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

Rio Grande LNG Project
Final Environmental Impact Statement
Volume I

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

April 2019
Docket Nos. CP16-454-000, CP16-455-000
FERC/EIS-0287F

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 final 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 final 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, including the Texas LNG and Annova LNG Projects, would contribute to potential significant cumulative impacts from construction noise during nighttime pile-driving, sediment/turbidity, and shoreline erosion within the Brownsville Ship Channel during operations from vessel transits; on the federally listed ocelot and jaguarundi from habitat loss and potential for increased vehicular strikes during construction; on the federally listed northern aplomado falcon from habitat loss in combination with past actions; and on visual resources from the presence of aboveground structures. Construction and operation of the Rio Grande LNG Project would result in mostly temporary or short-term environmental impacts; however, some long-term and permanent environmental impacts would occur.

The U.S. Army Corps of Engineers, U.S. Coast Guard, U.S. Department of Energy, U.S. Department of Transportation's (DOT) 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 final EIS, the agencies will present their own conclusions and recommendations in their respective Records of Decision for the Project.

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

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

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

TABLE OF CONTENTS

RIO GRANDE LNG PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT
VOLUME I

TABLE OF CONTENTS i
LIST OF TABLES vi
LIST OF FIGURES x
LIST OF APPENDICES xii
ACRONYMS AND ABBREVIATIONS xiii

EXECUTIVE SUMMARY ES-1
1.0 INTRODUCTION 1-1
1.1 PURPOSE AND NEED 1-4
1.2 PURPOSE AND SCOPE OF THIS STATEMENT 1-5
1.2.1 Federal Energy Regulatory Commission 1-6
1.2.2 U.S. Army Corps of Engineers 1-6
1.2.3 U.S. Coast Guard 1-7
1.2.4 U.S. Department of Energy 1-8
1.2.5 U.S. Department of Transportation 1-9
1.2.6 Federal Aviation Administration 1-9
1.2.7 U.S. Fish and Wildlife Service 1-10
1.2.8 National Park Service 1-10
1.2.9 U.S. Environmental Protection Agency 1-10
1.2.10 National Oceanic and Atmospheric Administration, National Marine Fisheries Service 1-11
1.3 PUBLIC REVIEW AND COMMENT 1-11
1.3.1 Pre-filing Process and Scoping 1-11
1.3.2 Public Review of the Draft EIS 1-12
1.3.3 Final EIS 1-13
1.4 NON-JURISDICTIONAL FACILITIES 1-17
1.4.1 LNG and Natural Gas Liquids Condensate Trucking 1-17
1.4.2 Electric Transmission Line and Switchyard for the LNG Terminal 1-18
1.4.3 Potable Water Supply Header 1-19

1.4.4 Pumped Sewage Pipeline from the LNG Terminal 1-19
1.4.5 Utility Connections for the Pipeline Facilities 1-19
1.4.6 Modifications to State Highway 48 1-20
1.5 PERMITS, APPROVALS, AND REGULATORY REVIEWS 1-20
2.0 PROPOSED ACTION 2-1
2.1 PROPOSED FACILITIES 2-1
2.1.1 LNG Terminal 2-2
2.1.2 LNG Transport Vessels 2-16
2.1.3 Pipeline Facilities 2-17
2.2 LAND REQUIREMENTS 2-22
2.2.1 LNG Terminal 2-24
2.2.2 Pipeline Facilities 2-25
2.3 CONSTRUCTION SCHEDULE AND WORKFORCE 2-31
2.4 ENVIRONMENTAL COMPLIANCE 2-34
2.5 CONSTRUCTION PROCEDURES 2-35
2.5.1 LNG Terminal 2-36
2.5.2 Pipeline Facilities 2-42
2.6 OPERATION AND MAINTENANCE PROCEDURES 2-58
2.6.1 LNG Marine Traffic along the Waterway 2-58
2.6.2 LNG Terminal 2-58
2.6.3 Pipeline Facilities 2-59
2.7 SAFETY AND SECURITY PROCEDURES 2-60
2.7.1 LNG Terminal 2-60
2.7.2 Pipeline Facilities 2-61
3.0 ALTERNATIVES 3-1
3.1 NO-ACTION ALTERNATIVE 3-2
3.2 SYSTEM ALTERNATIVES 3-3
3.2.1 LNG Terminal Alternatives 3-3
3.2.2 Pipeline System Alternatives 3-11
3.3 LNG TERMINAL SITE ALTERNATIVES 3-15
3.3.1 Alternative Terminal Sites along the Texas Coast 3-15
3.3.2 Alternative Terminal Sites at the Port of Brownsville 3-19
3.4 FILL MATERIAL SUPPLY ACCESS ROUTE ALTERNATIVES 3-22
3.4.1 Temporary Haul Road via Dump Truck 3-22

3.4.2 State Highway 48 via Dump Truck 3-24
3.4.3 Brownsville Ship Channel via Barge (Proposed Action) 3-25
3.5 PIPELINE CONFIGURATION AND ROUTE ALTERNATIVES 3-25
3.5.1 Pipeline Configuration and Size 3-25
3.5.2 Pipeline Route Alternatives 3-26
3.6 ABOVEGROUND FACILITY SITE ALTERNATIVES 3-27
3.6.1 Compressor Stations 1 and 2 3-28
3.6.2 Compressor Station 3 3-28
4.0 ENVIRONMENTAL ANALYSIS 4-1
4.1 GEOLOGIC CONDITIONS, RESOURCES, HAZARDS, AND MITIGATION DESIGN MEASURES 4-1
4.1.1 Geologic Setting 4-1
4.1.2 Mineral Resources 4-2
4.1.3 Geologic Hazards 4-5
4.1.4 Blasting 4-8
4.1.5 Paleontology 4-8
4.1.6 General Impacts and Mitigation 4-8
4.2 SOILS 4-9
4.2.1 Existing Soil Resources 4-9
4.2.2 Soil Impacts and Mitigation 4-13
4.2.3 Dredged Material Disposal Sites 4-19
4.2.4 Soil Contamination 4-22
4.3 WATER RESOURCES 4-22
4.3.1 Groundwater Resources 4-22
4.3.2 Surface Water 4-29
4.4 WETLANDS 4-55
4.4.1 Existing Wetland Resources 4-56
4.4.2 Wetland Impacts and Mitigation 4-59
4.5 VEGETATION 4-69
4.5.1 Existing Vegetation Resources 4-69
4.5.2 Vegetation Impacts and Mitigation 4-76
4.5.3 Exotic or Invasive Plant Communities and Noxious Weeds 4-81
4.5.4 Vegetation Communities of Special Concern 4-82
4.6 WILDIFE AND AQUATIC RESOURCES 4-84
4.6.1 Terrestrial Wildlife Resources 4-84

4.6.2 Aquatic Resources 4-103
4.6.3 Essential Fish Habitat 4-120
4.7 THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES 4-127
4.7.1 Federally Listed Threatened and Endangered Species 4-133
4.7.2 State Listed Species 4-164
4.7.3 Marine Mammals 4-173
4.8 LAND USE, RECREATION, AND VISUAL RESOURCES 4-176
4.8.1 Land Use 4-176
4.8.2 Visual Resources 4-198
4.8.3 Coastal Zone Management 4-205
4.9 SOCIOECONOMICS 4-206
4.9.1 Population 4-206
4.9.2 Economy and Employment 4-211
4.9.3 Tourism and Recreational Fishing 4-214
4.9.4 Commercial Industries 4-221
4.9.5 Local Taxes and Government Revenue 4-223
4.9.6 Housing 4-224
4.9.7 Public Services 4-226
4.9.8 Transportation 4-227
4.9.9 Property Values 4-232
4.9.10 Environmental Justice 4-233
4.10 CULTURAL RESOURCES 4-238
4.10.1 Cultural Resources Surveys 4-239
4.10.2 Unanticipated Discovery Plan 4-241
4.10.3 Native American Consultation 4-241
4.10.4 Other Parties Contacted 4-242
4.10.5 Compliance with the National Historic Preservation Act 4-242
4.11 AIR QUALITY AND NOISE 4-243
4.11.1 Air Quality 4-243
4.11.2 Noise 4-279
4.12 RELIABILITY AND SAFETY 4-304
4.12.1 LNG Terminal 4-304
4.12.2 Pipeline Facilities 4-381
4.13 CUMULATIVE IMPACTS 4-392

4.13.1 Projects and Activities Considered 4-393
4.13.2 Potential Cumulative Impacts by Resource 4-421
4.14 Transboundary Effects 4-495
5.0 CONCLUSIONS AND RECOMMENDATIONS 5-1
5.1 SUMMARY OF THE ENVIRONMENTAL ANALYSIS 5-1
5.1.1 Geologic Resources (Pipeline Facilities) 5-1
5.1.2 Soils 5-2
5.1.3 Water Resources 5-3
5.1.4 Wetlands 5-5
5.1.5 Vegetation 5-6
5.1.6 Wildlife and Aquatic Resources 5-7
5.1.7 Threatened, Endangered, and Other Special-status Species 5-9
5.1.8 Land Use, Recreation, and Visual Resources 5-10
5.1.9 Socioeconomics 5-12
5.1.10 Cultural Resources 5-14
5.1.11 Air Quality and Noise 5-15
5.1.12 Reliability and Safety 5-18
5.1.13 Cumulative Impacts 5-19
5.1.14 Alternatives 5-23
5.2 FERC STAFF'S RECOMMENDED MITIGATION 5-24

LIST OF TABLES

Table 1.3-1	Key Environmental Concerns Identified During Scoping and from Comments on the draft EIS 1-14
Table 1.3-2	Issues Identified and Comments Received That Are Outside the Scope of the EIS 1-16
Table 1.5-1	Federal and State Agency Permits, Approvals, and Consultations for the Project 1-21
Table 2.1.3-1	Counties Crossed by the Rio Bravo Pipeline System....2-19
Table 2.1.3-2	Proposed Pipeline Interconnects for the Rio Bravo Pipeline Project....2-20
Table 2.2-1	Land Requirements for the Rio Grande LNG Terminal Project 2-23
Table 2.2.2-1	Collocation of the Pipeline System and Existing ROWs and Man-made Linear Features 2-26
Table 2.3-1	Major Components of the Proposed Construction Stages....2-32
Table 2.5.1-1	Pile-driving Activities Associated with Construction of the Rio Grande LNG Terminal 2-38
Table 2.5.2-1	Proposed HDD Crossings along the Rio Bravo Pipeline 2-53
Table 2.5.2-2	Buried Utility Crossing Locations....2-55
Table 3.2.1-1	Summary of LNG System Alternatives Along the Texas Gulf Coast....3-5
Table 3.3.1-1	Comparison of Alternative Rio Grande LNG Terminal Sites Along the Texas Gulf Coast 3-16
Table 3.3.2-1	Comparison of Alternative Rio Grande LNG Terminal Sites Along the Brownsville Ship Channel....3-23
Table 4.1.2-1	Active and Permitted Oil and Gas Wells within 0.25 Mile of the Pipeline Facilities 4-3
Table 4.2.1-1	Characteristics of Soils Associated with the Rio Grande LNG Terminal and Pipeline Facilities....4-11
Table 4.3.1-1	Public and Private Water Supply Wells within 200 feet of Pipeline System Workspaces....4-25
Table 4.3.2-1	Watersheds Crossed by the Rio Grande LNG Project 4-31
Table 4.3.2-2	Waterbodies in the Vicinity of the Rio Grande LNG Terminal Site....4-35
Table 4.3.2-3	Proposed Sources of Water for Hydrostatic Testing for the Pipeline System 4-53
Table 4.4.1-1	Wetland and Special Aquatic Site Types in the Rio Grande LNG Project Area....4-57
Table 4.4.1-2	Wetlands and Special Aquatic Sites within the Rio Grande LNG Terminal Site 4-57

