations in noise and turbidity levels from maintenance dredging within the BSC. To minimize impacts on aquatic resources due to increased turbidity and suspended solid levels, RG LNG would use equipment designed to meet Texas state water quality standards and in accordance with applicable COE permit requirements which include turbidity minimization methods as well as avoidance of adverse effects to water quality and aquatic. With the implementation of these permit requirements and mitigation measures, we have determined that the Project would have temporary and minor impacts on fisheries and aquatic resources.

Portions of the BSC, wetlands, waterbodies, and mudflats on the LNG Terminal site, the Bahia Grande Channel, and the water column at potential dredged material disposal sites have been designated as EFH. Although the activities would result in the alteration of habitat and the mortality or displacement of individuals, the impacts on EFH and the species and life stages that utilize EFH would be permanent, but minor. As part of the consultation under the MSFCMA, NMFS may provide recommendations to FERC regarding further measures that can be taken to conserve EFH. We would respond to any such recommendations per the requirements of the MSFCMA.

5.1.7 Threatened, Endangered, and Other Special-status Species

A total of 24 species that are federally listed as threatened or endangered, or those that are candidates, proposed, or under review for listing, may occur in counties affected by the Project. Within these counties, or offshore of them, critical habitat has been designated for two species, the piping plover and the loggerhead sea turtle. We determined that the Project would have *no effect* on one federally listed and one candidate species, is *not likely to adversely affect* 17 federally listed (or proposed) species, and would *not result in a trend towards federal listing* for two species (one candidate and one that is under review). We have also determined that the Project would not be likely to destroy or adversely modify designated critical habitat for the loggerhead sea turtle. Our *not likely to adversely affect* determinations for the West Indian manatee and federally listed plants are based on our recommendations to conduct appropriate training and complete applicable surveys, respectively.

We have determined that the Project *is likely to adversely affect* the northern aplomado falcon, piping plover (and its critical habitat), and the ocelot based on direct and indirect habitat impacts, and consideration of how those habitat impacts would affect the recovery of the species. For further protection of the northern aplomado falcon, we have recommendations related to nest identification, monitoring, and implementation of BMPs for the species. For further protection of the ocelot, we recommend that RG Developers develop a plan to mitigate for the loss (or decrease in quality) of suitable habitat where ocelots are known to exist. Because consultation with the FWS and NMFS is ongoing, we recommend that the FERC staff completes any necessary ESA consultation with these agencies prior to construction.

In consultation with the TPWD and review of county species lists, we identified 30 species that are state listed as threatened or endangered with the potential to occur in the Project area. RB Pipeline has proposed use of the Texas Tortoise BMPs during construction to minimize the potential for impacts on the species; however, as the Texas tortoise was identified during surveys on the LNG Terminal site, we note that RG Developers may need to work with the TPWD to mitigate potential impacts on this species. With implementation of RG Developers' Plan and Procedures, SWPPPs, and SPCCs, we have determined that state listed species would not be significantly affected by the Project. In addition, dolphins, which are protected under the MMPA, may be affected by noise produced by in-water pile-driving at the LNG Terminal site. Although RG LNG has minimized this potential by restricting in-water pile-driving to just four conventional piles and one sheet pile, we recommend that RG LNG consult with the NMFS to identify mitigation measures to avoid or minimize noise-related impacts from in-water pile-driving.

5.1.8 Land Use, Recreation, and Visual Resources

Construction of the Rio Grande LNG Project would occur predominately on large tracts of land classified as open land with scrub-shrub vegetation and would affect about 3,655.6 acres of open land, shrub/forest land, agricultural land, barren land, emergent wetlands, open water, and industrial/commercial land. About 2,147.8 acres of the affected area would be maintained for operation of the Project. A portion of the Project is within the designated coastal zone, which is managed by the RRC. We recommend that RG Developers file documentation of concurrence from the RRC that the Project is consistent with the Texas CZMP.

RG Developers would construct the Project across or near several recreation areas, including a National Historic Landmark (King Ranch); the Lower Rio Grande Valley and Laguna Atascosa NWRs; the Zapata boat launch; land planned for conservation through the Bahia Grande Coastal Corridor Project; four Great Texas Coastal Birding Trails; and three conservation easement areas under the CRP. The pipelines would directly affect each of these recreation areas, except for the Laguna Atascosa NWR. However, construction of the Pipeline System would last a few weeks in any one area, except at 19 discrete locations along the Pipeline System (including areas adjacent to recreation/special use areas) where up to 10 weeks would be required for crossings accomplished by HDD; therefore, impacts would be temporary. To ensure proper mitigation of impacts on conservation easements, we recommend that RB Pipeline consult with the applicable agencies regarding the specific location of parcels under contract and identify appropriate mitigation measures on them. While RB Pipeline is proposing use of ATWS within the Lower Rio Grande Valley NWR, we recommend that RB Pipeline adjust these workspaces to avoid impacts on the NWR.

In addition to the special use areas, recreational boating and fishing activities occur within the BSC, Bahia Grande Channel, and San Martin Lake and could be affected by construction and operation of the LNG Terminal due to increased noise, restrictions on fishing in the immediate vicinity of the LNG Terminal, and vessel traffic. Increased noise associated with construction of the Project could deter recreational users from fishing in the immediate vicinity of Project activities. In particular, dredging activities, which would take place 24 hours per day, 7 days per week, during a two-week period; and land- and water-based pile-driving which would occur at discrete points during construction for periods as short as a few days to as long as five months, could result in avoidance of these areas by recreational users. In addition, construction of the Pipeline System across the Zapata boat launch would be accomplished by HDD, and could take up to 10 weeks. As a result, we have determined that there would be moderate impacts on recreational use of the Zapata boat launch during construction of the Pipeline System.

The nearest residential areas to the LNG Terminal are in Port Isabel and Laguna Heights, Texas, (about 2.2 miles north and northeast, respectively). Views of the LNG Terminal would generally be associated with mobile receptors such as motorists on SH-48, and boaters on the BSC or in the Bahia Grande Channel; these receptors may experience moderate impacts on the viewshed from the presence of the LNG Terminal. RG LNG's siting of the LNG Terminal along the BSC, which supports the movement of domestic and foreign products, and in proximity to the Port of Brownsville, result in it being consistent with current industrial use. Lighting at the LNG Terminal would be minimized to the extent practicable to maintain safe working conditions.

Numerous public comments identified concerns with the visual impact of the LNG Terminal to surrounding communities, specifically including Port Isabel and South Padre Island. Based on our review of visual simulations conducted by RG LNG, most public vantage points (e.g., the Port Isabel lighthouse, historic battlegrounds/landmarks, Isla Grand Hotel) are at a distance far enough away from the LNG Terminal site that impacts on the viewshed would be permanent, but negligible or minor. Visual receptors within nearby waters north of the LNG Terminal site, such as Laguna Madre, would be at lower elevations and/or far enough away such that the nearby shoreline areas would obscure the LNG Terminal site. Visual receptors at locations closer to the LNG Terminal site (e.g., SH-48, the Bahia Grande Channel, and the Zapata boat launch), would be able to discern individual structures; however, these receptors would generally not be stationary and therefore would have a short viewing time (i.e., until the vehicle or vessel passes the site). Based on these considerations, we conclude that the visual impact of the LNG Terminal would be permanent, but negligible to moderate, dependent on the elevation and proximity of the viewers.

Given the siting of the Pipeline System on larger tracts of land, no planned residential developments would be within 0.25 mile, and no residences are within 50 feet of proposed construction work areas. Although three residences are within 50 feet of proposed access roads; these roads are existing and would be used without modification. RB Pipeline would affect visual resources along the pipeline route by vegetation clearing along the right-of-way and construction of the pipeline facilities. Visual impacts on the greatest number of people would occur where the pipeline route parallels or crosses roads, trails, or prominent offsite observation points and other places where the right-of-way may be seen by passing motorists or recreationists. The presence of construction personnel and equipment would result in short-term impacts on the viewshed of those areas. Although clearing of shrub/forest land would result in minor long-term and permanent impacts on the viewshed, we conclude that the visual character would not change substantially from existing conditions given the presence of other oil and gas pipeline easements throughout the Project area and RB Pipeline's effort to site the pipelines within or directly adjacent to existing pipeline corridors (about 66.4 percent of the route). Similarly, although passing motorists may be able to view Compressor Station 2 from U.S. Highway 77, we conclude that there would be no significant impacts on visual resources at Compressor Stations 1 and 2 given the distance to the nearest residences (2.9 miles or greater).

5.1.9 Socioeconomics

Construction of the Rio Grande LNG Project would generally have a minor impact on local populations, employment, housing, provision of community services, and property values. There would not be any disproportionately high or adverse environmental and human health impacts on low-income and minority populations from construction or operation of the Project. No residences or businesses would be displaced as a result of construction or operation of the LNG Terminal or pipeline facilities.

Construction of the LNG Terminal would occur in phases over a 7-year period. RG LNG expects an average monthly construction workforce of 2,950 workers would be required, with a peak workforce of 5,000 workers during a 17-month period. About 30 percent of the workforce is expected to be hired locally, resulting in on average 2,065 non-local workers and a maximum of 3,658 non-local workers. Assuming non-resident workers would be accompanied by family members, and based on the average household size in Texas, up to 10,058 non-local persons and family members could relocate to the affected area during construction of the LNG Terminal, which would represent a 0.8 percent increase in the total population within Cameron, Willacy, and Hidalgo Counties. Given the number of housing units that we estimate would be available for rent to the workforce (75,406 units), no serious disruptions to housing and temporary accommodations are anticipated. Operation of the LNG Terminal would require 108 workers, all of which are expected to be non-local hires.

RB Pipeline estimates the average monthly workforce would be 1,240 workers, with a peak of 1,500 workers, during the first two stages of construction, which would last about 12 months. The workforce would be concentrated near the compressor stations with an average monthly workforce of 160 workers each (including Compressor Station 3); the remaining workers would be separated into two construction spreads along the Header System and Pipeline 1. Stages 3 through 6 would require smaller workforces, estimated to be 240 workers each month on average with 300 workers at the peak of construction efforts.

RB Pipeline estimates that about 10 percent of the workers for the pipeline facilities would be hired locally. Based on the expected peak construction workforce, the addition of 1,350 non-local workers would result in a negligible increase in the affected area's population (0.003 percent). Within the affected area for the pipeline facilities, a total of 38,212 housing units would be available for rent to the workforce, including hotel and motel rooms, vacant housing units, and RV sites. This inventory of housing units indicates that sufficient lodging units would be available to accommodate the non-resident workers. Twenty permanent workers, including three to four staff at each compressor station, would be required for operation of the pipeline facilities. This workforce and their families would represent a permanent but minor increase in the local population and housing requirements.

Impacts on roadways in the Project area would include potential delays from increased traffic levels and diminished roadway capacity. To identify, quantify, and recommend mitigation for traffic impacts on area roadways during construction of the Rio Grande LNG Project, RG Developers commissioned a *Traffic Impact Analysis*, which recommended several improvements to safely accommodate access to the LNG Terminal, as well as strategic scheduling of deliveries and arrival/departure of construction workers to limit congestion. RG LNG committed to the measures recommended in the *Traffic Impact Study*, as well as hiring off-duty police officers to direct traffic during peak commuting hours and installing roadway warning signs to notify travelers of construction activities. To further minimize impacts on traffic congestion, we recommend that, prior to the end of the draft EIS comment period, RG Developers develop traffic monitoring and mitigation procedures in consultation with applicable transportation authorities. Additionally, if onsite parking becomes limited RG LNG would be provided offsite parking at a 25-acre Port of Brownsville temporary storage area on the south side of SH-48. Construction workers would be bused from this location to the LNG Terminal site. With the implementation of the proposed measures, we have determined that impacts from construction of the LNG Terminal would have temporary and minor impacts on local users of the roadway network.

Marine barge transportation would supplement truck transport for delivery of construction materials to the LNG Terminal site. RG LNG anticipates about 880 barge deliveries over the 7-year construction period for the LNG Terminal site, which represents a 25 percent increase in the current barge traffic. In addition to increased vessel traffic during construction, dredging for the marine facilities would temporarily reduce the area of the BSC available for vessel transit. RG LNG would coordinate with local authorities so that dredging activity would not restrict large vessels from transiting the BSC during the limited period for which this activity would be required. The additional vessels in the BSC during construction would not result in an exceedance of the channel's traffic capacity. Based on these considerations we anticipate that the overall impact on recreational boating and fishing would be minor.

The BSC currently experiences about six large vessels per week (i.e., about two transits per day) calling at the Port of Brownsville, including cargo vessels, tankers, and ocean barges. During operation of the Project, about 312 LNG carriers would call on the LNG Terminal per year, or about 6 per week. In a letter dated December 26, 2017, the Coast Guard issued the LOR for the Project, which stated that the BSC is considered suitable for LNG marine traffic in accordance with the guidance in the Coast Guard's NVIC 01-2011. The WSA review focused on the navigation safety and maritime security aspects of LNG carrier transits along the BSC. The WSA itself is designated Sensitive Security Information as defined in 49 CFR 1520. Because any unauthorized disclosure of these details could be employed to circumvent the proposed security measures, they are not releasable to the public. Based on the Coast Guard's LOR for the Project, the expected doubling in large vessel traffic, and the potential to preclude vessel traffic 30 hours per week, we have determined that operation of the LNG Terminal would result in a permanent and moderate increase in marine traffic within the BSC, based on current conditions.

Construction of the pipelines would increase traffic on roadways, most notably during the first year of construction. Use of a segment of FM 106 in Cameron County during construction of the pipeline facilities was not recommended per the findings of the *Traffic Impact Analysis*; however, RB Pipeline has stated that it would use FM 106. To further minimize impacts on traffic congestion, we recommend that, prior to the end of the draft EIS comment period, RG Developers identify traffic mitigation procedures in consultation with applicable transportation authorities.

Construction of the Rio Grande LNG Project would result in positive impacts due to increases in construction jobs, payroll taxes, purchases made by the workforce, and expenses associated with the acquisition of material goods and equipment. Operation of the Project would have a positive effect on the local governments' tax revenues due to the increase in property taxes that would be collected.

5.1.10 Cultural Resources

To date, our responsibilities under Section 106 of the NHPA have not been completed and are pending the completion of all outstanding cultural resources surveys and subsequent review of the resulting reports and/or plans by FERC staff and the SHPO. We recommend that RG Developers file documentation of consultation with the SHPO, NPS, and Advisory Council on Historic Preservation prior to construction to ensure the FERC's responsibilities under Section 106 are met. Cultural resources field surveys have been completed for approximately 75 percent of the pipeline facilities, including 35.2 miles of access roads. Surveys have been completed for the entire LNG Terminal site, including 4.5 miles of the non-jurisdictional BND Utility Corridor, 2.9 miles of SH-48 turning lanes, the two offsite storage/parking areas, and a 1.3-mile-long section of the 1.8-mile-long temporary haul road.

Surveys for the remainder of the pipelines (including along the Header System) remain incomplete due to access restrictions. This includes approximately 30 miles of the Project that crosses the King Ranch National Historic Landmark. These surveys will be completed once access is obtained.

RG Developers have conducted viewshed and noise impacts assessments of two National Historic Landmarks, including the Palmito Ranch Battlefield and the Palo Alto Battlefield, and concluded that due to distance and topography, visual impacts would be moderate and minor, respectively. They also concluded that the Project would have no noise impacts on the National Historic Landmarks.

RG Developers contacted seven Native American tribes with requests for consultation; four responded with requests to review survey reports and to be notified in the event of unanticipated discoveries, including human remains. We sent our NOI and follow-up letters to the same tribes; no responses were received. RG Developers requested comments from 13 other parties, including local historic preservation groups and museums. Of these groups, three responded. No concerns were expressed by any of the responding organizations.

RG Developers submitted a plan to the FERC and SHPO for addressing unanticipated discovery of cultural resources or human remains during construction. We and the SHPO requested revisions to the plan. RG Developers submitted a revised plan which we find acceptable. The SHPO concurred with the plan on November 10, 2016.

5.1.11 Air Quality and Noise

5.1.11.1 Air Quality

The Project would be located in areas currently classified as being in attainment for all criteria pollutant standards. Air pollutant emissions during construction of the Project would result from the operation of construction vehicles, marine traffic, vehicles driven by construction workers commuting to and from work sites, and fugitive dust generated during construction activities. Air quality impacts due to construction would generally be localized, and are not expected to cause or contribute to a violation of applicable air quality standards. Combustion emissions during construction at the LNG Terminal site would occur over a longer period than construction of the pipeline facilities. RG Developers would minimize combustion emissions by using bus transportation during construction, limiting engine idling, using recent models of construction equipment, and conducting regular inspections of construction vehicles. Fugitive dust emissions would be minimized through implementation of RG Developers' Fugitive Dust Control Plans. Based on our independent review of the analyses conducted and mitigation measures proposed, we conclude that construction of the Project would result in elevated emissions near construction areas and would impact local air quality. However, construction emissions would not have a long-term, permanent effect on air quality in the area.

The LNG Terminal (including Compressor Station 3) would be a PSD major source and a Title V major source for certain criteria pollutants, HAPs, and GHGs. On March 21, 2017, RG Developers submitted a revised application to the TCEQ for a PSD permit for the LNG Terminal and Compressor Station 3. The results of ambient pollutant concentration modeling and ozone modeling conducted by RG Developers show that the LNG Terminal and Compressor Station 3 would not cause or significantly contribute to an exceedance of the NAAQS. In addition, the results of the State Health Effects modeling evaluation required by the TCEQ for the LNG Terminal indicate that the Project emissions are below applicable effects screening levels, and therefore adverse health effects are not expected. However, concurrent emissions from staged construction, commissioning and start-up, and operations of the LNG Terminal would temporarily impact local air quality and could result in exceedances of the NAAQS in the immediate vicinity of the LNG Terminal during these construction years. These exceedances would not be persistent at any one time during these years due to the dynamic and fluctuating nature of construction activities within a day, week, or month. RG Developers would minimize air quality impacts by adhering to applicable federal and state regulations and installing BACT as described in their PSD permit application to meet the emissions limitations required by the TCEQ. RG Developers plan to submit the Title V permit application for the LNG Terminal and Compressor Station 3 prior to beginning construction.

Compressor Stations 1 and 2 and Booster Stations 1 and 2 would require state minor source permits for all criteria pollutants; RB Pipeline submitted state permits for these facilities on March 24, 2017. In addition, Compressor Stations 1 and 2 would be Title V major sources for NO_x and CO. RB Pipeline would minimize potential impacts on air quality due to operation of the aboveground facilities by adhering to applicable federal and state regulations as described in its air permit applications.

Based on our independent review of the analyses conducted and mitigation measures proposed, we conclude that operation of the Project would have minor impacts on local and regional air quality. However, given the mitigation measures proposed by RG Developers, and air quality controls and monitoring requirements that would be included in the Title V/Prevention of Significant Deterioration permits/state minor source permits for the facilities, the Project would not result in regionally significant impacts on air quality.

5.1.11.2 Noise

Construction activities at the LNG Terminal would generate increased noise levels over a period of about 7 years. Construction activities would occur predominantly during the day, between 7:00 a.m. and 7:00 p.m., Monday through Friday, and site preparation and construction activities (including pile-driving) would be limited to daytime hours. However, dredging may be conducted up to 24 hours per day, 7 days per week. The most prevalent noise-generating equipment and activity during construction of the LNG Terminal is anticipated to be pile-driving, although internal combustion engines associated with general construction equipment would also produce noise that is perceptible at the nearest NSAs. RG LNG plans to use both impact-type and vibratory pile-drivers during each stage of construction of the LNG Terminal, and pile-driving would be conducted both on-land and in-water. During the first stage (including LNG Train 1 and related offsite utilities), land-based pile-driving would require up to 165 days; each subsequent stage of construction and water-based pile-driving would require less time.

The highest expected sound level from pile-driving would occur at nearby NSA 3 when three impact pile-driving platforms are simultaneously in use for installation of the marine berths (56.4 dBA L_{max} at a distance of about 2.8 miles). This level corresponds to a quiet to moderate sound level, and would result in an 11 dB increase over ambient sound levels at NSA 3. As a result, we recommend that RG LNG monitor pile-driving, file weekly noise data, and implement mitigation measures in the event that measured noise impacts are greater than 10 dB over ambient levels at nearby NSAs. Estimated noise levels for site preparation and facility construction (including intermittent pile-driving during which all three pile-drivers do not operate simultaneously) are not estimated to result in significant impacts on NSAs in the LNG Terminal vicinity.

Installation of the pipeline facilities would include noise from internal combustion engines associated with typical pipeline and aboveground facility construction, as well as HDD activities. While most construction activity would take place during daytime hours, RB Pipeline indicated that some specialized construction activities could occur at night (between 10 p.m. and 7 a.m.). If, during construction, RB Pipeline determines that nighttime construction is warranted, it would be required to submit a variance request for review and approval by the Director of OEP including certain details such as projected noise, dust, and light pollution impacts, and identify the measures that RB Pipeline would be implemented to mitigate these impacts.

RB Pipeline conducted an HDD acoustical impact assessment, which found that sound levels for 24-hour HDD operations would exceed FERC's noise criterion of a day-night noise level of 55 dB on the A-weighted scale at NSAs near seven proposed HDDs. While RB Pipeline has identified potential mitigation measures to reduce sound levels during HDD construction, the site-specific measures that it would implement at each location have not been identified. Therefore, we recommend that RB Pipeline prepare a noise mitigation plan for HDDs at MPs 82.0, 92.0, 93.0, 99.8, 101.2, 102.0, and 118.7, which would exceed FERC's noise requirement at the nearest NSAs, and that these plans be implemented during construction.