Table 4.4.2-1 Wetlands Affected by the Rio Grande LNG Project 4-60
Table 4.5-1 Vegetation Communities Crossed by the Proposed Rio Grande LNG Project 4-70
Table 4.5.1-1 Vegetation Types Affected by Construction and Operation of the Rio Grande LNG Project (in acres) 4-73
Table 4.6.2-1 Representative Fish Species Occurring in Aquatic Habitats in the Rio Grande LNG Project Area 4-104
Table 4.6.2-2 Estimated Sound Levels from Underwater Pile-Driving for the Rio Grande LNG Project and Effects Levels for Fish 4-110
Table 4.6.2-3 Estimated Zones of Impact for Fish from Underwater Pile-Driving Sound 4-111
Table 4.6.3-1 Life Stage Occurrence for Species with Designated Essential Fish Habitat Occurring in the Rio Grande LNG Project Area 4-123
Table 4.6.3-2 Essential Fish Habitat Types affected by Construction and Operation of the Rio Grande LNG Terminal 4-125
Table 4.7-1 Federal Special Status Species Potentially Occurring in the Vicinity of the Proposed Rio Grande LNG Project 4-128
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 4-138
Table 4.7.1-2 Estimated Zones of Impact for Protection Marine Species from Underwater Pile-driving Sound 4-139
Table 4.7.1-3 Estimated Noise Level Contributions for Site Preparation and Construction of the Rio Grande LNG Terminal at Nearby Sensitive Habitats 4-152
Table 4.7.1-4 Composite Noise Levels from the Rio Grande LNG Terminal at Nearby Sensitive Habitats during Operations 4-153
Table 4.7.2-1 State Listed Species Potentially Occurring in the Vicinity of the Proposed Rio Grande LNG Project 4-165
Table 4.7.2-2 Non-Endangered Species Act Listed Marine Mammals Potentially Occurring Along the LNG Transit Routes in the Gulf of Mexico 4-174
Table 4.8.1-1 Land Use Types Affected by Construction and Operation of the Rio Grande LNG Project (in acres) 4-177
Table 4.8.1-2 Structures within 50 feet of Rio Grande LNG Project Workspaces 4-189
Table 4.8.1-3 Recreation Areas Located within 0.25 Mile of the Rio Grande LNG Project 4-193
Table 4.9.1-1 Existing Socioeconomic Conditions in the Affected Areas 4-207
Table 4.9.6-1 Available Housing for Non-Local Construction Workers during Construction of the Project 4-224

Table 4.9.7-1 Public Services in the Affected Areas 4-226

Table 4.9.10-1 Demographics and Economic Statistics in the Vicinity of the Rio Grande LNG Project 4-235

Table 4.11.1-1 Ambient Air Quality Standards 4-246

Table 4.11.1-2 Ambient Air Quality Concentrations for Areas Near the Rio Grande LNG Terminal and Pipeline Facilities 4-247

Table 4.11.1-3 Major Stationary Source and Prevention of Significant Deterioration Emission Thresholds 4-252

Table 4.11.1-4 Estimated Construction Emissions for the Rio Grande LNG Terminal and Compressor Station 3 (tpy) 4-257

Table 4.11.1-5 Estimated Marine Vessel VOC and NOx Emissions in the Houston-Galveston-Brazoria Area (tpy) 4-259

Table 4.11.1-6 Estimated Emissions from LNG Train Commissioning and Start-Up (tpy) 4-260

Table 4.11.1-7 Summary of Estimated Emissions from Routine Operation of the LNG Terminal and Compressor Station 3 (tpy) 4-262

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 4-265

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 4-265

Table 4.11.1-10 Summary of National Ambient Air Quality Standards Full Impact Analysis 4-266

Table 4.11.1-11 Summary of NAAQS Full Impact Analysis, Palo Alto Battlefield Receptors 4-267

Table 4.11.1-12 SO2 NAAQS Analysis Modeling Results for the Rio Grande LNG Terminal 4-268

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) 4-270

Table 4.11.1-14 Estimated Construction Emissions for the Pipeline System (tpy) 4-271

Table 4.11.1-15 Estimated Construction Emissions for the Aboveground Facilities (tpy) 4-273

Table 4.11.1-16 Compressor Stations 1 and 2 Estimated Annual Emission Rates (tpy) ..4-275

Table 4.11.1-17 Summary of Air Dispersion Modeling at Compressor Stations 1 and 2 and Comparison to NAAQS 4-276

Table 4.11.1-18 Booster Stations 1 and 2 Estimated Annual Emission Rates (tpy) 4-278

Table 4.11.1-19	Summary of Air Dispersion Modeling at Booster Stations 1 and 2 and Comparison to NAAQS	4-279
Table 4.11.2-1	Sound Levels and Relative Loudness	4-281
Table 4.11.2-2	Existing Sound Levels at Noise Sensitive Areas Near the Rio Grande LNG Terminal	4-282
Table 4.11.2-3	Existing Sound Levels at Noise Sensitive Areas Near Compressor Stations and Booster Stations	4-283
Table 4.11.2-4	Existing Sound Levels at Noise Sensitive Areas Near HDD Construction	4-285
Table 4.11.2-5	Pile-driving Noise Estimates for Impact-driven Piles During Construction of the Rio Grande LNG Terminal	4-289
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	4-291
Table 4.11.2-7	Equipment Quantities and Sound Power Levels at the Rio Grande LNG Terminal	4-293
Table 4.11.2-8	Composite Noise Levels from the Rio Grande LNG Terminal at Nearby Noise Sensitive Areas during Operations	4-293
Table 4.11.2-9	Estimated Sound Levels for Construction of the Pipeline System	4-297
Table 4.11.2-10	Horizontal Directional Drill Construction Sound Estimates	4-297
Table 4.11.2-11	Ambient and Construction Sound Levels at Representative NSAs near HDDs	4-298
Table 4.11.2-12	Composite Construction Sound Estimates for Compressor Stations 1 and 2	4-301
Table 4.11.2-13	Composite Sound Levels at Nearby Noise Sensitive Areas from Aboveground Facilitiesa	4-302
Table 4.12.2-1	Onshore Natural Gas Transmission Pipeline Significant Incidents by Cause 1996-2015	4-388
Table 4.12.2-2	Outside Forces Incidents by Cause 1996-2015	4-389
Table 4.12.2-3	Injuries and Fatalities - Natural Gas Transmission Pipelines	4-391
Table 4.12.2-4	Nationwide Accidental Deaths	4-392
Table 4.13.1-1	Geographic Scope for Cumulative Impact Analysis	4-394
Table 4.13.1-2	Projects and Resources Considered in the Cumulative Impacts Analysis for the Rio Grande LNG Project	4-396
Table 4.13.2-1	Wetlands Affected by the Proposed Brownsville LNG Terminals	4-429
Table 4.13.2-2	Estimated Construction Emissions for the Brownsville LNG Projects (tons per year)	4-472

Table 4.13.2-3 Peak Concentrations Estimated in Cumulative Air Dispersion Modeling for Stationary Source and LNG carriers for the Brownsville LNG Projects....4-476
Table 4.13.2-4 Standardized NSAs and Calculation Point Locations for Cumulative Noise Analysis....4-484
Table 4.13.2-5 Summary of Cumulative LNG Construction Impacts at Standardized NSA and CP Locations, All Levels are dBA Ldn....4-486
Table 4.13.2-6 Calculation of the Incremental Impact of Cumulative LNG Construction Noise at Standardized NSA and CP Locations, All Levels are dBA Ldn....4-488
Table 4.13.2-7 Cumulative Operational Noise Impacts from LNG Facilities....4-491

LIST OF FIGURES

Figure 1-1 Project Location Map....1-2
Figure 2.1.1-1 Rio Grande LNG Terminal Site....2-3
Figure 2.1.1-2 LNG Terminal Plot Plan....2-4
Figure 2.1.1-3 Schematic of C3MR^{TM} Process....2-7
Figure 2.1.1-4 Typical LNG Tank Components....2-9
Figure 2.1.1-5 Rio Grande LNG Terminal Rendering....2-10
Figure 2.1.3-1 Compressor Stations and Interconnect Booster Station Locations....2-18
Figure 2.2.2-1 Typical Right-of-way Cross-section for Uplands....2-28
Figure 2.2.2-2 Typical Right-of-way Cross-section for Wetlands....2-29
Figure 2.5.2-1 Typical Pipeline Construction Sequence....2-43
Figure 3.2.1-1 LNG Terminal System Alternatives....3-6
Figure 3.2.2-1 Pipeline Systems Alternatives....3-12
Figure 3.2.2-2 VCP System Alternative....3-14
Figure 3.3.1-1 Alternative Terminal Sites Along the Texas Gulf Coast....3-17
Figure 3.3.2-1 Alternative Terminal Sites at the Port of Brownsville....3-21
Figure 4.2.3-1 Dredge Disposal Locations Considered for Placement of Dredged Materials....4-20
Figure 4.3.2-1 Watersheds Crossed by the Rio Grande LNG Project....4-30
Figure 4.3.2-2 Waterbodies in the Vicinity of the Rio Grande LNG Terminal Site....4-33
Figure 4.4.1-1 Aquatic Resources within the LNG Terminal Site....4-58
Figure 4.5.1-1 Vegetation Communities within the Rio Grande LNG Terminal Site....4-72

Figure 4.6.1-1 Sensitive or Managed Wildlife Habitats in the Vicinity of the Rio Grande LNG Project 4-99
Figure 4.6.3-1 Aquatic Habitat in the Rio Grande LNG Project Area 4-122
Figure 4.7.1-1 Critical Habitat for the Piping Plover in the Vicinity of the Rio Grande LNG Terminal Site 4-150
Figure 4.9.1-1 Construction Workforce Associated with the LNG Terminal Site 4-208
Figure 4.9.1-2 Construction Workforce Associated with the Pipeline Facilities 4-210
Figure 4.9.3-1 Local Tourism Sites in the Vicinity of the Proposed Rio Grande LNG Terminal 4-215
Figure 4.11.2-1 Noise Sensitive Areas Near the Rio Grande LNG Terminal 4-284
Figure 4.11.2-2 Sound Contours for Operation of the Rio Grande LNG Terminal 4-294
Figure 4.12.1.3-1 Accidental Hazard Zones along LNG Marine Vessel Route 4-317
Figure 4.12.1.3-2 Intentional Hazard Zones along LNG Marine Vessel Route 4-317
Figure 4.13.1-1 Cumulative Projects Overview of the Rio Grande LNG Terminal 4-411
Figure 4.13.1-2 Cumulative Projects Overview of the Rio Bravo Pipeline 4-412
Figure 4.13.2-1 Cumulative Impacts (Rio Grande LNG, Texas LNG, Annova LNG, and Background), 1-Hour NO_2 4-477
Figure 4.13.2-2 Locations of Cumulative Impact NSAs and Calculation Points 4-485
Figure 4.13.2-3 Cumulative Operational Sound Levels, dBA L_{dn}, for Texas LNG, Rio Grande LNG, and Annova LNG 4-492

VOLUME II

LIST OF APPENDICES

Appendix A	Distribution for Notice of Availability
Appendix B	Topographic Map of the Rio Grande LNG Project
Appendix C	Permanent and Temporary Access Roads for the Rio Bravo Pipeline System
Appendix D	Rio Grande LNG Project Project-Specific Upland Erosion Control, Revegetation, and Maintenance Plan
Appendix E	Rio Grande LNG Project Project-Specific Wetland and Waterbody Construction and Mitigation Procedures
Appendix F	Requested Alternative Measures from the FERC Plan and Procedures for the Rio Grande LNG Project
Appendix G	Waterbodies Crossed by the Rio Bravo Pipeline System
Appendix H	Roads Crossed by the Rio Bravo Pipeline System
Appendix I	Soil Series Crossed by the Rio Bravo Pipeline System Pipeline Centerlines
Appendix J	Wetlands Crossed by the Rio Bravo Pipeline System
Appendix K	Migratory Birds and Birds of Conservation Concern in the Rio Grande LNG Project Area
Appendix L	Visual Simulations of the Rio Grande LNG Terminal
Appendix M	Rio Grande LNG Project Essential Fish Habitat Assessment
Appendix N	Project-Specific Best Management Practices, Northern Aplomado Falcon
Appendix O	Location of Additional Temporary Workspace for the Rio Bravo Pipeline System
Appendix P	Air Cumulative Analysis
Appendix Q	Construction Noise Normalization for Cumulative Impact Noise Assessment
Appendix R	Draft Environmental Impact Statement Comments and Responses
Appendix S	References
Appendix T	List of Preparers
Appendix U	Index

ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
μg	micrograms
μPa	micropascal
AAQS	Ambient Air Quality Standards
ACHP	Advisory Council on Historic Preservation
ACI	American Concrete Institute
AEP	American Electric Power
AIChE	American Institute of Chemical Engineers
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
BCC	Birds of Conservation Concern
Bcf/d	billion cubic feet per day
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
BS	British Standard
BSC	Brownsville Ship Channel
BTEX	benzene, toulene, ethylbenzene, and xylene
Btu/m^2-hr	British thermal units per square foot per hour
C3MR^{TM}	Air Products and Chemicals, Inc. liquefaction process
CAA	Clean Air Act
CAMx	Comprehensive Air Quality Model with Extensions
Cat	Category
CCPS	Center for Chemical Process Safety
CCRMA	Cameron County Regional Mobility Authority
CEB	Comite Euro-International du Beton

CEQ	Council on Environmental Quality
Certificate	Certificate of Public Convenience and Necessity
CFE	Comisión Federal de Electricidad
CFR	Code of Federal Regulations
CH_4	methane
Cheniere Corpus Christi	Cheniere Corpus Christi LNG, LLC and Cheniere Corpus Christi Pipeline, LP
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
COE	U.S. Army Corps of Engineers
Commission	Federal Energy Regulatory Commission
Corpus Christi	Corpus Christi LNG, LLC
COTP	Captain of the Port
CP	calculation point
CPT	cone penetration test
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
DHS	Department of Homeland Security
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DPS	distinct population segment
DR	dimension ratio
EEM	estuarine emergent marsh
EFH	essential fish habitat
EI	environmental inspector
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPAct 2005	Energy Policy Act of 2005
ERP	Emergency Response Plan

ESA	Endangered Species Act
ESD	emergency shutdown
ESS	estuarine scrub-shrub
EUS	estuarine unconsolidated shore
FAA	Federal Aviation Administration
FEED	Front End Engineering Design
FEMA	Federal Emergency Management Administration
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FIS	Flood Insurance Study
FLEX	Freeport LNG Expansion and FLNG Liquefaction, LLC
FM	farm to market
FRA	Federal Railroad Administration
Freeport Development	Freeport LNG Development, L.P.; FLNG LNG, LLC; FLNG LNG 2, LLC; and FLNG LNG 3, LLC
FSA	Farm Service Agency
ft^2	square feet
FTA	free trade agreement
Fugro	Fugro Consultants, Inc.
FWCA	Fish and Wildlife Coordination Act
FWS	U.S. Fish and Wildlife Service
GBLNG	Galveston Bay LNG, LLC
GHG	greenhouse gases
GIS	geographic information system
GMFMC	Gulf of Mexico Fisheries Management Council
gpm	gallons per minute
GPP	Golden Pass Products LLC
Gulf Coast	Gulf Coast LNG Export, 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
HMI	human machine interfaces
hp	horsepower

HUC	hydrologic unit code
IBC	International Building Code
IBWC	International Boundary and Water Commission
ILI	in-line inspection
IMO	International Maritime Organization
IMP	integrity management program
IPaC	Information for Planning and Consultation
ISA	Interatnional Society of Automation
ISO	International Organization for Standardization
KOP	key observation point
kV	kilovolt
kW/m^2	kilowatts per square meter
lb	pounds
L_{dn}	day-night sound level
L_{eq}	equivalent sound level
LFL	lower flammability limit
L_{max}	maximum sound level observed during a measurement period or
LNG	liquefied natural gas
LOD	Letter of Determination
LOI	Letter of Intent
LOR	Letter of Recommendation
LOS	Level-of-Service
LPG	liquefied petroleum gas
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
Memorandum	Memorandum of Understanding on Natural Gas Transportation Facilities
MEOW	maximum envelope of water
mg/L	milligrams per liter
MLLW	mean low low water
MLV	mainline valve
MMPA	Marine Mammal Protection Act
MMscf	million standard cubic foot
MOF	material offloading facility

MOU	Memorandum of Understanding
MP	milepost
mph	miles per hour
MSA	metropolitan statistical area
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MTPA	million tons per annum
MTSA	Maritime Transportation Security Act
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
NHTSA	National Highway Traffic Safety Administration
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPIL	The Williams Transco North Padre Island Lateral
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NSA	noise sensitive area
NSPS	New Source Performance Standards
NSR	New Source Review
NVIC	Navigation and Vessel Inspection Circular
NWI	National Wetlands Inventory
NWR	national wildlife refuge
ODMDS	Ocean Dredged Material Disposal Site
OEP	Office of Energy Projects
P&ID	piping and instrument diagrams
PA	Placement Area
PEM	palustrine emergent

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_{10}	particulate matter with an aerodynamic diameter less than or equal to 10 microns
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to 2.5 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
psi	pounds per square inch
PSS	palustrine scrub-shrub
PVB	pressure vessel burst
RB Pipeline	Rio Bravo Pipeline Company, LLC
RG Developers	Rio Grande LNG, LLC (RG LNG) and Rio Bravo Pipeline Company, LLC
RG LNG	Rio Grande LNG, LLC
RHA	Rivers and Harbors Act
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
Secretary	Secretary of the Commission
SH	State Highway
SHPO	State Historic Preservation Office
SIL	significant impact level
SIS	safety instrument system
SLOSH	Sea, Lake, and Overland Surge from Hurricanes

SO_2	sulfur dioxide
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan
SSE	safe shutdown earthquake
SSURGO	NRCS Soil Survey Geographic database
STSSN	Sea Turtle Stranding and Salvage Network
SWEL	standing water elevation
SWPPP	Stormwater Pollution Prevention Plan
TAC	Texas Administrative Code
TAHC	Texas Animal Health Commission
TCEQ	Texas Commission of Environmental Quality
TDWR	Texas Department of Water Resources
Texas Eastern	Texas Eastern Transmission Pipeline
Texas LNG	Texas LNG Brownsville
TGS	Texas Gas Service Company
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
TPG	The Perryman Group
TPWD	Texas Parks and Wildlife Department
tpy	tons per year
TWDB	Texas Water Development Board
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
VCP	Valley Crossing Pipeline
VLCC	very large crude carrier
VOC	volatile organic compounds
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 exports would be consistent with authorizations from the DOE. The DOE granted an

1 We," "us," and "our" refer to the environmental and engineering 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.

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 Year 4 of construction, 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] 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 of gas. Although the Header System and Pipeline 1 are proposed to be constructed at the same

[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.

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 Year 4 of construction, 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 (TPWD) 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 scoping 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]

On October 12, 2018, we issued a *Notice of Availability of the Draft Environmental Impact Statement for the Proposed Rio Grande LNG Project.* This notice, which was published in the Federal Register, listed the date and locations of public comment sessions and established a closing date of December 3, 2018, for receiving comments on the draft EIS. Copies of the notice were mailed to 3,253 stakeholders. The EPA noticed the draft EIS in the Federal Register on October 18, 2018. We held three public comment sessions in the Project area to solicit and receive comments on the draft EIS. These sessions were held on November 13, 14, and 15, 2018, in Kingsville, Raymondville, and Port Isabel, respectively. The sessions provided the

[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.

public an opportunity to present oral comments directly to FERC staff (which were recorded by a court reporter) on the environmental analysis presented in the draft EIS. A total of 63 individuals provided oral comments. We also received 861 comment and form letters from federal agencies, companies/organizations, and individuals in response to the draft EIS. Transcripts from the public sessions, as well as written comment letters, were entered into the public record and are available for viewing on FERC's eLibrary website (www.ferc.gov).[6] All substantive environmental comments on the draft EIS have been addressed in this final EIS. In addition, issues raised in the comments and our responses are provided in appendix R of this final EIS.

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 (EFH); threatened, endangered, and other special-status species; land use, recreation, and visual resources; socioeconomics; cultural resources; air quality and noise; reliability and safety; and cumulative impacts. Where necessary, we recommend additional mitigation 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 3,633.2 acres of land. Following construction, the LNG Terminal site and pipeline facilities would encompass about 2,149.2 acres. The remaining 1,484.0 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).

6 The public meeting transcripts are available on FERC's elibrary website (see accession numbers 20190102-4002, 20190102-4003, and 20190102-4005).

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). Impacts on surface water quality would be adequately mitigated through adherence to applicable COE permits and 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 63 waterbodies, including 21 perennial streams, 19 intermittent streams, 10 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). No active surface water intakes for public water supply are within 3 miles downstream of the Pipeline System or LNG Terminal. The Pipeline System would cross two waterbodies regulated by the International Boundary and Water Commission, and RB Pipeline is developing site-specific HDD crossing plans for these waterbodies that would adhere to the International Boundary and Water Commission's criteria.

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. 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; and Spill Prevention, Control, and Countermeasures Plans; we conclude that impacts on water resources would be adequately minimized.

Wetlands

Construction of the Project would affect a total of 327.7 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 107.3 acres would be maintained in an herbaceous wetland state within the permanent right-of-way for the pipelines. The remaining 38.0 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, EPA, and the TPWD, 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.

RG LNG originally proposed to use a temporary haul road for construction to transport fill material from the Port Isabel dredge pile. We reviewed RG LNG's proposal and determined that construction of the temporary haul road through wetlands was not adequately justified. We therefore recommended in the draft EIS that RG LNG conduct a feasibility assessment for transporting fill material from the Port Isabel dredge pile (if necessary) to the LNG Terminal site via the existing system of roads or via barges. As a result of our recommendation in the draft EIS, RG LNG is no longer pursuing use of the temporary haul road, thus the associated wetland impacts would be avoided.

With adherence to measures contained in the Project-specific Procedures and applicable COE permits, 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 3,220.1 acres of wildlife habitat would be within the footprint of the LNG Terminal and pipeline facilities; of this, 2,055.9 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. In response to comments on the draft EIS regarding concern over facility lighting, we recommend that RG Developers finalize Project lighting plans in coordination with the FWS and TPWD to minimize potential effects on wildlife. 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 during the bird nesting period 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 and TPWD. We have also determined that the overall increase in nighttime lighting during 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 and noise 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, the channel to San Martin Lake, the Bahia Grande Channel, and the water column at potential dredged material disposal sites have been designated as habitats that function as EFH. Although the construction 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 temporary and minor. Consultation under the Magnuson Stevens Fishery Conservation and Management Act is complete, and given the temporary, minor impacts on EFH, NMFS does not have EFH conservation recommendations for the Project.

Threatened, Endangered, and Other Special-status Species

A total of 25 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* 19 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 piping plover or 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. Similarly, our *not likely to adversely affect* determination for the northern aplomado falcon is related to nest identification, monitoring, and implementation of best management practices for the species, but also accounts for its coverage under a Safe Harbor Agreement that allows development (and take) in the Project area. As RG Developers have committed to multiple mitigation measures for the protection of federally and state listed species (e.g., implementing biological monitors, following agency-recommended best management practices), we have also recommended that RG Developers file documentation demonstrating that such measures have been incorporated into its environmental training program.

We have determined that the Project *is likely to adversely affect* the ocelot and the Gulf coast jaguarundi. 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. Although there is a lack of confirmed sightings for the jaguarundi in the Project area, its range and habitat usage overlaps that of the ocelot and, if present in the area, the jaguarundi would experience impacts similar to those discussed for the ocelot. Final mitigation requirements would be determined by FWS in its Biological Opinion and through completion of the Endangered Species Act Section 7 consultation process. 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 3,633.2 acres of land. Following construction, the LNG Terminal site and permanent rights-of-way would encompass about 2,149.2 acres. The remaining 1,484.0 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 and Lower Rio Grande Valley National Wildlife Refuges, 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.

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 LNG and barge 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 5 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 U.S. Code [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, charter, and tour boats), 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, and the TCEQ issued an Order granting the PSD permit on December 17, 2018. 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; RB Pipeline submitted state permit applications for these facilities on March 24, 2017, and the permits were approved in June 2017. The annual emissions of greenhouse gases 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 greenhouse gas 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 and the TCEQ also performed ozone modeling analyses to quantify the potential impacts of the Project on ozone concentrations in the surrounding area. Both analyses 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).

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

As a cooperating agency, the DOT advises the Commission on whether RG LNG's proposed design would meet the DOT's Title 49 of the Code of Federal Regulations, Part 193 Subpart B (49 CFR 193 Subpart B) siting requirements. On March 26, 2019, the DOT provided a Letter of Determination on the Project's compliance with 49 CFR Part 193 Subpart B.[7] This determination was provided to the Commission for consideration in its decision on the Project application. If the Project is authorized, constructed, and operated, the facility would be subject to the DOT's inspection and enforcement program; 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 Valley Crossing Pipeline that is routed through the northern part of the proposed LNG Terminal site. FERC staff,

7 March 26, 2019 letter "Re: Rio Grande LNG Terminal, Docket No. CP16-454-000, 49 CFR, Part 193, Subpart B, Siting – Letter of Determination." Filed in Docket Number CP16-454-000 on March 27, 2019. FERC eLibrary accession number 20190327-3003.

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'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.

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, constructed, and operated, 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 a number of 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, we conclude 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 off-site 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 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, tourism and commercial fisheries, 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 (significant), because of past cumulative habitat loss and construction of aboveground structures adjacent to areas of remaining 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 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.

Although the land proposed to be developed for the three Brownsville LNG projects is zoned for industrial use, the concurrent construction and operation of three large industrial facilities would result in a change of the character of the landscape that could cause some visitors to choose to vacation elsewhere or alter their recreation activities to destinations in the region that are further from the proposed Brownsville LNG project sites. In addition, increased vessel traffic resulting from the concurrent operation of the three Brownsville LNG projects would likely result in delays for commercial fishing and recreational vessels that need to transit the BSC. Therefore, we anticipate that cumulative impacts on tourism and commercial fisheries would be permanent and moderate.

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 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.

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. However, for the duration of Annova's nighttime pile-driving, significantly higher levels of noise are estimated and this would result in significant cumulative noise impacts. The only 24-hour construction proposed at the Rio Grande LNG Terminal would be dredging. As described in section 4.11.2.3, the estimated sound level from dredging associated with the Rio Grande LNG Terminal at the nearest NSAs would be below existing ambient sound levels, and noise associated with dredging activities is not expected to be perceptible. Therefore, RG LNG's contribution to cumulative nighttime construction noise would be negligible. 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 presented a significant environmental advantage 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 stated 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 seven LNG Terminal system alternatives, including four existing LNG import terminals with planned, proposed, or authorized liquefaction projects; and three proposed/planned 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. In the draft EIS we evaluated alternatives to RG LNG's proposed new haul road to bring fill material from the Port Isabel dredge pile to the terminal site. In response to our recommendation in the draft EIS, RG LNG adopted an alternative to transport the fill materials, if necessary, using barges.

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 construction noise during nighttime pile-driving, 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; on the federally listed northern aplomado falcon from habitat loss, 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 66.0 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 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 off-site 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.
- 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.
- Consultation under the Magnuson Stevens Fishery Conservation and Management Act is complete, and NMFS does not have EFH conservation recommendations for the Project.
- 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. Our recommendations are presented in section 5.2 of the EIS. We recommend 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 final 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 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).

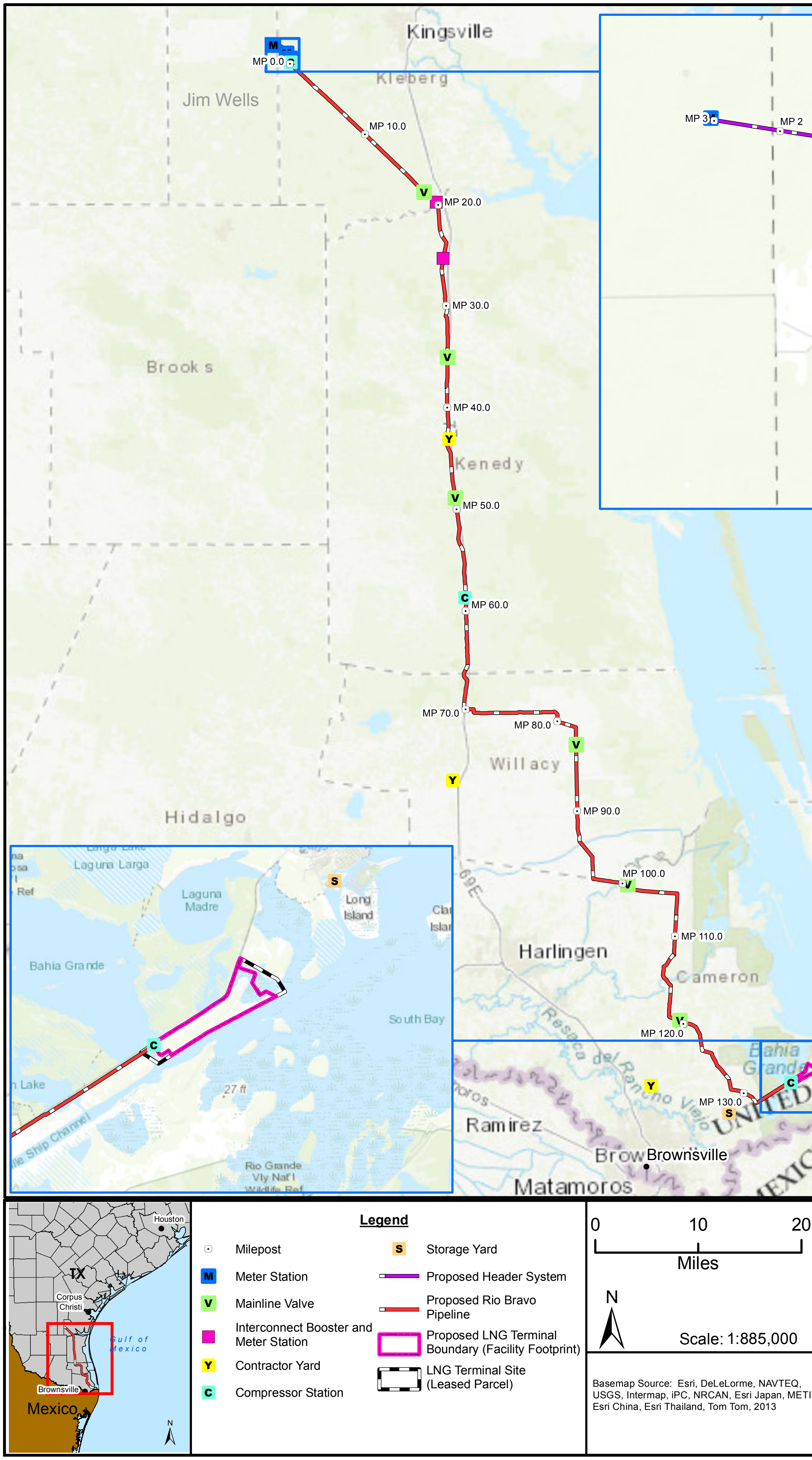
The vertical line in the margin identifies text that is new or modified in the final EIS and differs materially from corresponding text in the draft EIS. Changes were made to address comments from cooperating agencies and other stakeholders on the draft EIS, incorporate applicant-proposed modifications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

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.



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). The EIS also considers 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, the 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.

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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] In accordance with the August 31, 2018 Memorandum of Understanding (MOU), the DOT issued a Letter of Determination (LOD) to FERC on the 49 CFR 193 Subpart B regulatory requirements, which was filed with the Commission as part of the consolidated record for the Project to be one of the considerations for the Commission to deliberate in its decision to authorize, with or without modification or conditions, or deny an application.[8]

1.2.6 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 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.

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

8 March 26, 2019 letter "Re: Rio Grande LNG Project, Docket No. CP16-454-000, 49 CFR, Part 193, Subpart B, Siting – Letter of Determination." Filed in Docket Number CP16-454-000 on March 27, 2019. FERC eLibrary accession number 20190327-3003.

1.2.7 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 USC 703) and the Bald and Golden Eagle Protection Act (BGEPA) (16 USC 688).

1.2.8 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 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.

1.2.9 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.

1.2.10 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 EFH and to protect marine mammals.

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 the planned 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 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.

1.3.2 Public Review of the Draft EIS

On October 12, 2018, we issued a *Notice of Availability of the Draft Environmental Impact Statement for the Proposed Rio Grande LNG Project.* This notice, which was published in the Federal Register, listed the date and locations of public comment sessions and established a closing date of December 3, 2018, for receiving comments on the draft EIS. Copies of the notice were mailed to 3,253 stakeholders. The EPA noticed the draft EIS in the Federal Register on October 18, 2018.

We held three public sessions in the Project area to solicit and receive comments on the draft EIS. These sessions were held on November 13, 14, and 15, 2018, in Kingsville, Raymondville, and Port Isabel, respectively. The sessions provided the public an opportunity to present oral comments to a court reporter on the environmental analysis described in the draft EIS. A total of 63 individuals provided oral comments. We also received 861 comment and form letters from federal agencies, companies/organizations, and individuals in response to the draft EIS. All comments received are included in our comment responses contained in appendix R. Transcripts from the public sessions, as well as written comment letters, were entered into the public record and are available for viewing on FERC's eLibrary website (www.ferc.gov).[9]

This EIS addresses all substantive comments submitted to the FERC or made at open houses, scoping meetings, interagency meetings, and public comment sessions on the draft EIS. Issues identified are summarized in table 1.3-1, along with the EIS section that addresses 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.

1.3.3 Final EIS

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

9 The public meeting transcripts are available on FERC's elibrary website (see accession numbers 20190102-4002, 20190102-4003, and 20190102-4005).

Table 1.3-1 Key Environmental Concerns Identified During Scoping and from Comments on the draft EIS	
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
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

Table 1.3-1 (continued) Key Environmental Concerns Identified During Scoping and from Comments on the draft EIS	
Issue/Specific Comment	**EIS Section Addressing Comment**
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
Mitigation for species-specific habitat loss	4.7.1.3, 4.7.1.4
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 and from Comments on the draft EIS	
Issue/Specific Comment	**EIS Section Addressing Comment**
Reliability and Safety (continued)	
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	DOE has the legal authority to approve natural gas exports, and FERC is not required in its NEPA review to consider the possible environmental effects of end-use of natural gas exports. 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.

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

1.4 NON-JURISDICTIONAL FACILITIES

Under 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.

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).[10] 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 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 2,725-

10 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).

kilowatt 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 early coordination with TxDOT and include the addition of land for acceleration, deceleration, and turning, as well as traffic lights. During a November 2018 meeting, RG Developers also identified a reduction in speed limit near the LNG Terminal site along SH-48. TxDOT requested that RG Developers provide an updated Traffic Impact Analysis for review, including a speed study, to assess the current road conditions and traffic mitigation. RG Developers filed the updated study for FERC review on March 13, 2019 (see section 4.9.8.1).

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.

Table 1.5-1 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. 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.[11]

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

Table 1.5-1
Federal and State Agency Permits, Approvals, and Consultations 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 / RHA - 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 filed May 1, 2018. Under COE review.
	Real Estate Permit application pursuant to the RHA - Section 14	Application filed on April 12, 2018.	Application filed on May 2, 2018.
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 PHMSA	49 CFR 192 Consultation (standards for natural gas pipelines) 49 CFR 193, Subpart B	LOD issued on March 26, 2019.	NA Informal consultation is ongoing.
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.

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

Agency	Permits, Approval, or Consultation	Status: Terminal	Status: Pipeline
FEDERAL (continued)			
FWS	ESA Section 7 Consultation Fish and Wildlife Coordination Act Consultation MBTA Consultation	Technical Assistance Request Submitted on March 27, 2015. Multiple follow-up meetings through 2018 to discuss 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 through 2018 to discuss the Rio Grande LNG Project status, mitigation measures, and Section 7 consultation. Consultation is ongoing.
International Boundary and Water Commission (IBWC)	Permit to cross waterbodies regulated by the IBWC	NA	Consultation is ongoing. Permit application pending, anticipated one month after FERC authorization.
NMFS	ESA Section 7 Consultation MMPA Section 101(a)(5) - Consultation, in conjunction with FWS, for potential impacts on federally protected marine mammals Fish and Wildlife Coordination Act Consultation MSFCMA Consultation	Technical assistance request Submitted on March 27, 2015. Follow-up meetings in 2017 and 2018. FERC submitted a final EFH Assessment to NMFS for review on February 14, 2019, and NMFS concurred on February 15, 2019. Consultation is complete.	Technical assistance request Submitted on March 27, 2015. Follow-up meetings in 2017 and 2018. FERC submitted a final EFH Assessment to NMFS for review on February 14, 2019, and NMFS concurred on February 15, 2019. Consultation is complete.
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.
DOT 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) filed on June 21, 2018. FAA determination provided for temporary construction cranes[a].	NA
U.S. Department of Defense	Consultation regarding impacts on military operations	Letter of minimal impacts received June 4, 2018.	NA

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			
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 June 2017; PSD permits received on December 17, 2018. Anticipated Temporary Water Use Permit Application submittal: 3rd Quarter 2019.	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; approvals received June 26 and 7, respectively. 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.
TxDOT	Form 1058, Permit to Construct Access Driveway Facilities on Highway Right-of-Way pursuant to Texas Administrative Code (TAC), 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, TAC - Section 65	Technical assistance request submitted on March 27, 2015. Follow-up meetings through 2018. Consultation is ongoing.	Technical assistance request submitted on March 27, 2015. Follow-up meetings through 2018. 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
STATE (continued)			
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.
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, TAC - 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, TAC - 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.