Typical pipeline installation and facility construction would be temporary at a given location; however, construction at Compressor Stations 1 and 2 would occur in stages over several years. During construction activities, the composite sound level at the NSA nearest to Compressor Station 1 is estimated to be 42.7 L_{eq} (dBA). The recently monitored daytime sound level at this NSA is 38.3 dBA L_{eq}, and the combined ambient and construction sound levels would be 44.1 dBA, a 5.8 dB increase above ambient levels. Construction of Compressor Station 2 would not result in an increase above ambient levels at the nearest NSA. Noise levels would be below the FERC criterion of 55 dBA at both locations.

Operation of the LNG Terminal, and compressor, meter, and booster stations would produce noise on a continual basis during the lifetime of the Project. The results of the noise impact analysis indicate that the noise attributable to construction and operation of the LNG Terminal would be lower than the FERC noise level requirement at the nearest NSAs and the Palmito Ranch Battlefield (between 3.7 and 5.4 miles from the LNG Terminal site), and the predicted increases in ambient noise would be below perceptible levels (between 0.1 and 0.4 dB). To ensure that NSAs are not significantly affected by noise during operation of the LNG Terminal, we recommend that RG LNG conduct post-construction noise surveys after each after each noise-producing unit (e.g. each liquefaction train and compressor) is placed into service and once the entire LNG Terminal (including Compressor Station 3) is placed into service. If the noise attributable to operation of the equipment at the LNG Terminal exceeds the FERC threshold at any stage, RG LNG should file a report on what changes are needed and should install additional noise controls to meet the level within 1 year of the in-service date. RG LNG should confirm compliance with these requirements by filing an additional noise survey no later than 60 days after it installs the additional noise controls.

The results of the noise impact analysis conducted for the compressor and booster stations indicates that operation of these facilities would not generate noise that exceeds FERC sound level requirements or results in an increase in ambient sound levels at the nearest NSAs. To further ensure that NSAs are not significantly affected by noise during operation of the pipeline facilities, we recommend that RB Pipeline conduct post-construction noise surveys after each compressor unit is placed into service, as well as after the completed stations are operational. No NSAs are within 1 mile of the stand-alone meter stations proposed for the

Project; therefore, operation of these facilities is not expected to result in perceptible noise impacts at any NSAs.

While construction of the Rio Grande LNG Project would result in localized minor to moderate elevated noise levels near construction areas, impacts would be limited to the construction period for the Project. During operations, noise impacts would be minor at the aboveground facilities along the Pipeline System and at the NSAs in the vicinity of the LNG Terminal. Based on the analyses conducted, mitigation measures proposed, and with our additional recommendations, we conclude that construction and operation of the Project would not result in significant noise impacts on residents and the surrounding communities.

5.1.12 Reliability and Safety

As part of the NEPA review and NGA determinations, Commission staff assessed the potential impact to the human environment in terms of safety and whether the proposed facilities would be in the public interest based on whether it would operate safely, reliably, and securely.

As a cooperating agency, the DOT assisted FERC staff in evaluating whether RG LNG's proposed design would meet the DOT's 49 CFR Part 193 Subpart B siting requirements. The DOT reviewed the design spill information submitted by RG LNG, and on November 29, 2016, provided a letter to FERC staff stating that the DOT had no objection to RG LNG's design spill selection methodology to comply with the 19 CFR 193 siting requirements for the LNG Terminal facilities. The DOT will provide an LOD on the Project's compliance with 49 CFR Part 193 Subpart B. This determination will be provided to the Commission as further consideration to the Commission on its decision to authorize or deny the Project. If the Project is authorized and constructed, the facility would be subject to the DOT's inspection and enforcement program; final determination of whether a facility is in compliance with the requirements of 49 CFR 193 would be made by the DOT staff.

Furthermore, DOT's 49 CFR 192 requirements would apply to the currently under construction VCP that would be routed through the northern part of the LNG Terminal site. FERC staff has evaluated the potential risk and impact from an incident on the VCP. Based on PHMSA's incident data, the likelihood of a pipeline incident or failure would be low, and a worst-case pipeline rupture scenario would be even less likely. If a pipeline incident were to occur, the likely consequences from these cascading effects would not reach the public. To protect the VCP during construction and operation of the Project, RG LNG has identified extra protective measures, and we have made additional recommendations regarding temporary and permanent crossings. Therefore, FERC staff does not believe the proposed Project would significantly increase the risk to offsite public.

As a cooperating agency, the Coast Guard also assisted the FERC staff by reviewing the proposed LNG Terminal and the associated LNG marine carrier traffic. The Coast Guard reviewed a WSA submitted by RG LNG that focused on the navigation safety and maritime security aspects of LNG carrier transits along the affected waterway. On December 26, 2017, the Coast Guard issued an LOR to FERC staff indicating the BSC 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 Coast Guard's NVIC 01-11. If the

Project is authorized and constructed, the LNG Terminal would be subject to the Coast Guard's inspection and enforcement program to ensure compliance with the requirements of 33 CFR 105 and 33 CFR 127.

As a cooperating agency, the FAA assisted FERC staff in evaluating impacts on and from the SpaceX rocket launch facility in Cameron County. Specific recommendations are included to address potential impacts from rocket launch failures on the Project. However, the extent of impacts on SpaceX operations, the National Space Program, and to the federal government would not fully be known until SpaceX submits an application with the FAA requesting to launch, and whether the LNG Terminal is under construction or in operation at that time.

FERC staff conducted a preliminary engineering and technical review of the RG LNG design, including potential external impacts based on the site location. Based on this review, we recommend the Commission consider incorporating into any authorization for the Project, a number of proposed mitigation measures, which would ensure continuous oversight prior to initial site preparation, prior to construction of final design, prior to commissioning, prior to introduction of hazardous fluids, prior to commencement of service, and throughout life of the LNG Terminal, in order to enhance the reliability and safety of the terminal to mitigate the risk of impact on the public. With the incorporation of these mitigation measures and oversight, FERC staff concluded that RG LNG's terminal design would include acceptable layers of protection or safeguards that would reduce the risk of a potentially hazardous scenario from developing into an event that could impact the offsite public.

The Pipeline System 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 qualifications; minimum design requirements; and protection from internal, external, and atmospheric corrosion. We conclude that the Pipeline System 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 System would not have a significant impact on public safety.

5.1.13 Cumulative Impacts

We considered the potential contributions of the Project to cumulative impacts in specific cumulative impact areas for the affected resources. As part of that assessment, we identified existing projects, projects under construction, projects that are proposed or planned, and reasonably foreseeable projects—including future LNG liquefaction and export projects, currently operating and future oil and gas projects, electric transmission and generation projects, land transportation projects, commercial developments, waterway improvement projects, and other miscellaneous activities. Our assessment considered the cumulative impacts of the proposed Project combined with the impacts of other projects on resources within all or part of the same area and timeframe.

As discussed in detail in section 4.13 and as summarized in sections 5.1.1 through 5.1.12, due to measures to minimize effects on environmental resources, mitigation measures, laws and regulations protecting environmental resources, and permitting requirements on the Rio Grande

LNG Project and other projects, the potential for the LNG Terminal and pipeline facilities to significantly contribute to cumulative impacts is not anticipated for the following environmental resources: geology, groundwater, wetlands, cultural, land use, recreation, socioeconomics (except land- and water-based transportation), and safety. Cumulative impacts for the remaining resources are further summarized below.

Construction of the proposed Project, the Texas LNG Project, and the non-jurisdictional facilities for both projects are anticipated to occur concurrently and on immediately adjacent lands, which would result in soil disturbance in succession. The Annova LNG Terminal would be on the south side of the BSC, thus it would not contribute to cumulative impacts on soils. Collectively the Rio Grande LNG and Texas LNG Projects would contribute to moderate, permanent impacts on soils due to prolonged and delayed revegetation and the potential for increased runoff and erosion from unstable soils. Similarly, if dredging were to occur in the BSC for multiple projects at the same time, moderate, but temporary, impacts on water quality and aquatic resources may occur.

The greatest potential for cumulative impacts associated with surface water resources for the Rio Grande Project is associated with dredging activities (initial and maintenance) and vessel traffic in the BSC. Moderate to significant impacts on surface water quality specifically within the BSC could occur during concurrent dredging for the Brownsville LNG terminals due to increases in turbidity and sedimentation, and from the potential erosion of shorelines along unarmored portions of the BSC due to the increase in large LNG carriers persistently transiting the BSC. The Rio Grande LNG Project and other projects would be required to comply with the CWA to minimize impacts on surface water quality and to avoid, minimize, or mitigate wetland impacts. Therefore, while the proposed Project would contribute to cumulative impacts on surface water and wetlands, along with other projects in the area, this impact would not be significant.

The Rio Grande LNG Project and most of the other projects we identified (including, but not limited to Texas LNG and Annova LNG) would be constructed partially or wholly within the HUC-12 watershed, which is the geographic scope for vegetation, wildlife, aquatic species, and threatened and endangered species. Due to the relatively large proportion of the HUC-12 subwatershed that would be affected by the projects considered, as well as the low revegetation potential of the local soils, we have determined that the LNG Terminal would contribute to moderate cumulative impacts on rare plant communities and vegetation. This impact on vegetation would also contribute to moderate impacts on wildlife species using the vegetation communities. Federally listed threatened and endangered species that may be subjected to moderate to significant cumulative impacts include sea turtles (moderate), from the combined construction impacts associated with dredging and in-water pile-driving; the northern aplomado falcon (moderate), from loss of potential foraging habitat; the piping plover (moderate), from noise-related indirect impacts that are likely to adversely affect adjacent critical habitat; and the ocelot and jaguarundi (significant), from the loss and/or decrease in suitability of habitat and the potential increase in vehicular strikes during construction. All federally regulated projects, including all three of the proposed LNG projects along the BSC, are required to coordinate with FWS to minimize impacts on federally listed species.

Construction of the Rio Grande LNG Project and the other projects within the geographic scope would result in increased land- and water-based traffic within common transportation corridors and during the period(s) when construction activities overlap. Specifically, the construction of the proposed LNG Terminal and the Texas LNG Project would result in a substantial increase in daily vehicle trips on SH-48. Both RG LNG and Texas LNG have agreed to make improvements to SH-48 to ensure safe movement of traffic along the road, especially during peak hour traffic flows. Further, RG LNG has committed to hiring off-duty police officers to direct traffic during peak commuting hours and would provide off-site parking for construction personnel. Based on the results of the commissioned studies for the proposed Project and Texas LNG, in conjunction with RG LNG's proposed roadway improvements, the Rio Grande LNG Project and other projects would contribute to a moderate cumulative impact on roadways during the 7-year construction period. The greatest cumulative impacts would result during concurrent construction of the Rio Grande LNG and Texas LNG terminals.

The potential for cumulative visual impacts would be greatest if, in addition to the proposed LNG Terminal, the Annova LNG and Texas LNG Projects are permitted and built concurrently. Motorists on SH-48 (and other local roadways) and visitors to local recreation areas would experience a permanent change in the existing viewshed during construction and operation of the projects and we conclude that cumulative impacts of the three LNG projects on visual resources would be potentially significant.

All three LNG Project are proposing use of the BSC during construction and operation, which would likely result in a cumulative impact on marine vessel traffic flow and would likely increase vessel travel times due to congestion. During operations, LNG carriers calling on the Rio Grande LNG Terminal and other LNG facilities along the BSC may have moving security zones that could preclude other vessels from transiting the waterway for up to 39 hours per week. Mandates for prior notice of expected arrivals would minimize impacts on other vessels. As a result, we conclude that there would be a moderate cumulative impact on marine vessel traffic in the BSC during from overlapping construction and operation.

With other projects in the geographic scope, construction of the Rio Grande LNG Project would contribute to localized moderate elevated emissions of criteria pollutants near construction areas during the period(s) when construction of these activities would overlap. Operational air emissions from the Rio Grande LNG Project would contribute to cumulative emissions with other projects in the geographic scope, and would be required to comply with applicable air quality regulations. Overall, impacts from the Rio Grande LNG Terminal along with the other LNG facilities would cause elevated levels of air contaminants in the area and a potential exceedance of the 1-hour NO_2 NAAQS in an uninhabited area between the proposed LNG project facilities. We are aware that each LNG Terminal could be constructed within the same time period, and the concurrent construction, commissioning, and operations emissions of the proposed Brownsville LNG terminals could contribute significantly to air quality impacts, potentially exceed the NAAQS in local areas, and result in cumulatively greater local air quality impacts. Along the Rio Bravo Pipeline, no compressor or booster stations would trigger PSD major source permitting requirements for any pollutants and would not cause or contribute to a NAAQS exceedance. Therefore, cumulative impacts on regional air quality as a result of the operation of the Rio Grande LNG Project and other facilities would be long-term during the operational life of the Project, but minor.

The Rio Grande LNG Project would emit GHGs, which have the potential to contribute to climate change. There is no standard methodology to determine how the Project's incremental contribution to GHGs would translate into physical effects on the global environment. However, the 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. 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.

For simultaneous construction activities at all of the three LNG projects proposed along the BSC, the predicted sound level increase over the existing ambient ranges from 2.2 to 9.8 dBA L_{dn} at certain NSAs (residences) in the general vicinity of the projects. These noise level increases result in levels slightly over 55 dBA L_{dn}, and range between less than noticeable increases in ambient noise to a doubling of noise at specific NSAs. For construction activities that are not simultaneous but incremental, the predicted sound level increase ranges from 1.0 to 8.6 dBA L_{dn} at the NSAs. These increases would be minor to moderate; however, all levels would be below 55 dBA $L_{dn.}$ For the Palmito Ranch Battlefield National Historic Landmark (4.1 miles from the Rio Grande LNG Project), the predicted cumulative construction increase is 10.1 dBA L_{dn} over the existing ambient level, which could result in periods of perceived doubling of noise. The predicted sound level impacts for simultaneous operation of all three LNG projects are much lower than construction impacts, with potential increases over the existing ambient sound level between 0.3 and 1.5 dBA L_{dn} at NSAs, resulting in a negligible to minor impact. Construction and operation of the pipeline facilities would not contribute to significant cumulative noise impacts on nearby NSAs.

In summary, the anticipated cumulative impacts associated with the construction and operation of projects in the geographic scope are primarily construction-related dredging and pile-driving impacts in the BSC on fish and sea turtles, construction vehicle traffic on SH-48, potential direct impacts on the federally endangered ocelot and jaguarundi, and construction noise impacts on NSAs during concurrent construction. The primary operation-related cumulative impacts include marine vessel impacts on water quality and on existing marine vessel traffic in the BSC, as well as loss or degradation of vegetation that provides habitat for federally listed species. These cumulative impacts are predominantly based on concurrent construction and operation of the Rio Grande LNG, Texas LNG, and Annova LNG Projects.

5.1.14 Alternatives

In accordance with NEPA and FERC policy, we evaluated the no-action alternative, system alternatives, and other siting and design alternatives that could achieve the Project objectives. The range of alternatives that could achieve the Project objectives included system alternatives for both the terminal and pipeline, alternative LNG Terminal sites, and alternative pipeline configurations. Alternatives were evaluated and compared to the Project to determine whether these alternatives were environmentally preferable to the proposed Project. While the no-action alternative would avoid the environmental impacts identified in this EIS, adoption of this alternative would preclude meeting the Project objectives. If the Project is not approved and built, the need could potentially be met by other LNG export projects developed elsewhere along the Texas Gulf Coast. Implementation of other LNG export projects likely would result in impacts similar to or greater than those of the proposed Project.

We evaluated six LNG Terminal system alternatives, including four existing LNG import terminals with planned, proposed, or authorized liquefaction projects; and two proposed stand-alone LNG export terminals. To meet all or part of RG LNG's contractual agreements, each of these projects would require substantial construction beyond what is currently planned and would not offer significant environmental advantages over the proposed LNG Terminal. In addition, the permitting and authorization processes for constructing additional facilities and the time required for construction would substantially delay meeting the proposed timeline for the Project. As a result, we eliminated all potential system alternatives from further consideration.

We evaluated alternative sites for the LNG Terminal along the Texas coast and along the BSC. Four alternative sites along the Texas coast were identified; however, the sites either lacked a tract size large enough to meet the needs of the Project or lacked a port system that could accommodate the deep draft LNG carriers. Along with the proposed location on the BSC, we reviewed five other sites along the BSC as alternatives. Each alternative site provided access to the deep draft LNG carriers; however, one was not an adequate size for the Project, one was not available for a long-term lease, and the other alternatives affected more resources such as wetlands and special status species. We concluded that these sites would be impractical, and they were eliminated from further consideration.

We are also assessing alternatives to RG LNG's proposed temporary haul road through wetlands, which would extend about 1 mile between the LNG Terminal site boundary and the Port Isabel dredge pile. As we do not find use of the proposed haul road to be justified if better options are available, we recommend that that RG LNG assess the feasibility of using barges or the existing roadway system to transport the fill material.

We reviewed three pipeline system alternatives; however, none of the alternatives had enough available capacity to transport the Project volumes. We also reviewed the construction of one larger diameter pipeline as opposed to the two mainline pipelines, as well as concurrent construction of both pipelines, but eliminated these alternatives from further review based on construction and safety considerations. RB Pipeline reviewed potential pipeline alternatives as part of its routing process to minimize and avoid environmental impacts; however, as much of the proposed Pipeline System is collocated with existing rights-of-way and the King Ranch National Historic Landmark cannot be fully avoided due to its size, we did not evaluate alternatives for the Pipeline System.

5.2 FERC STAFF'S RECOMMENDED MITIGATION

If the Commission authorizes the Project, we recommend that the following measures be included as specific conditions in the Commission's Order. We believe that these measures would further mitigate the environmental impacts associated with construction and operation of the proposed Project. These measures may apply to RG LNG, RB Pipeline, or to both Applicants collectively, referred to as "RG Developers."

1. RG Developers shall follow the construction procedures and mitigation measures described in their application and supplements (including responses to staff data requests) and as identified in the EIS, unless modified by the Order. RG Developers must:

   a. request any modification to these procedures, measures, or conditions in a filing with the Secretary;

   b. justify each modification relative to site-specific conditions;

   c. explain how that modification provides an equal or greater level of environmental protection than the original measure; and

   d. receive approval in writing from the Director of OEP **before using that modification**.

2. For the LNG Terminal, the Director of OEP, or the Director's designee, has delegated authority to address any requests for approvals or authorizations necessary to carry out the conditions of the Order, and take whatever steps are necessary to ensure the protection of life, health, property, and the environment during construction and operation of the project. This authority shall allow:

   a. the modification of conditions of the Order;

   b. stop-work authority and authority to cease operation; and

   c. the imposition of any additional measures deemed necessary to ensure continued compliance with the intent of the conditions of the Order as well as the avoidance or mitigation of unforeseen adverse environmental impact resulting from Project construction and operation.

3. For the pipeline facilities, the Director of OEP, or the Director's designee, has delegated authority to address any requests for approvals or authorizations necessary to carry out the conditions of the Order, and take whatever steps are necessary to ensure the protection of environmental resources during construction and operation of the Project. This authority shall allow:

   a. the modification of conditions of the Order;

   b. stop-work authority; and

   c. the imposition of any additional measures deemed necessary to ensure continued compliance with the intent of the conditions of the Order as well as the avoidance or mitigation of unforeseen adverse environmental impact resulting from Project construction and operation.

4. **Prior to any construction**, RG Developers shall file an affirmative statement with the Secretary, certified by a senior company official, that all company personnel, EIs, and contractor personnel will be informed of the EI's authority and have been or will be trained on the implementation of the environmental mitigation measures appropriate to their jobs **before** becoming involved with construction and restoration activities.

5. The authorized facility locations shall be as shown in the EIS, as supplemented by filed alignment sheets. **As soon as they are available and before the start of construction**, RG Developers 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.

   RB Pipeline's exercise of eminent domain authority granted under NGA Section 7(h) in any condemnation proceedings related to the Order must be consistent with these authorized facilities and locations. RB Pipeline's right of eminent domain granted under NGA Section 7(h) does not authorize it to increase the size of its natural gas pipeline or facilities to accommodate future needs or to acquire a right-of-way for a pipeline to transport a commodity other than natural gas.

6. RG Developers 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, contractor/pipe yards, new access roads, and other areas that will be used or disturbed and have not been previously identified in filings with the Secretary. Approval for each of these areas must be explicitly requested in writing. For each area, the request must include a description of the existing land use/cover type, documentation of landowner approval, whether any cultural resources or federally listed threatened or endangered species will be affected, and whether any other environmentally sensitive areas are within or abutting the area. All areas shall be clearly identified on the maps/sheets/aerial photographs. Each area must be approved in writing by the Director of OEP **before construction in or near that area**.

   This requirement does not apply to extra workspace allowed by the Commission's *Upland Erosion Control, Revegetation, and Maintenance Plan* and/or minor fieldrealignments 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;
   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 Order and before construction begins,** RG Developers shall file an Implementation Plan with the Secretary for review and written approval by the Director of OEP. RG Developers must file revisions to the plan as schedules change. The plans shall identify:

   a. how RG Developers will implement the construction procedures and mitigation measures described in their application and supplements (including responses to staff data requests), identified in the EIS, and required by the Order;

   b. how RG Developers 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/or facility, and how RG Developers 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 RG Developers will give to all personnel involved with construction and restoration (initial and refresher training as the Project progresses and personnel changes), with the opportunity for OEP staff to participate in the training session(s);

   f. the company personnel (if known) and specific portion of RG Developers' organizations having responsibility for compliance;

   g. the procedures (including use of contract penalties) RG Developers will follow if noncompliance occurs; and

   h. for each discrete facility, a Gantt or PERT chart (or similar project scheduling diagram), and dates for:

      i. the completion of all required surveys and reports;

      ii. the environmental compliance training of onsite personnel;

      iii. the start of construction; and

      iv. the start and completion of restoration.