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, which was revised based on additional Project information from RG Developers and recommendations by NMFS. On February 15, 2019, NMFS issued a letter concurring with our conclusion that impacts on open water EFH would be temporary and minor, and does not have EFH conservation recommendations for the Project. Therefore, consultation under the MSFCMA is complete. The EFH assessment is included as appendix M 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 Historic Preservation (ACHP) an opportunity to comment. 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. 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 permit applications were submitted in early 2018 to account for Project changes, and the COE issued a formal Notice for public review on October 18, 2018, regarding the LNG Terminal and Pipeline System permit applications. This COE review is underway. 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. 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. Applications for authorizations under Section 14, which authorizes the review of requests that could modify COE civil works projects, were filed in early 2018 and are currently under 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 milepost (MP) 69.8 to the LNG Terminal would be located 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 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. 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, and the TCEQ issued an Order granting the PSD permit on December 17, 2018. 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; these applications were approved in June 2017. Title V operating permits 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. Figure 1-1 in section 1.0 provides the general location of the Rio Grande LNG Project. 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 (or LNG marine vessels) and trucks for export and domestic distribution, respectively:
    - liquefaction trains;[12]
    - 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:

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[12] A liquefaction train is a system that liquefies natural gas.

- 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).

o 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.

2.1.1 LNG Terminal

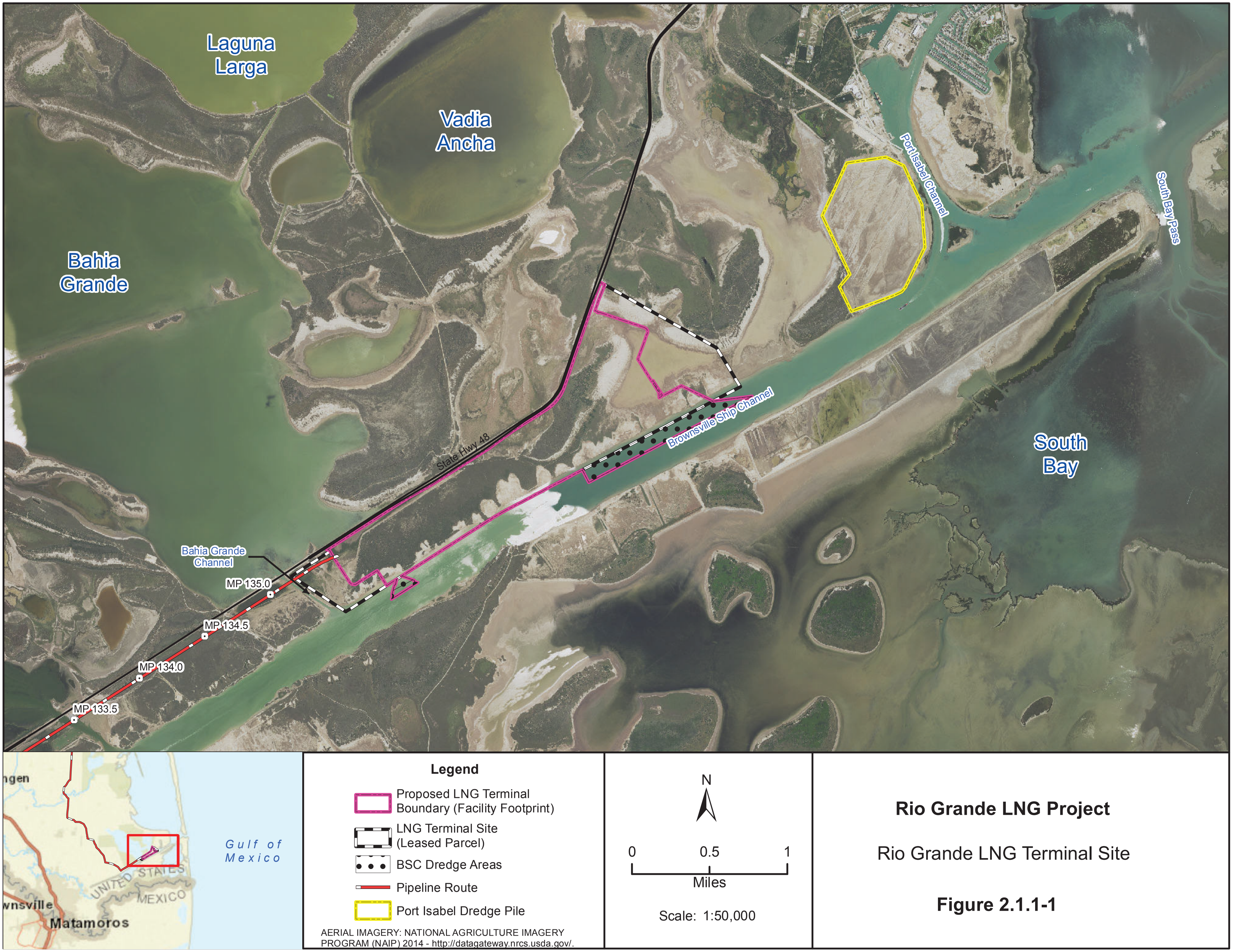
The LNG Terminal would be located on 750.4 acres of a 984.2-acre parcel of land along the northern shore of the BSC in Cameron County, approximately 9.8 miles east of Brownsville and about 2.2 miles southwest of Port Isabel (see figure 2.1.1-1). RG LNG would lease the site from the BND for a term of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

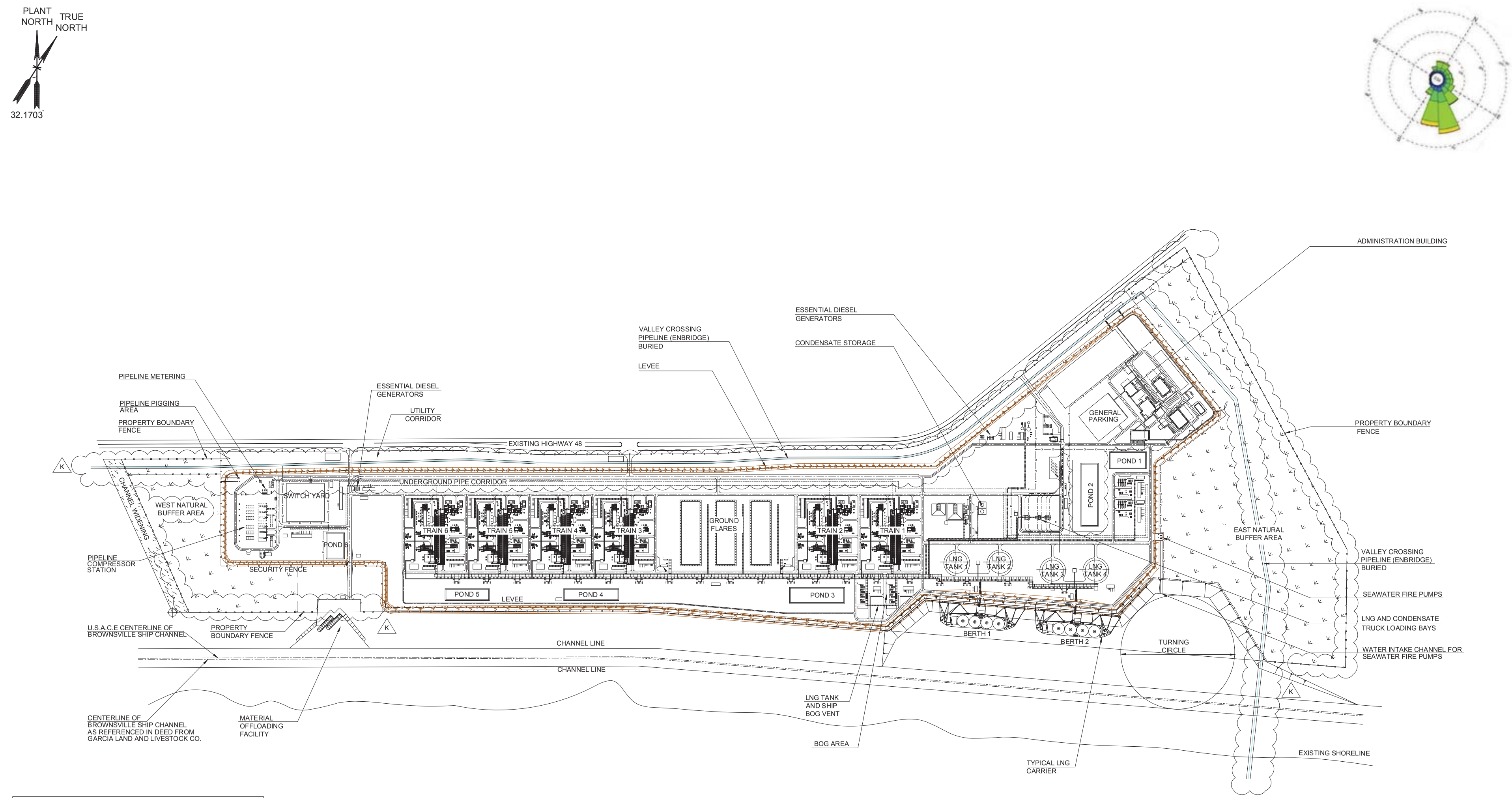
RB Pipeline would construct and operate the Gas Gate Station within the boundary of the LNG Terminal. The Gas Gate Station would include Compressor Station 3, which would facilitate the transportation of up to 4.5 Bcf/d of natural gas (feed gas) from RB Pipeline's proposed Pipeline System to the LNG 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).



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

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.

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. Once saturated with water, heated regeneration gas would release water from the molecular sieve beds. The regeneration gas would be cooled to condense out the 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^{TM}). 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.

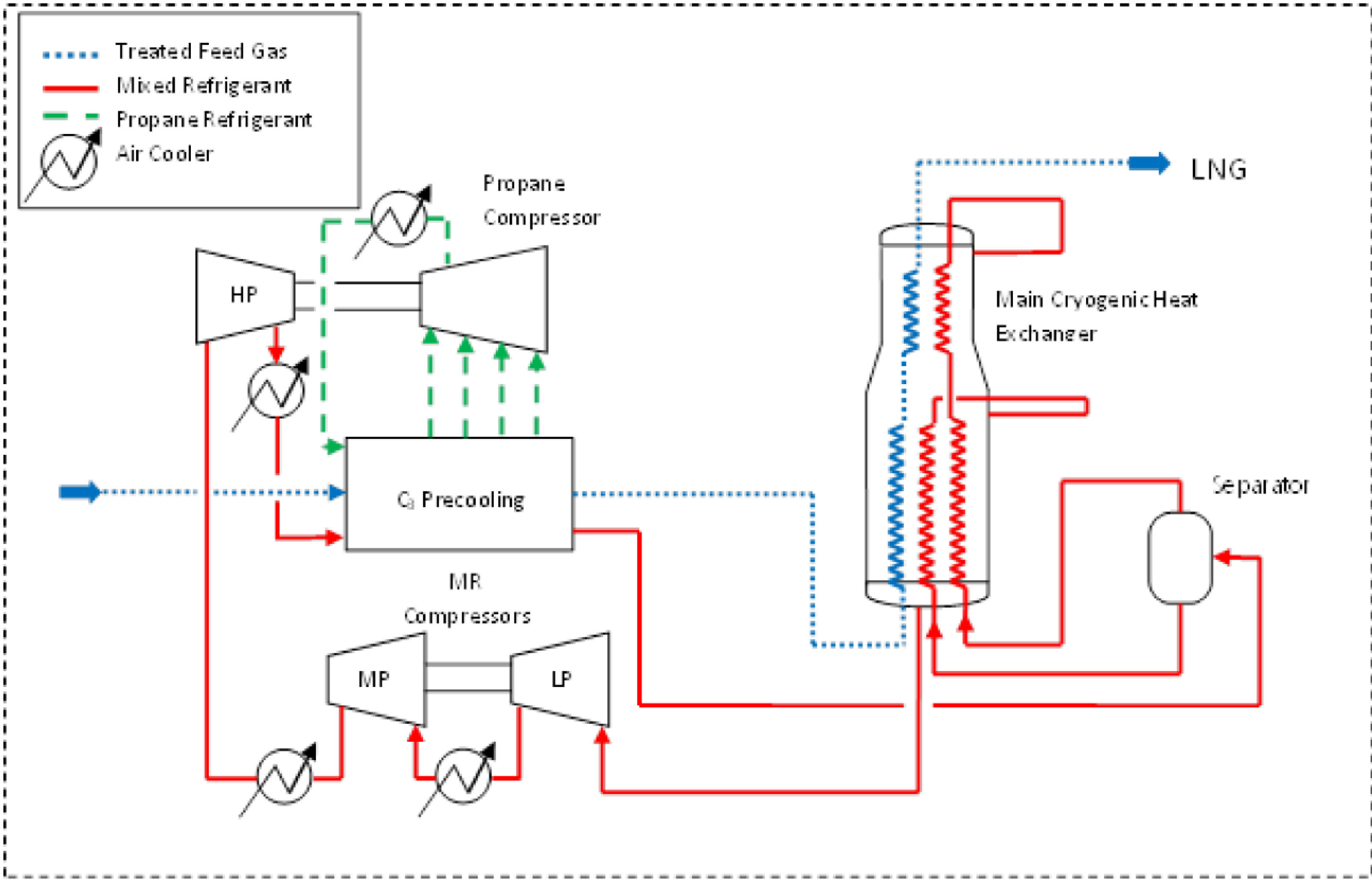
LNG exiting the main cryogenic heat exchanger would then be let down in pressure using valves, and would be routed and flashed into the LNG storage tanks. The flash gas produced in the LNG storage tanks would be routed to the boil-off gas (BOG) compressor system, where it would be compressed and be sent 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;



Rio Grande LNG Project

Schematic of C3MR™ Process

Figure 2.1.1-3

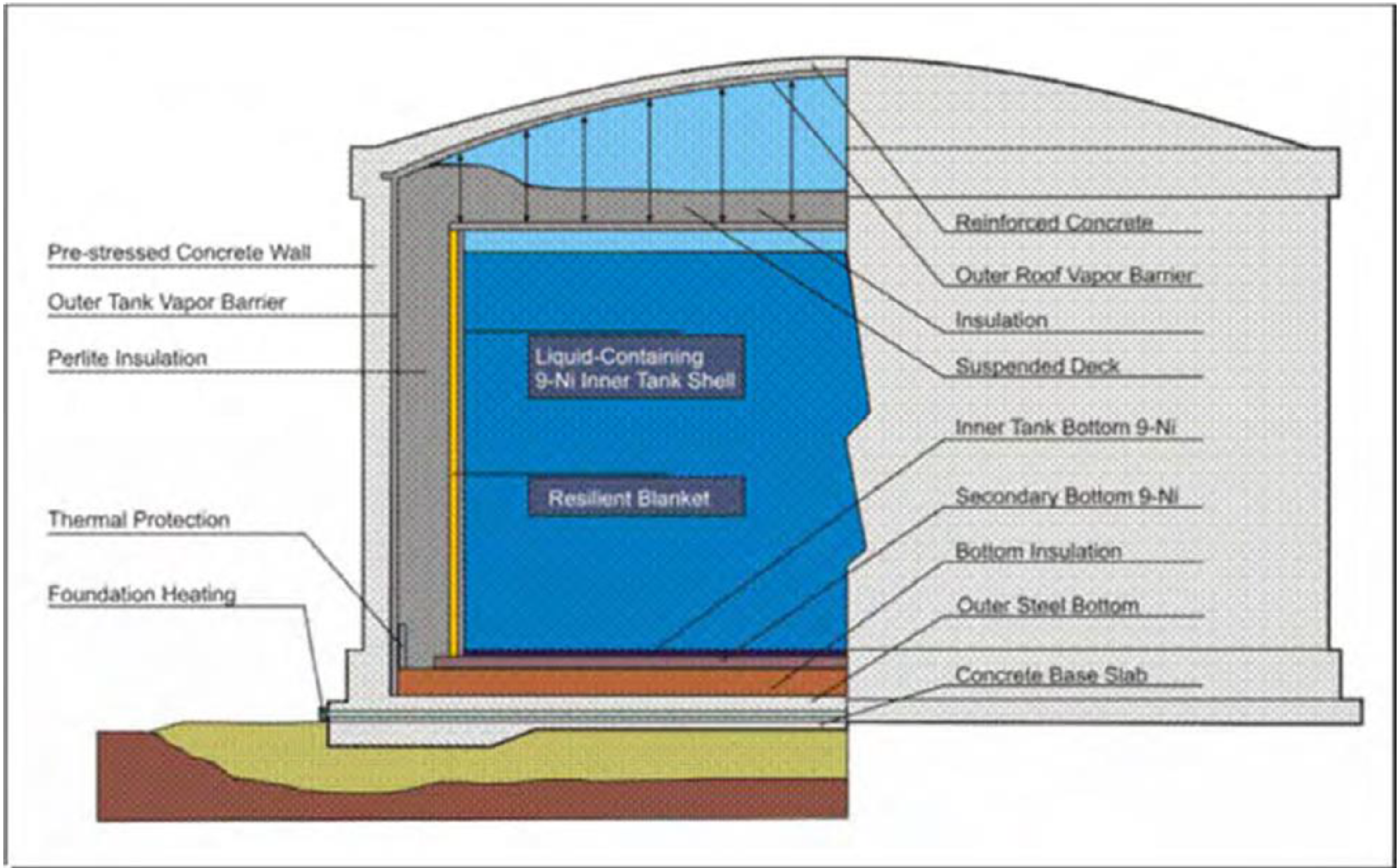
- thermal insulation systems:
  - foam-glass layers under the inner tank with bottom/corner protection,
  - resilient blanket with perlite fill of the annular space between inner and outer tank walls, and
  - thermal insulation (blankets) on the suspended deck;
- submerged motor in-tank pumps and supported 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).



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

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.

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 currently 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 pre-fabricated 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 rollon/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 4 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 surrounded 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

<u>Freshwater Supply</u>

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 2,725-kilowatt 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.

RG LNG originally proposed a new 1.8-mile-long temporary haul road to transport fill material from the nearby Port Isabel dredge pile; however, based on RG LNG's justification for the temporary haul road's placement in wetlands, we determined that its construction and use was not an acceptable deviation from our 2013 *Wetland and Waterbody Construction and Mitigation Procedures* (Procedures) and recommended in the draft EIS that RG LNG conduct a feasibility assessment for transporting fill material from the Port Isabel dredge pile (if necessary) to the LNG Terminal site via the existing system of roads or via barges. As a result of our recommendation in the draft EIS, RG LNG is no longer pursuing use of the temporary haul road, thus the associated wetland impacts would be avoided (see section 3.4). 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 has committed to 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 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).

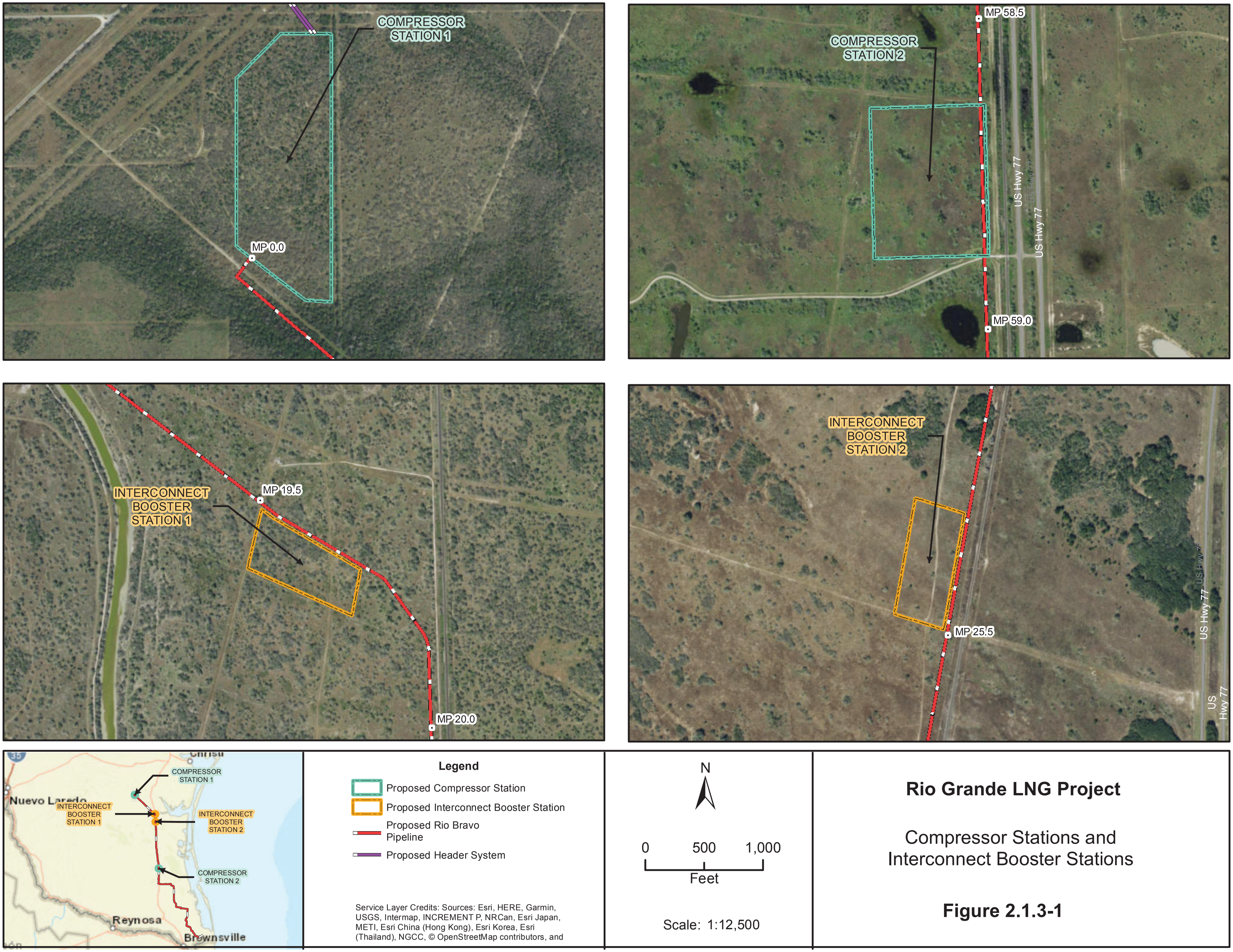
2.1.3 Pipeline Facilities

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), eight 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 five route variations during pre-filing or following RG Developers' application filing and the issuance of the draft EIS. 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 final EIS also reflect the inclusion of these five realignments:

- RB Pipeline realigned its pipeline between milepost (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.



Rio Grande LNG Project

Compressor Stations and Interconnect Booster Stations

Figure 2.1.3-1

- 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, reduce wetland impacts, and avoid wildlife denning areas.

- RB Pipeline, based on our recommendation in the draft EIS, incorporated a 2.4-mile-long variation between MP 113.0 and MP 115.5 to minimize impacts on parcels with Conservation Reserve Program (CRP) easements. The variation would result in an increase of the overall pipeline length of about 0.2 mile; however, the variation minimizes impacts on parcels that have been designated for protection of ocelot habitat.

- RB Pipeline realigned its pipeline between MP 119.0 and MP 119.5 to avoid a newly constructed residence. The realignment moved additional temporary workspace (ATWS) from being adjacent to the residence to over 55 feet from the residence, and sited the pipelines about 150 feet from the residence.