8. RG Developers shall employ a team of EIs (at least one EI per stage of LNG Terminal construction and at least two EIs per pipeline spread) for the Project. The EIs shall be:

   a. responsible for monitoring and ensuring compliance with all mitigation measures required by the Order and other grants, permits, certificates, or other authorizing documents;

   b. responsible for evaluating the construction contractor's implementation of the environmental mitigation measures required in the contract (see condition 7 above) and any other authorizing document;

c. empowered to order correction of acts that violate the environmental conditions of the Order, and any other authorizing document;

d. a full-time position, separate from all other activity inspectors;

e. responsible for documenting compliance with the environmental conditions of the Order, as well as any environmental conditions/permit requirements imposed by other federal, state, or local agencies; and

f. responsible for maintaining status reports.

9. Beginning with the filing of the Implementation Plan, RG Developers shall file updated status reports with the Secretary on a **monthly** basis for the LNG Terminal and a **weekly** basis for the Pipeline System until all construction and restoration activities are complete. Problems of a significant magnitude shall be reported to the FERC **within 24 hours**. On request, these status reports will also be provided to other federal and state agencies with permitting responsibilities. Status reports shall include:

   a. an update on RG Developers' efforts to obtain the necessary federal authorizations;

   b. Project schedule, including current construction status of the Project and 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 RG Developers from other federal, state, or local permitting agencies concerning instances of noncompliance, and RG Developers' response.

10. RG Developers must receive written authorization from the Director of OEP **before commencing construction of any Project facilities.** To obtain such authorization, RG Developers must file with the Secretary documentation that it has received all applicable authorizations required under federal law (or evidence of waiver thereof).

11. RG LNG must receive written authorization from the Director of OEP **prior to introducing hazardous fluids into the Project facilities**. Instrumentation and controls, hazard detection, hazard control, and security components/systems necessary for the safe introduction of such fluids shall be installed and functional.

12. RB Pipeline must receive written authorization from the Director of OEP, **before placing each phase of the Pipeline System into service** (i.e., Header System/Pipeline 1 and associated facilities, and Pipeline 2 and upgrades to associated facilities)**.** Such authorization will only be granted following a determination that rehabilitation and restoration of the right-of-way and other areas affected by the Project are proceeding satisfactorily.

13. RG LNG must receive written authorization from the Director of OEP **before placing the LNG Terminal into service**. Such authorization will only be granted following a determination that the facilities have been constructed in accordance with FERC approval, can be expected to operate safely as designed, and the rehabilitation and restoration of the areas affected by the LNG Terminal are proceeding satisfactorily.

14. **Within 30 days of placing each of the authorized facilities in service,** RG Developers 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 of the Order RG Developers have complied with or will comply with. This statement shall also identify any areas affected by the Project where compliance measures were not properly implemented, if not previously identified in filed status reports, and the reason for noncompliance.

15. **Prior to the end of the draft EIS comment period**, RG LNG shall file with the Secretary a feasibility assessment for transporting fill material from the Port Isabel dredge pile to the LNG Terminal site via barge and via the existing system of roads. RG LNG's filing shall include documentation of its consultations with the local transit authorities to identify any road improvements necessary for the road transport alternative. *(section 3.4)*

16. **Prior to construction of Compressor Station 2, Booster Stations 1 and 2, and the HDD locations,** RB Pipeline shall file with the Secretary, results of its geotechnical investigations for each of these sites, including any recommended mitigation measures RB Pipeline will adopt as part of the final engineering design. *(section 4.1.1.1)*

17. **Prior to construction of the Project**, RG Developers shall file their final Fugitive Dust Control Plans for the LNG Terminal and Pipeline System with the Secretary, for review and approval by the Director of OEP. The final plans shall specify that no chemicals may be used in Willacy and Cameron Counties. *(section 4.2.2.1)*

18. **Prior to construction of the Project**, RG Developers shall file with the Secretary, for review and written approval by the Director of the OEP, final versions of their SWPPPs and SPCC Plans for construction and operation of the Project, as well as the final version of the *Unanticipated Contaminated Sediment and Soils Discovery Plan*. *(section 4.2.2.1)*

19. **Prior to construction of the LNG Terminal**, RG LNG shall file with the Secretary, for review and written approval by the Director of OEP, its final LNG Tank Hydrostatic Test Plan. *(section 4.3.2.2)*

20. **Prior to the end of the draft EIS comment period**, RB Pipeline shall file with the Secretary, records of consultation with the IBWC that identifies any regulated waterbodies and appropriate crossing methods, as well as any necessary mitigation, developed in coordination with the IBWC. *(section 4.3.2.2)*

21. **Prior to the end of the draft EIS comment period**, RB Pipeline shall file with the Secretary updated information on the waterbody areas in appendix F of the draft EIS identified as unacceptable. The information shall include all appropriate details in a consistent manner for each area, updated site-specific justifications for alternative measures to the Commission's Procedures, and revised alignment sheets, as necessary. *(section 4.3.2.2)*

22. **Prior to construction of the Rio Bravo Pipeline through wetland WW-T04-015**, RB Pipeline shall file with the Secretary, for review and written approval by the Director of OEP, revised construction right-of-way configurations that either exclude inaccessible temporary workspace at the wetland crossing, or reconfigure the workspace so that it complies with section 6.1.3 of RG Developers' Procedures. *(section 4.4.2.2)*

23. **Prior to the end of the draft EIS comment period**, RG Developers shall file with the Secretary updated information on the impacted wetland areas in appendix F of the draft EIS identified as unacceptable. The information shall include all appropriate details in a consistent manner for each area, updated site-specific justifications for alternative measures to the Commission's Procedures, and revised alignment sheets, as necessary. *(section 4.4.2.3)*

24. **Prior to construction of the Project**, RG Developers shall consult with the FWS to develop a final MBCP, which shall include outstanding surveys at the Port Isabel dredge pile. RG Developers shall file the revised MBCP and evidence of consultation with FWS with the Secretary. *(section 4.6.1.3)*

25. **Prior to construction of the Rio Bravo Pipeline between MPs 115.9 and 116.6**, RB Pipeline shall file with the Secretary, for review and written approval by the Director of OEP, updated alignment sheets depicting the modification of ATWS within this section to avoid surface impacts within the boundary of the Lower Rio Grande Valley NWR. *(section 4.6.1.4)*

26. **Prior to construction of the Rio Bravo Pipeline HDD crossings at MPs 115.6 and 116.4,** RB Pipeline shall file with the Secretary, for review and written approval by the Director of OEP, estimates of ambient sound levels at the boundary of the Lower Rio Grande Valley NWR near the HDDs, as well as anticipated noise impacts and any necessary mitigation to minimize potential effects on wildlife. *(section 4.6.1.4)*

27. **Prior to construction of the Project**, RG Developers shall file with the Secretary the final seed mixes that will be used in applicable areas of the LNG Terminal site and the pipeline right-of-way that incorporate native flowering plants, developed in coordination with the NRCS and FWS. RG Developers shall include in the filing records of agency consultation. *(section 4.6.1.4)*

28. **Prior to construction of the LNG Terminal**, RG LNG shall conduct training for construction and operational employees that includes the identification, treatment, and reporting protocols for the West Indian manatee. Training materials shall be developed in coordination with the FWS. *(section 4.7.1.2)*

29. **Prior to construction of each pipeline and the LNG Terminal**, RG Developers shall file with the Secretary documentation confirming that they obtained updated records of active nests from The Peregrine Fund for the appropriate breeding season and consulted with the FWS to determine if any additional mitigation is warranted based on the new nest data. RG Developers shall also identify in the filing, their intent to have biological monitors monitor construction activities within 0.5 mile (pipelines) or 1.0 mile (LNG Terminal) of occupied habitat during the breeding season, in accordance with the northern aplomado falcon BMPs, and provide the locations of such habitat by milepost. *(section 4.7.1.3)*

30. **Prior to the end of the draft EIS comment period**, RG Developers shall file with the Secretary, their preliminary plans to support aplomado falcon recovery, as recommended in the BMPs for the northern aplomado falcon, specifically identifying any intent to mitigate for the loss of foraging habitat at the LNG Terminal site. RG Developers shall include in their filing, evidence of correspondence with the FWS and The Peregrine Fund regarding potential mitigation. *(section 4.7.1.3)*

31. **Prior to construction of the LNG Terminal,** RG Developers shall consult with FWS to determine the likelihood for ocelots to use land in the lower Laguna Atascosa NWR that are within 1 mile of the LNG Terminal site, develop a plan to mitigate for a decrease in the quality of potential habitat within the NWR, and finalize the proposed mitigation for direct loss of potential habitat within the LNG Terminal site in a manner that adheres to the Final Recovery Plan for the ocelot. This mitigation plan shall be filed with the Secretary along with written records of concurrence or other comments from the FWS. *(section 4.7.1.4)*

32. **Prior to construction of the Rio Bravo Pipeline,** RB Pipeline shall file with the Secretary, the results of its completed surveys for the black lace cactus, slender rush-pea, and south Texas ambrosia as well as any comments from the FWS regarding the results. If applicable, RB Pipeline shall file avoidance/minimization measures that it will implement if individual plants are found, developed in consultation with the FWS. *(section 4.7.1.6)*

33. RG Developers shall **not begin construction activities until**:

    a. the FERC staff receives comments from the FWS and NMFS regarding the proposed action;

    b. FERC staff completes ESA Section 7 consultation with the FWS and NMFS; and

    c. RG Developers have received written notification from the Director of OEP that construction or use of mitigation may begin. *(section 4.7.3)*

34. **Prior to construction of the LNG Terminal**, RG LNG shall file with the Secretary, for review and written approval by the Director of OEP, its proposed mitigation measures to avoid or minimize take of bottlenose and spotted dolphins during in-water pile-driving at the LNG Terminal site, developed in consultation with NMFS, and, if applicable, a copy of its MMPA Incidental Take Authorization. *(section 4.7.2.2)*

35. **Prior to the end of the draft EIS comment period**, RB Pipeline shall consult with the NRCS and FSA to determine the specific location of the three CRP-SAFE easements located between MPs 108.1 and 128.2 and identify appropriate measures to avoid (or minimize or mitigate for) impacts on the easements and the wildlife that they support. Results of this consultation shall be filed with the Secretary. *(section 4.8.1.5)*

36. **Prior to construction of the Project**, RG Developers shall file with the Secretary a determination from the RRC that the Project is consistent with the laws and rules of the Texas Coastal Zone Management Program. *(section 4.8.3)*

37. **Prior to the end of the draft EIS comment period**, RG Developers shall file with the Secretary traffic mitigation procedures, developed in consultation with applicable transportation authorities, to monitor LOS on roadways proposed for use during construction of the Project. These procedures shall describe mitigation measures that will be implemented for a resultant LOS of C or below, including alternative routes if necessary. *(section 4.9.9.1)*

38. RG Developers shall **not begin construction of facilities or use of staging, storage, or temporary work areas and new or to-be-improved access roads until**:

    a. RG Developers file with the Secretary:

        i. outstanding SHPO comments on reports, plans, special studies, or information provided to date, as well as any NPS comments, as applicable;

        ii. any outstanding updates, reports, plans, or special studies, and the SHPO's comments on these, as well as any NPS comments, as applicable; and

        iii. any necessary treatment plans or site-specific avoidance/protection plans, and the SHPO's comments on the plans.

b. The ACHP is afforded an opportunity to comment if historic properties will be adversely affected.

c. The FERC staff reviews and the Director of OEP approves all cultural resources survey reports and plans, and notifies RG Developers in writing that construction may proceed.