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**

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 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.

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.

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 below), 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 below). 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 3,638.5 acres of land, including 1,137.3 acres associated with construction of the LNG Terminal and 2,501.2 acres for the Pipeline System. Following construction, 2,149.1 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 1,330.0 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.

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
Port Isabel dredge pile[b]	N/A	293.4	0.0
West natural buffer area (65 acres)[c]	N/A	0.0	0.0
East natural buffer area (158 acres)[c]	N/A	0.0	0.0
LNG Terminal Total	**--**	***1,137.3***	***819.1***
PIPELINE SYSTEM			
Header System	HS-0.0 to HS-2.4	32.9	17.0
Pipeline 1	0.0 to 135.5	1,963.7	1,207.4
Pipeline 2[d]	0.0 to 135.5	1,963.6	1,207.4
Pipeline System Subtotal[e]	**--**	***1,996.5***	***1,224.4***
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	**--**	***93.0***	***93.0***

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	***114.4***	***12.6***
Contractor / pipe yards	--	***297.2***	***0.0***
Pipeline System Total	--	***2,501.2***	***1,330.0***
Grand Total	--	***3,638.6***	***2,149.1***

Note: The totals shown in this table may not equal the sum of the addends due to rounding.

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

[c] 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.

[d] 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.

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 is proposing to use a temporary bulk water loading area and two offsite storage/parking areas to support construction activities. In addition, RG LNG may obtain dredge material from the Port Isabel dredge pile, via barge, for use at the LNG Terminal site. Collectively these offsite facilities would temporarily impact 318.3 acres. 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 ATWS would require a total of 1,996.5 acres of land. Of this, 1,224.4 acres would be retained for operation and maintenance of the pipeline facilities. Approximately 66.0 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.

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.

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 1,963.7 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 1,207.4 acres of land that would be permanently maintained in an herbaceous state.

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
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	0[d]	0.0
Willacy County						
66.2	69.8	3.6	Gas pipeline	VCP	0[d]	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

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]
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
113+3,361 ft[e]	113+6,328 ft[e]	0.5	Electrical	Unknown	-10[d]	0.6
115.3	117.1	1.8	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.

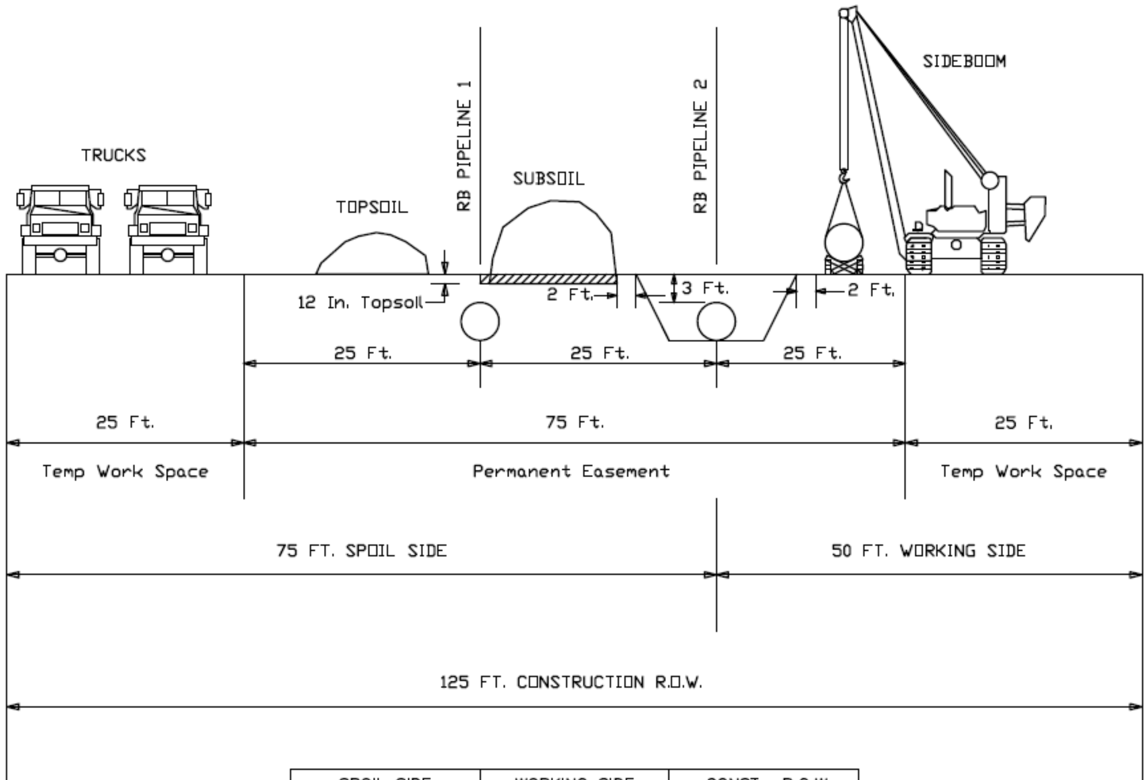
a The offset distance is the estimated distance between the edge of the construction ROW and the foreign feature. A negative number denotes overlap.

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.

d The offset distance is calculated from the edge of the construction ROW to the estimated edge of the foreign feature's permanent easement. A negative number denotes the amount of overlap.

e Due to a short reroute, the beginning and ending mileposts are presented as feet downstream of the nearest original milepost (the milepost where the reroute diverges from the original route).



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.

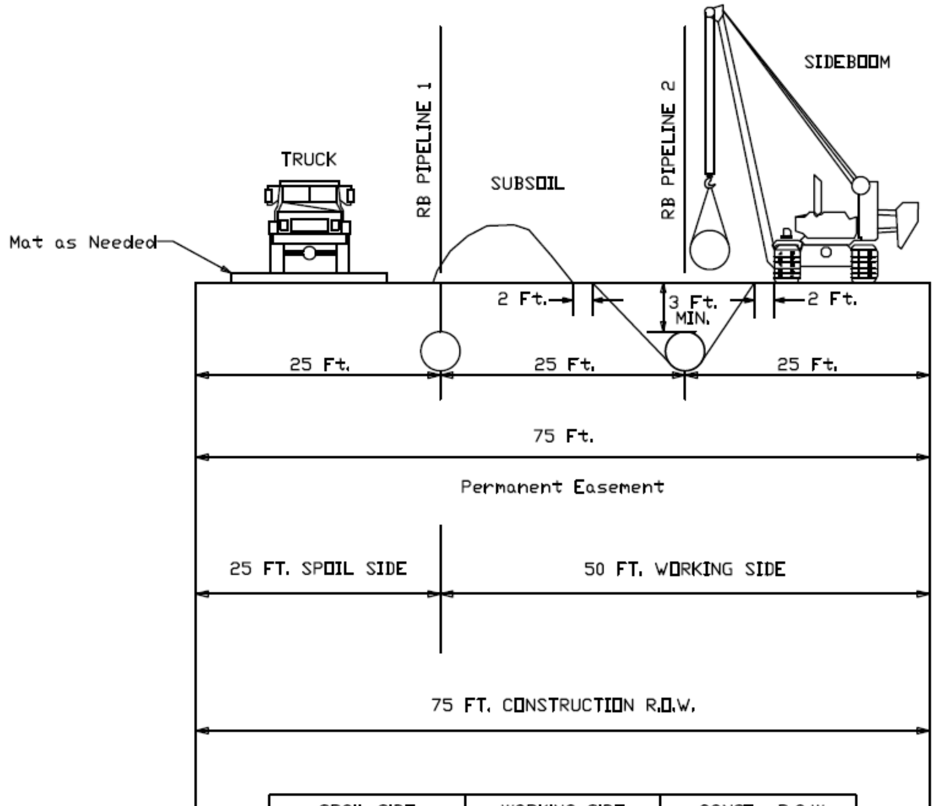
2. TOPSOIL AND SUBSOIL SHALL BE SEGREGATED WITHIN ALL CULTIVATED OR ROTATED CROPLANDS AND MANAGE PASTURES AND OTHER AREAS AT LANDOWNER'S OR LAND MANAGING AGENCY'S REQUEST.

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 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

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 includes 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 proposes to 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.

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 start-up 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.

Table 2.3-1
Major Components of the Proposed Construction Stages

Construction Stage (planned timeframe)	LNG Terminal Construction	Pipeline System Construction
Stage 1 (Q2 Year 1 to Q3 Year 4)	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	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
Stage 2 (Q2 Year 2 to Q1 Year 5)	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	
Stage 3 (Q1 Year 3 to Q4 Year 5)	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	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

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		

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 can 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 Project (see sections 4 and 5). We will recommend that the additional requirements and mitigation measures presented in the EIS (identified by bold type in the text) 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 they committed to as part of the proposed 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 2.5.2), to monitor construction activities at the pipeline facilities during all phases of construction, including cleanup and restoration; one EI would be responsible for inspecting the pipeline and one EI would be responsible for 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[13], 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. In response to our recommendation in the draft EIS regarding insufficient justification for certain requested alternative measures, RB Pipeline removed certain ATWS from the Project. We have reviewed the remaining alternative measures presented in appendix F and find them acceptable. The EIs would inspect construction and mitigation activities to verify environmental compliance.

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13 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.

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 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 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.

In accordance with the August 31, 2018 MOU, the DOT issued a LOD to FERC on the 49 CFR 193 Subpart B regulatory requirements.[14] The LOD provides DOT PHMSA's analysis and conclusions regarding 49 CFR 193 Subpart B regulatory requirements for the Commission's consideration in its decision on the Project application.

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

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14 March 26, 2019 letter "Re: Rio Grande LNG Project, Docket No. CP16-454-000, 49 CFR, Part 193, Subpart B, Siting – Letter of Determination" from Massoud Tahamtani to Rich McGuire. Filed in Docket Number CP16-454-000 on March 27, 2019. FERC eLibrary accession number 20190327-3003.

internal, external, and atmospheric corrosion; and qualification procedures for welders and operations personnel.

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[15] (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 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.

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15 The draft 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 draft SPCC Plan for pipeline construction was filed with the FERC on December 29, 2016 (see accession number 20161229-5149).

After priority areas are accessible, RG LNG has indicated that it may import an estimated 3.5 million cubic yards (mcy) from the nearby Port Isabel dredge pile via barge. 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.

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.

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.

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's LNG safety regulations are codified in 49 CFR 193. The DOT establishes and has the authority to enforce the federal safety standards for the siting, construction, operation, and maintenance of onshore LNG facilities, as defined in 49 CFR 193. These regulations would apply to each LNG train. In addition, 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 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 the American Society of Mechanical Engineers (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 EIS 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.