All material filed with the Commission containing location, character, and ownership information about cultural resources must have the cover and any relevant pages therein clearly labeled in bold lettering: "CUI/PRIV – DO NOT RELEASE." *(section 4.10.5)*

39. RG LNG shall monitor pile-driving activities, and file **weekly** noise data with the Secretary **following the start of pile-driving activities** that identify the noise impact on the nearest NSAs. If any measured noise impacts (L_{max}) at the nearest NSAs are greater than 10 dBA over the L_{eq} ambient levels, RG LNG shall:

a. cease pile-driving activities and implement noise mitigation measures;

b. file with the Secretary evidence of noise mitigation installation;

c. file with the Secretary documentation that the noise mitigation measures reduced the noise levels at the nearest NSA to less than 10 dBA over Leq background levels.

RG LNG shall not resume pile-driving activities until receipt of written notification from the Director of OEP that pile-driving may resume. *(section 4.11.2.3)*

40. RG LNG shall file a full power load noise survey with the Secretary for the LNG Terminal **no later than 60 days** after each liquefaction train is placed into service. If the noise attributable to operation of the equipment at the LNG Terminal and Compressor Station 3 exceeds an L_{dn} of 55 dBA at the nearest NSA, **within 60 days** RG LNG shall modify operation of the liquefaction facilities or install additional noise controls until a noise level below an L_{dn} of 55 dBA at the NSA is achieved. RG LNG shall confirm compliance with the above requirement by filing a second noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls. *(section 4.11.2.3)*

41. RG LNG shall file a noise survey with the Secretary **no later than 60 days** after placing the entire LNG Terminal, including the Compressor Station 3, into service. If a full load condition noise survey is not possible, RG LNG shall provide an interim survey at the maximum possible horsepower load **within 60 days** of placing the LNG Terminal and Compressor Station 3 into service and provide the full load survey **within 6 months**. If the noise attributable to operation of the equipment at the LNG Terminal and Compressor Station 3 exceeds an L_{dn} of 55 dBA at the nearest NSA under interim or full horsepower load conditions, RG LNG shall file a report on what changes are needed and shall install the additional noise controls to meet the level **within 1 year** of the in-service date. RG LNG shall confirm compliance with the above requirement by filing an additional noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls. *(section 4.11.2.3)*

42. **Prior to construction of HDDs at MPs 82.0, 92.0, 93.0, 99.8, 101.2, 102.0, and 118.7**, RB Pipeline 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 proposed drilling operations. The noise mitigation plan shall identify all reasonable measures RB Pipeline will implement to reduce noise levels attributable to the proposed drilling operations to no more than an Ldn of 55 dBA at NSAs, and the resulting noise levels at each NSA with mitigation. *(section 4.11.2.3)*

43. RB Pipeline shall file a noise survey with the Secretary **no later than 60 days** after each set of compressor units at Compressor Stations 1 and 2, and Booster Stations 1 and 2 are placed in service. If a full load condition noise survey is not possible, RB Pipeline shall provide an interim survey at the maximum possible horsepower load **within 60 days** of placing the phased station into service and provide the full load survey **within 6 months**. If the noise attributable to the operation of all of the equipment at any of the facilities under interim or full horsepower load conditions exceeds an L_{dn} of 55 dBA at any nearby NSAs, RB Pipeline shall file a report on what additional noise controls are needed and shall install the additional noise controls to meet the level **within 1 year** of the in-service date. RB Pipeline shall confirm compliance with the above requirement by filing an additional noise survey with the Secretary **no later than 60 days** after it installs the additional noise controls. *(section 4.11.2.3)*

44. **Prior to pipeline construction across, in, or adjacent to the Union Pacific Railroad Company right-of-way**, RB Pipeline shall file with the Secretary details concerning the pipeline construction under the railroad (the depth of cover for the pipeline under the railroad, and how RB Pipeline will monitor the path of the drill during the pilot hole and reaming process for the proposed HDD); correspondence with Union Pacific Railroad Company regarding construction and operation of the pipeline under and parallel to the railroad; and the specific federal and state regulations that RB Pipeline will follow to ensure safety and reliability of the pipeline operations in or under the railroad right-of-way. *(section 4.12.10)*

45. **Prior to the end of the draft EIS comment period**, RG LNG shall determine if the heights of the LNG carriers will be higher than other objects that traverse the waterway and if applicable, file for an Aeronautical Study under 14 CFR 77 for LNG carriers that may exceed the height requirements in 14 CFR 77.9. *(section 4.12.6)*

46. **Prior to the end of the draft EIS comment period**, RG LNG shall consult with DOT PHMSA on whether using normally-closed valves as a stormwater removal device on local bunds and curbs will meet the requirements of 49 CFR 193. *(section 4.12.6)*

47. **Prior to the end of the draft EIS comment period**, RG LNG shall consult with DOT on whether the use of 130 mph 3-second gust in ASCE 7-05 for “other structures” will be subject to DOT requirements under 49 CFR 193 Subpart B. *(section 4.12.6)*

48. **Prior to initial site preparation**, RG LNG shall file with the Secretary documentation demonstrating LNG carriers will be no higher than existing ship traffic or it has received a determination of no hazard (with or without conditions) by DOT FAA for mobile objects that exceed the height requirements in 14 CFR 77.9. *(section 4.12.6)*

49. **Prior to construction of final design**, RG LNG shall file with the Secretary the following information, stamped and sealed by the professional engineer-of-record licensed in the state where the Project is being constructed:

a. site preparation drawings and specifications;

b. LNG storage tank and foundation design drawings and calculations;

c. LNG terminal structures and foundation design drawings and calculations;

d. seismic specifications for procured Seismic Category I equipment; and

e. quality control procedures to be used for civil/structural design and construction.

In addition, RG LNG shall file, in its Implementation Plan, the schedule for producing this information. *(section 4.12.6)*

50. **Prior to construction of final design**, RG LNG shall file with the Secretary design information adopting the recommendations presented by Fugro to minimize the impacts of the identified surface growth fault in the southwestern portion of the LNG Terminal, stamped and sealed by the professional engineer-of-record registered in Texas. *(section 4.12.6)*

51. **Prior to commencement of service**, RG LNG shall file with the Secretary a monitoring and maintenance plan, stamped and sealed by the professional engineer-of-record registered in Texas, for the perimeter levee which ensures the crest elevation relative to mean sea level will be maintained for the life of the facility considering berm settlement, subsidence, and sea level rise. *(section 4.12.6)*

Conditions 53 through 139 shall apply to the Rio Grande LNG Terminal facilities. Information pertaining to these specific conditions shall be filed with the Secretary for review and written approval by the Director of OEP, or the Director's designee, within the timeframe indicated by each condition. Specific engineering, vulnerability, or detailed design information meeting the criteria specified in Order No. 833 (Docket No. RM16-15-000), including security information, shall be 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 FR. 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.

52. **Prior to initial site preparation**, RG LNG shall develop, file, and implement procedures to position construction crews outside of areas that could be impacted by rocket debris of a failed launch during initial moments of rocket launch activity. *(section 4.12.6)*

53. **Prior to initial site preparation**, RG LNG shall file calculations demonstrating the loads on buried pipelines and utilities at temporary crossings will be adequately distributed. The analysis shall be based on API RP 1102 or other approved methodology. *(section 4.12.6)*

54. **Prior to initial site preparation**, RG LNG shall file pipeline and utility damage prevention procedures for personnel and contractors. The procedures shall include provisions to mark buried pipelines and utilities prior to any site work and subsurface activities. *(section 4.12.6)*

55. **Prior to initial site preparation**, RG LNG shall conduct and file the results of a minimum of five equally distributed borings, cone penetration tests, and/or seismic cone penetration tests to a depth of at least 100 feet or refusal underneath the locations of each LNG storage tank to affirm or better characterize underlying conditions and validate the proposed use of shallow foundations. *(section 4.12.6)*

56. **Prior to initial site preparation**, RG LNG shall file an overall Project schedule, which includes the proposed stages of the commissioning plan. *(section 4.12.6)*

57. **Prior to initial site preparation**, RG LNG shall file quality assurance and quality control procedures for construction activities for both the Engineering Procurement Contractor and RG LNG to monitor construction activities. *(section 4.12.6)*

58. **Prior to initial site preparation**, RG LNG shall file procedures for controlling access during construction. *(section 4.12.6)*

59. **Prior to initial site preparation**, RG LNG shall develop an ERP (including evacuation) and coordinate procedures with the Coast Guard; state, county, and local emergency planning groups; fire departments; state and local law enforcement; and appropriate federal agencies. This plan shall include at a minimum:

    a. designated contacts with state and local emergency response agencies;

    b. scalable procedures for the prompt notification of appropriate local officials and emergency response agencies based on the level and severity of potential incidents;

    c. procedures for notifying residents and recreational users within areas of potential hazard;

    d. evacuation routes/methods for residents and public use areas that are within any transient hazard areas along the route of the LNG marine transit;

    e. locations of permanent sirens and other warning devices; and

    f. an "emergency coordinator" on each LNG carrier to activate sirens and other warning devices.

    RG LNG shall notify the FERC staff of all planning meetings in advance and shall report progress on the development of its ERP at **3-month intervals**. *(section 4.12.6)*

60. **Prior to initial site preparation**, RG LNG shall file a Cost-Sharing Plan identifying the mechanisms for funding all Project-specific security/emergency management costs that will be imposed on state and local agencies. This comprehensive plan shall include funding mechanisms for the capital costs associated with any necessary security/emergency management equipment and personnel base. RG LNG shall notify FERC staff of all planning meetings in advance and shall report progress on the development of its Cost Sharing Plan at **3-month intervals**. *(section 4.12.6)*

61. **Prior to construction of final design**, RG LNG shall file calculations demonstrating the loads on buried pipelines and utilities at permanent crossings will be adequately distributed. The analysis shall be based on API RP 1102 or other approved methodology. *(section 4.12.6)*

62. **Prior to construction of final design**, RG LNG shall file change logs that list and explain any changes made from the front end engineering design provided in RG LNG's application and filings. A list of all changes with an explanation for the design alteration shall be provided and all changes shall be clearly indicated on all diagrams and drawings. Records of changes shall be kept so FERC staff can verify during construction inspections. *(section 4.12.6)*

63. **Prior to construction of final design**, RG LNG shall file information/revisions pertaining to RG LNG' response numbers 5, 6, 7, 8, 14, 19, 22, 24, 25, 31, and 44 of its October 20, 2016 filing, which indicated features to be included or considered in the final design. *(section 4.12.6)*

64. **Prior to construction of final design**, RG LNG shall file a plot plan of the final design showing all major equipment, structures, buildings, and impoundment systems. *(section 4.12.6)*

65. **Prior to construction of final design**, RG LNG shall file three-dimensional plant drawings to confirm plant layout for maintenance, access, egress, and congestion. *(section 4.12.6)*

66. **Prior to construction of final design**, RG LNG 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 (SIS) specifications, cable specifications, other electrical and instrumentation specifications); and

    d. Security and Fire Safety Specifications (security, passive protection, hazard detection, hazard control, firewater). *(section 4.12.6)*

67. **Prior to construction of final design**, RG LNG shall file the design specifications for the feed gas inlet facilities (e.g., metering, pigging system, pressure protection system, compression, etc.). *(section 4.12.6)*

68. **Prior to construction of final design**, RG LNG shall file up-to-date process flow diagrams and P&IDs. The PFDs shall include heat and material balances. The P&IDs shall include the following information:

    a. equipment tag number, name, size, duty, capacity, and design conditions;

    b. equipment insulation type and thickness;

c. storage tank pipe penetration size and nozzle schedule;

d. valve high pressure side and internal and external vent locations;

e. piping with line number, piping class specification, size, and insulation type and thickness;

f. piping specification breaks and insulation limits;

g. all control and manual valves numbered;

h. relief valves with size and set points; and

i. drawing revision number and date. *(section 4.12.6)*

69. **Prior to construction of final design**, RG LNG shall file P&IDs, specifications, and procedures that clearly show and specify the tie-in details required to safely connect subsequently constructed facilities with the operational facilities. *(section 4.12.6)*

70. **Prior to construction of final design**, RG LNG shall file a car seal philosophy and a list of all car-sealed and locked valves consistent with the P&IDs. *(section 4.12.6)*

71. **Prior to the construction of final design**, and at the onset of detailed engineering, RG LNG shall compete a preliminary hazard and operability review of the proposed design. A copy of the review, a list of recommendations, and actions taken on the recommendations shall be filed. *(section 4.12.6)*

72. **Prior to construction of final design**, RG LNG shall file a hazard and operability review prior to issuing the P&IDs for construction. A copy of the review, a list of the recommendations, and actions taken on the recommendations shall be filed. *(section 4.12.6)*

73. **Prior to the construction of final design**, RG LNG shall file an evaluation of the need for additional check valves and relief valves in the truck LNG fill line. *(section 4.12.6)*

74. **Prior to construction of final design**, RG LNG shall file the safe operating limits (upper and lower), alarm and shutdown set points for all instrumentation (i.e., temperature, pressures, flows, and compositions). *(section 4.12.6)*

75. **Prior to construction of the final design**, RG LNG shall file cause-and-effect matrices for the process instrumentation, fire and gas detection system, and emergency shutdown system for review and approval. The cause-and-effect matrices shall include alarms and shutdown functions, details of the voting and shutdown logic, and set points. *(section 4.12.6)*

76. **Prior to construction of final design**, RG LNG shall file an evaluation of the emergency shutdown valve closure times. The analysis shall account for the time to detect an upset or hazardous condition, notify plant personnel, and close the emergency shutdown valve. *(section 4.12.6)*

77. **Prior to construction of the final design**, RG LNG shall demonstrate that, for hazardous fluids, piping and piping nipples 2 inches or less in diameter are designed to withstand external loads, including vibrational loads in the vicinity of rotating equipment and operator live loads in areas accessible by operators. *(section 4.12.6)*

78. **Prior to construction of final design**, RG LNG shall file electrical area classification drawings. *(section 4.12.6)*

79. **Prior to construction of the final design**, RG LNG shall file drawings and details of how process seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system meet the requirements of NFPA 59A (2001 edition). *(section 4.12.6)*

80. **Prior to construction of the final design**, RG LNG shall file details of an air gap or vent installed downstream of process seals or isolations installed at the interface between a flammable fluid system and an electrical conduit or wiring system. Each air gap shall vent to a safe location and be equipped with a leak detection device that shall continuously monitor for the presence of a flammable fluid, alarm the hazardous condition, and shut down the appropriate systems. *(section 4.12.6)*

81. **Prior to construction of final design**, RG LNG shall file drawings of the storage tank piping support structure and support of horizontal piping at grade including pump columns, relief valves, pipe penetrations, instrumentation, and appurtenances. *(section 4.12.6)*

82. **Prior to construction of final design**, RG LNG shall include LNG storage tank fill flow measurement with high flow alarm.

83. **Prior to construction of final design**, RG LNG shall include BOG flow measurement from each LNG storage tank. *(section 4.12.6)*

84. **Prior to construction of final design**, RG LNG shall file the structural analysis of the LNG storage tank and outer containment demonstrating they are designed to withstand all loads and combinations. *(section 4.12.6)*

85. **Prior to construction of final design**, RG LNG shall file an analysis of the structural integrity of the outer containment of the full containment LNG storage tanks when exposed to a roof tank top fire or adjacent tank top fire. *(section 4.12.6)*

86. **Prior to construction of final design**, RG LNG shall file a projectile analysis 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 4.12.6)*

87. **Prior to construction of final design**, RG LNG shall file the sizing basis and capacity for the final design of the flares and/or vent stacks as well as the pressure and vacuum relief valves for major process equipment, vessels, and storage tanks. *(section 4.12.6)*

88. **Prior to construction of final design**, RG LNG shall file a drawing showing the location of the emergency shutdown buttons. Emergency shutdown buttons shall be easily accessible, conspicuously labeled, and located in an area which will be accessible during an emergency. *(section 4.12.6)*

89. **Prior to construction of final design**, RG LNG shall specify that all Emergency Shutdown valves will be equipped with open and closed position switches connected to the Distributed Control System (DCS)/Safety Instrumented System (SIS). *(section 4.12.6)*

90. **Prior to construction of final design**, and prior to injecting corrosion inhibitors into the 42-inch-diameter pipeline at any time during the life of the plant, RG LNG shall file the information used to determine that an inhibitor is required, the material data sheet for the inhibitor, the amount injected, and the schedule of injections. *(section 4.12.6)*

91. **Prior to construction of final design**, the feed gas flow to the Inlet Gas/Gas Exchanger (E-1701) shall include a high temperature alarm and shutdown to protect from exposure to hot feed gas. *(section 4.12.6)*

92. **Prior to the construction of final design**, the De-ethanizer (C-1701) shall include an additional cryogenic manual isolation valve downstream of shutoff valve (XV-117011). *(section 4.12.6)*

93. **Prior to the construction of final design**, RG LNG shall equip a low-low temperature shutdown on the temperature transmitter (TT-117014) located on the De-ethanizer bottoms discharge piping to detect temperatures that may reach below the minimum design metal temperature of the discharge piping transition from stainless to carbon steel. This shutdown shall include isolation under cryogenic conditions. *(section 4.12.6)*

94. **Prior to the construction of final design**, RG LNG shall file an explanation and justification for the dump lines located upstream of each LNG Loading Arm. *(section 4.12.6)*

95. **Prior to the construction of final design**, RG LNG shall file the complete range of anti-surge recycle conditions on the LP MR Compressor to confirm that the minimum temperature conditions will not require stainless steel piping. *(section 4.12.6)*

96. **Prior to the construction of final design**, RG LNG shall specify the set pressure of high pressure alarm (PAH-141002) is to be below the set pressure of regulator PCV-141005 on the Hot Oil Expansion Drum. *(section 4.12.6)*

97. **Prior to the construction of final design**, RG LNG shall file the design details of the shelters to verify safe access in all weather conditions. *(section 4.12.6)*

98. **Prior to construction of final design**, RG LNG shall file complete plan drawings of the security fencing and facility access and egress. *(section 4.12.6)*

99. **Prior to construction of final design**, RG LNG shall file drawings and specifications for vehicle barriers at each facility entrance for access control. *(section 4.12.6)*

100. **Prior to construction of final design**, RG LNG shall file security camera, intrusion detection, and lighting drawings. The security camera drawings shall show the location, areas covered, and features of the camera (fixed, tilt/pan/zoom, motion detection alerts, low light, mounting height, etc.) to verify camera coverage of the entire perimeter with redundancies for cameras interior to the facility to enable rapid monitoring of the LNG plant. The intrusion detection drawings shall show or note the location of the intrusion detection to verify it covers the entire perimeter of the LNG plant. The lighting drawings shall show the location, elevation, type of light fixture, and lux levels of the lighting system. *(section 4.12.6)*

101. **Prior to construction of final design**, RG LNG shall file an updated fire protection evaluation of the proposed facilities. A copy of the evaluation, a list of recommendations and supporting justifications, and actions taken on the recommendations shall be filed. *(section 4.12.6)*

102. **Prior to construction of final design**, RG LNG shall file spill containment system drawings with dimensions and slopes of curbing, trenches, impoundments, and capacity calculations considering any foundations and equipment within impoundments, as well as the sizing and design of the down-comer that will transfer spills from the tank top to the ground-level impoundment system. *(section 4.12.6)*

103. **Prior to construction of final design**, RG LNG shall file complete drawings and a list of the hazard detection equipment. The drawings shall clearly show the location and elevation of all detection equipment. The list shall include the instrument tag number, type and location, alarm indication locations, and shutdown functions of the hazard detection equipment. *(section 4.12.6)*

104. **Prior to construction of final design**, RG LNG shall file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas of the hazard detectors when determining the lower flammable limit set points for methane, propane, ethane/ethylene, and condensate. *(section 4.12.6)*

105. **Prior to construction of final design**, RG LNG shall file a list of alarm and shutdown set points for all hazard detectors that account for the calibration gas of hazard detectors when determining the set points for toxic components such as natural gas liquids and hydrogen sulfide. *(section 4.12.6)*

106. **Prior to construction of final design**, RG LNG shall file a technical review of facility design that:

    a. identifies all combustion/ventilation air intake equipment and the distances to any possible flammable gas or toxic release; and

    b. demonstrates that these areas are adequately covered by hazard detection devices and indicates how these devices will isolate or shut down any combustion or heating ventilation and air conditioning equipment whose continued operation could add to or sustain an emergency. *(section 4.12.6)*

107. **Prior to construction of final design**, RG LNG shall file complete plan drawings and a list of the fixed and wheeled dry-chemical, hand-held fire extinguishers, and other hazard control equipment. Drawings shall clearly show the location by tag number of all fixed, wheeled, and hand-held extinguishers. The list shall include the equipment tag number, type, capacity, equipment covered, discharge rate, and automatic and manual remote signals initiating discharge of the units. *(section 4.12.6)*

108. **Prior to construction of final design**, RG LNG shall file facility plan drawings showing the proposed location of the firewater and any foam systems. Plan drawings shall clearly show the location of firewater and foam piping, post indicator valves, and the location and area covered by each monitor, hydrant, hose, water curtain, deluge system, foam system, water mist system, and sprinkler. The drawings shall also include piping and instrumentation diagrams of the firewater and foam systems. *(section 4.12.6)*

109. **Prior to construction of final design**, RG LNG shall specify that the firewater flow test meter is equipped with a transmitter and that a pressure transmitter is installed upstream of the flow transmitter. The flow transmitter and pressure transmitter shall be connected to the DCS and recorded. *(section 4.12.6)*

110. **Prior to the construction of final design**, RG LNG shall specify the dimension ratio (DR) to be DR 7 for the high density polyethylene piping to allow consistent pressure rating requirements with the firewater system. *(section 4.12.6)*

111. **Prior to construction of final design**, RG LNG shall file drawings and specifications for the structural passive protection systems to protect equipment and supports from cryogenic releases. *(section 4.12.6)*

112. **Prior to construction of final design**, RG LNG shall file a detailed quantitative analysis to demonstrate that adequate thermal mitigation will be provided for each significant component within the 4,000 BTU/ft^2-hr zone from an impoundment, or provide an analysis to 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 4.12.6)*

113. **Prior to construction of final design**, RG LNG shall file an evaluation of the voting logic and voting degradation for hazard detectors. *(section 4.12.6)*

114. **Prior to the construction of final design**, RG LNG shall file the fire proofing specifications to show that the Jetty Marine Buildings will withstand an LNG tank roof fire. *(section 4.12.6)*

115. **Prior to commissioning**, RG LNG shall file a detailed schedule for commissioning through equipment startup. The schedule shall include milestones for all procedures and tests to be completed: prior to introduction of hazardous fluids and during commissioning and startup. RG LNG shall file documentation certifying that each of these milestones has been completed before authorization to proceed with the next phase of commissioning and startup will be issued. *(section 4.12.6)*

116. **Prior to commissioning**, RG LNG shall file detailed plans and procedures for: testing the integrity of onsite mechanical installation; functional tests; introduction of hazardous fluids; operational tests; and placing the equipment into service. *(section 4.12.6)*

117. **Prior to commissioning**, RG LNG 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 4.12.6)*

118. **Prior to commissioning**, RG LNG shall file a plan for clean-out, dry-out, purging, and tightness testing. This plan shall address the requirements of the American Gas Association's Purging Principles and Practice required by 49 CFR 193, and shall provide justification if not using an inert or non-flammable gas for clean-out, dry-out, purging, and tightness testing. *(section 4.12.6)*

119. **Prior to commissioning**, RG LNG shall file the operation and maintenance procedures and manuals, as well as safety procedures, hot work procedures and permits, abnormal operating conditions reporting procedures, simultaneous operations procedures, and management of change procedures and forms. *(section 4.12.6)*

120. **Prior to commissioning**, RG LNG shall tag all equipment, instrumentation, and valves in the field, including drain valves, vent valves, main valves, and car-sealed or locked valves. *(section 4.12.6)*

121. **Prior to commissioning**, RG LNG shall maintain a detailed training log to demonstrate that operating staff has completed the required training. *(section 4.12.6)*

122. **Prior to commissioning**, RG LNG shall file the results of the LNG storage tank hydrostatic test and foundation settlement results. At a minimum, foundation settlement results shall be provided thereafter annually. *(section 4.12.6)*

123. **Prior to commissioning**, RG LNG shall equip the LNG storage tank and adjacent piping and supports with permanent settlement monitors to allow personnel to observe and record the relative settlement between the LNG storage tank and adjacent piping. The settlement record shall be reported in the semi-annual operational reports. *(section 4.12.6)*

124. **Prior to introduction of hazardous fluids**, RG LNG shall complete and document all pertinent tests (e.g., Factory Acceptance Tests, Site Acceptance Tests, Site Integration Tests) associated with the DCS and SIS that demonstrates full functionality and operability of the system. *(section 4.12.6)*

125. **Prior to introduction of hazardous fluids**, RG LNG shall file an alarm management program to reduce alarm complacency and maximize the effectiveness of operator response to alarms. *(section 4.12.6)*

126. **Prior to introduction of hazardous fluids**, RG LNG shall develop and implement procedures for plant personnel to monitor the rocket launches and shut down operating equipment in the event of a rocket launch failure. *(section 4.12.6)*

127. **Prior to introduction of hazardous fluids**, RG LNG shall complete and document a firewater pump acceptance test and firewater monitor and hydrant coverage test. The actual coverage area from each monitor and hydrant shall be shown on facility plot plan(s). *(section 4.12.6)*

128. **Prior to introduction of hazardous fluids**, RG LNG shall complete and document a prestartup safety review to ensure that installed equipment meets the design and operating intent of the facility. The prestartup safety review shall include any changes since the last hazard review, operating procedures, and operator training. A copy of the review with a list of recommendations, and actions taken on each recommendation, shall be filed. *(section 4.12.6)*

129. RG LNG shall file a request for written authorization from the Director of OEP or designee **prior to unloading or loading the first LNG commissioning cargo**. After production of first LNG, RG LNG shall file **weekly** reports on the commissioning of the proposed systems that detail the progress toward demonstrating the facilities can safely and reliably operate at or near the design production rate. The reports shall include a summary of activities, problems encountered, and remedial actions taken. The weekly reports shall also include the latest commissioning schedule, including projected and actual LNG production by each liquefaction train, LNG storage inventories in each storage tank, and the number of anticipated and actual LNG commissioning cargoes, along with the associated volumes loaded or unloaded. Further, the weekly reports shall include a status and list of all planned and completed safety and reliability tests, work authorizations, and punch list items. Problems of significant magnitude shall be reported to the FERC **within 24 hours**. *(section 4.12.6)*

130. **Prior to commencement of service**, RG LNG shall label piping with fluid service and direction of flow in the field, in addition to the pipe labeling requirements of NFPA 59A (2001 edition). *(section 4.12.6)*

131. **Prior to commencement of service**, RG LNG shall file plans for any preventative and predictive maintenance program that performs periodic or continuous equipment condition monitoring. *(section 4.12.6)*

132. **Prior to commencement of service**, RG LNG shall develop procedures for handling offsite contractors' including responsibilities, restrictions, and limitations and for supervision of these contractors by RG LNG staff. *(section 4.12.6)*

133. **Prior to commencement of service**, RG LNG shall notify the FERC staff of any proposed revisions to the security plan and physical security of the plant. *(section 4.12.6)*

134. **Prior to commencement of service**, RG LNG shall file a request for written authorization from the Director of OEP. Such authorization will only be granted following a determination by the Coast Guard, under its authorities under the Ports and Waterways Safety Act, the Magnuson Act, the Maritime Transportation Security Act of 2002, and the Security and Accountability For Every Port Act, that appropriate measures to ensure the safety and security of the facility and the waterway have been put into place by RG LNG or other appropriate parties. *(section 4.12.6)*

In addition, conditions 136 through 139 shall apply **throughout the life of the Rio Grande LNG Terminal**.

135. The facilities 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, RG LNG shall respond to a specific data request including information relating to possible design and operating conditions that may have been imposed by other agencies or organizations. Up-to-date detailed P&IDs reflecting facility modifications and provision of other pertinent information not included in the semi-annual reports described below, including facility events that have taken place since the previously submitted annual report, shall be submitted. *(section 4.12.6)*

136. **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 quantities, boil off/flash gas); and plant modifications, including future plans and progress thereof. Abnormalities shall include, but not be limited to, unloading/loading/shipping problems, potential hazardous conditions from offsite vessels, storage tank stratification or rollover, geysering, storage tank pressure excursions, cold spots on the storage tanks, storage tank vibrations and/or vibrations in associated cryogenic piping, storage tank settlement, significant equipment or instrumentation malfunctions or failures, non-scheduled maintenance or repair (and reasons therefore), relative movement of storage tank inner vessels, hazardous fluids releases, fires involving hazardous fluids and/or from other sources, negative pressure (vacuum) within a storage tank, and higher than predicted boil off rates. Adverse weather conditions and the effect on the facility also shall be reported. Reports shall be submitted **within 45 days after each period ending June 30 and December 31**. In addition to the above items, a section entitled "Significant Plant Modifications Proposed for the Next 12 Months (dates)" shall be included in the semi-annual operational reports. Such information will provide the FERC staff with early notice of anticipated future construction/maintenance at the LNG facilities. *(section 4.12.6)*

137. In the event the temperature of any region of any secondary containment, including imbedded pipe supports, becomes less than the minimum specified operating temperature for the material, the Commission shall be notified **within 24 hours** and procedures for corrective action shall be specified. *(section 4.12.6)*

138. Significant non-scheduled events, including safety-related incidents (e.g., LNG, condensate, refrigerant, or natural gas releases; fires; explosions; mechanical failures; unusual over pressurization; and major injuries) and security-related incidents (e.g., attempts to enter site, suspicious activities) shall be reported to the FERC staff. In the event that an abnormality is of significant magnitude to threaten public or employee safety, cause significant property damage, or interrupt service, notification shall be made **immediately**, without unduly interfering with any necessary or appropriate emergency repair, alarm, or other emergency procedure. In all instances, notification shall be made to the FERC staff **within 24 hours**. This notification practice shall be

incorporated into the LNG facility's emergency plan. Examples of reportable hazardous fluids-related incidents include:

a. fire;

b. explosion;

c. estimated property damage of $50,000 or more;

d. death or personal injury necessitating in-patient hospitalization;

e. release of hazardous fluids for 5 minutes or more;

f. unintended movement or abnormal loading by environmental causes, such as an earthquake, landslide, or flood, that impairs the serviceability, structural integrity, or reliability of an LNG facility that contains, controls, or processes hazardous fluids;

g. any crack or other material defect that impairs the structural integrity or reliability of an LNG facility that contains, controls, or processes hazardous fluids;

h. any malfunction or operating error that causes the pressure of a pipeline or LNG facility that contains or processes hazardous fluids to rise above its maximum allowable operating pressure (or working pressure for LNG facilities) plus the build-up allowed for operation of pressure-limiting or control devices;

i. a leak in an LNG facility that contains or processes hazardous fluids that constitutes an emergency;

j. inner tank leakage, ineffective insulation, or frost heave that impairs the structural integrity of an LNG storage tank;

k. any safety-related condition that could lead to an imminent hazard and cause (either directly or indirectly by remedial action of the operator), for purposes other than abandonment, a 20 percent reduction in operating pressure or shutdown of operation of a pipeline or an LNG facility that contains or processes hazardous fluids;

l. safety-related incidents from hazardous fluids transportation occurring at or en route to and from the LNG facility; or

m. an event that is significant in the judgment of the operator and/or management even though it did not meet the above criteria or the guidelines set forth in an LNG facility's incident management plan. *(section 4.12.6)*

In the event of an incident, the Director of OEP has delegated authority to take whatever steps are necessary to ensure operational reliability and to protect human life, health, property, or the environment, including authority to direct the LNG facility to cease operations. Following the initial company notification, the FERC staff would determine the need for a separate follow-up report or follow up in the upcoming semi-annual operational report. All company follow-up reports shall include investigation results and recommendations to minimize a reoccurrence of the incident.