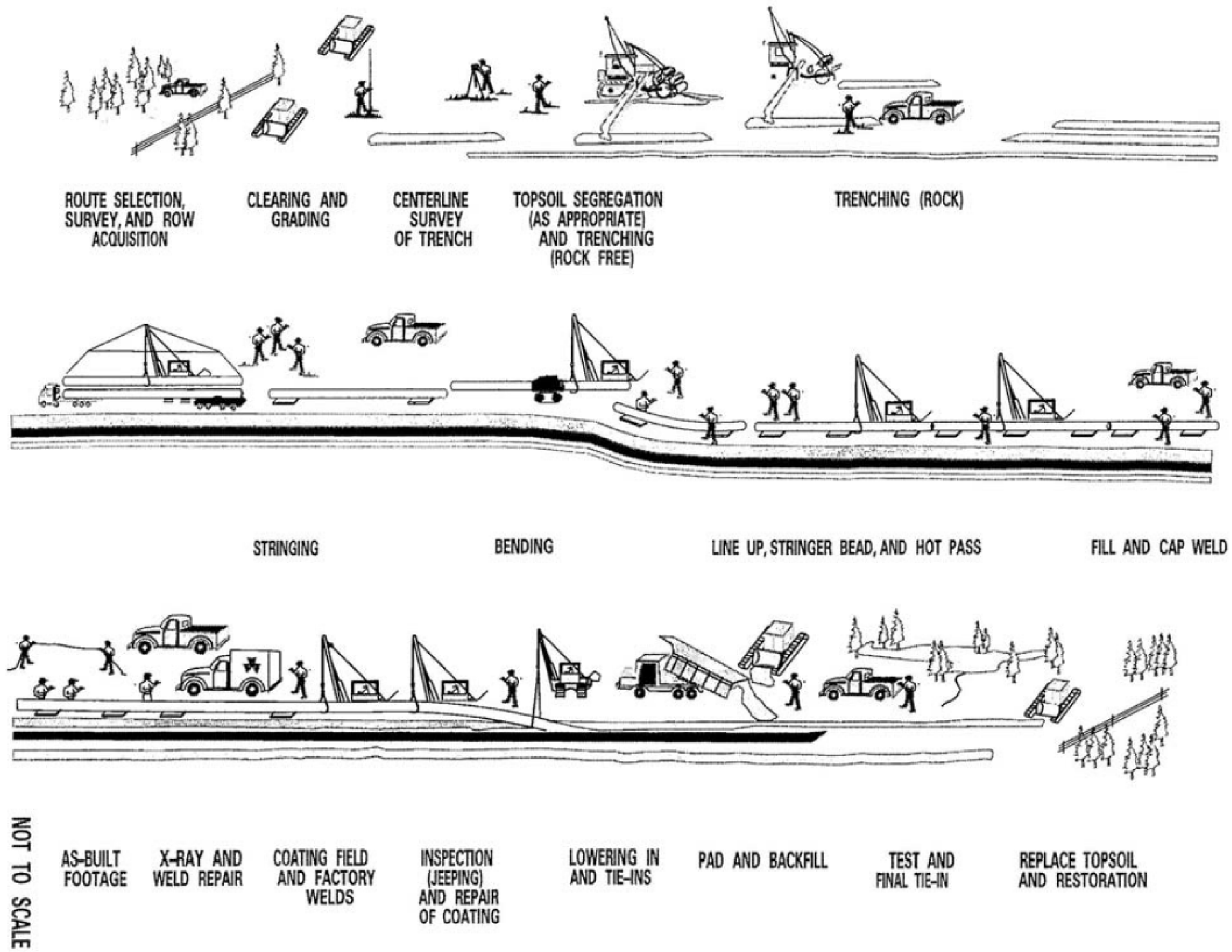
2.5.2 Pipeline Facilities

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.



Rio Grande LNG Project

Typical Pipeline Construction Sequence

Figure 2.5.2-1

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 in Coast to promote revegetation following construction.

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. In accordance with the Project-specific Plan, RG Developers may also leave construction debris, such as cleared trees and brush, within construction workspaces for beneficial reuse, stabilization, or habitat restoration, if approved by the landowner or land management agency.

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 or other 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 Standards.

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. RB Pipeline has stated it would complete in-water construction activities between June 1 and November 30 for the protection of warmwater fishes. However, section V.B.1 of FERC's Plan states that this crossing timing requirement applies unless expressly permitted or further restricted by the appropriate federal or state agency. In its comments on the draft EIS, the TPWD recommended that waterbodies be crossed between November and January during the driest period in south Texas. Therefore, RB Pipeline must cross all waterbodies with perceptible flow between November 1 and January 31. The TPWD also added that if crossings cannot be done "in the dry," RB Pipeline should further coordinate with the TPWD. In any case, and as identified in the Project-specific Procedures, if RB Pipeline believes that waterbody crossings need to be installed outside of this period, RB Pipeline would be required to coordinate with the FWS and TPWD and then submit appropriate documentation to FERC for written approval prior to construction through the waterbody.

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 pre-fabricated 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 a 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 waterbodies (those less than 10 feet wide) and intermediate waterbodies (those between 10 and 100 feet wide) 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 (those greater than 100 feet wide) 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 would be completed within 24 hours, and intermediate waterbody crossings 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 65 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 pre-fabricated 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. Abandonment measures include filling the drill hole(s) with drilling mud, grouting the upper 30 feet, and grading the surface to original contours. However, we note that 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. 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 file them for our 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 raised by the railroad company 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.

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

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.

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 the 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 start-up, 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, in accordance with the Project-specific Plan and Procedures. 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 to ensure 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. On March 26, 2019, the DOT issued an LOD to FERC on the 49 CFR 193 Subpart B regulatory requirements. The LOD provides DOT PHMSA's analysis and conclusions regarding 49 CFR 193 Subpart B regulatory requirements. Additional information regarding DOT siting requirements is presented in section 4.12.1.

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. If authorized and constructed, LNG facilities as defined in 49 CFR 193, would 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.

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 stated objectives.

The range of alternatives analyzed for the Rio Grande LNG Project 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 developed, 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 considerations above, we have dismissed the No-Action Alternative as a reasonable alternative. 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 Project. 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 export 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/Planned:

- Texas LNG Brownsville/Texas LNG (CP16-116) – Brownsville;
- Annova LNG/Annova LNG (CP16-480) – Brownsville;
- Port Arthur LNG/Port Arthur LNG (CP17-20) – Port Arthur; and
- Galveston Bay LNG (PF18-7) – Galveston.

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 authorized 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, proposed, and planned LNG export facilities along the Texas Gulf Coast.

Table 3.2.1-1
Summary of LNG System Alternatives Along the Texas Gulf Coast

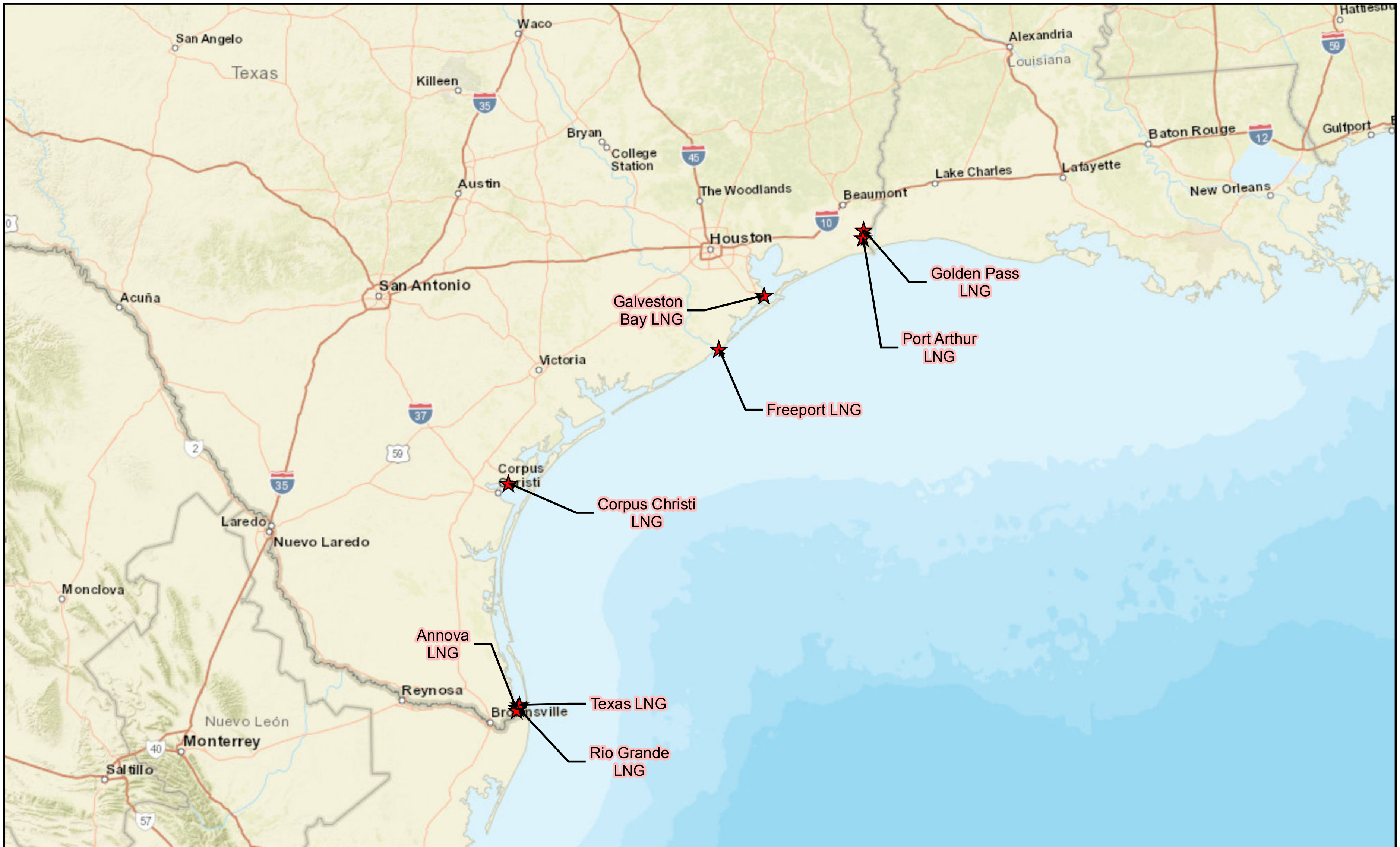
Facility	Proponent(s)	Location (TX)	FTA / Non-FTA[a]	Export Capacity (MTPA)[b]
Rio Grande LNG	RG Developers	Brownsville	A / P	27.0
Corpus Christi LNG	Cheniere Marketing / Cheniere Corpus Christi	Corpus Christi	A / A, P	25.0[c]
Freeport LNG	Freeport LNG / Freeport Developers	Freeport	A / A, P	20.4[c]
Golden Pass LNG	Golden Pass LNG / ExxonMobil	Sabine Pass	A / A	15.6[c]
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
Galveston Bay LNG	Galveston Bay LNG / NextDecade LNG	Galveston	A / P	16.5

[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.
[c] Export capacity volumes are different for the DOE FTA/non-FTA applications or the approved/pending applications.

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 14.8 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.



Legend

★ LNG System Alternative

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

On June 28, 2018, Cheniere Corpus Christi LNG, LLC and Cheniere Corpus Christi Pipeline, LP (Cheniere Corpus Christi) filed a 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 9.9 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.

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 (in non-additive volumes), 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 Freeport expansion 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. FLEX currently anticipates the first LNG train to enter into service in 2019 with the remaining two trains entering into service in 2020.

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 2022.

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 September 27, 2012, GPP received DOE approval for the export of about 2.0 Bcf/d of LNG to FTA countries over a 25-year period; 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 (CP14-517-000, CP14-518-000). 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 LNG to FTA and non-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, project approval is pending and no construction has begun.

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 is no longer feasible, and final timing is contingent upon project approval. The Annova LNG Terminal would receive domestic feed gas from the Agua Dulce Hub via an intrastate pipeline, which 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 of the proposed Rio Grande LNG Terminal site (see figure 3.2.1-1). The Port Arthur 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 Port Arthur terminal would receive natural gas via 35 miles of 42-inch-diameter pipeline, two compressor stations, metering stations, and other appurtenant facilities.

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; the final EIS was issued on January 31, 2019 (CP17-20-000, CP17-21-000, CP17-21-001, and CP18-7-000). Port Arthur anticipates an in-service date of 2023, if approved.

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.

3.2.1.7 Galveston Bay LNG

Galveston Bay LNG, LLC (GBLNG) is planning to construct an LNG export terminal in Galveston County, Texas, on a 750-acre site located on a parcel situated between the spur of the Texas City Ship Channel from the Houston Ship Channel and the Texas City turning basin. The planned terminal will have three liquefaction trains, each with a nominal capacity of 5.5 MTPA, up to four LNG storage tanks (220,000 m^3 net storage capacity each), two large-scale marine jetties, one turning basin, and up to four LNG tanker truck loading bays. The terminal would receive natural gas feedstock from interconnected natural gas transportation facilities within the state of Texas via a GBLNG-proposed, FERC-jurisdictional 97-mile-long pipeline with interconnects in the Katy Hub region running to the terminal. The pipeline is designed to transport 3.0 Bcf/d of natural gas to the terminal. GBLNG has planned for a phased construction approach, anticipating that construction would begin in 2023, and have an initial in-service date in 2027 for the first liquefaction train. Subsequent liquefaction trains would be constructed in 6 to 12-month intervals.

On June 13, 2018, GBLNG received DOE approval for the export of approximately 16.5 MTPA to FTA nations. Subsequently, on October 10, 2018, GBLNG received authorization to engage in the FERC pre-filing process (PF18-7-000) and anticipates an in-service date of 2027, if approved. GBLNG has an application pending with DOE for the export of LNG to non-FTA nations.

The design and size of the GBLNG 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 GBLNG 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.

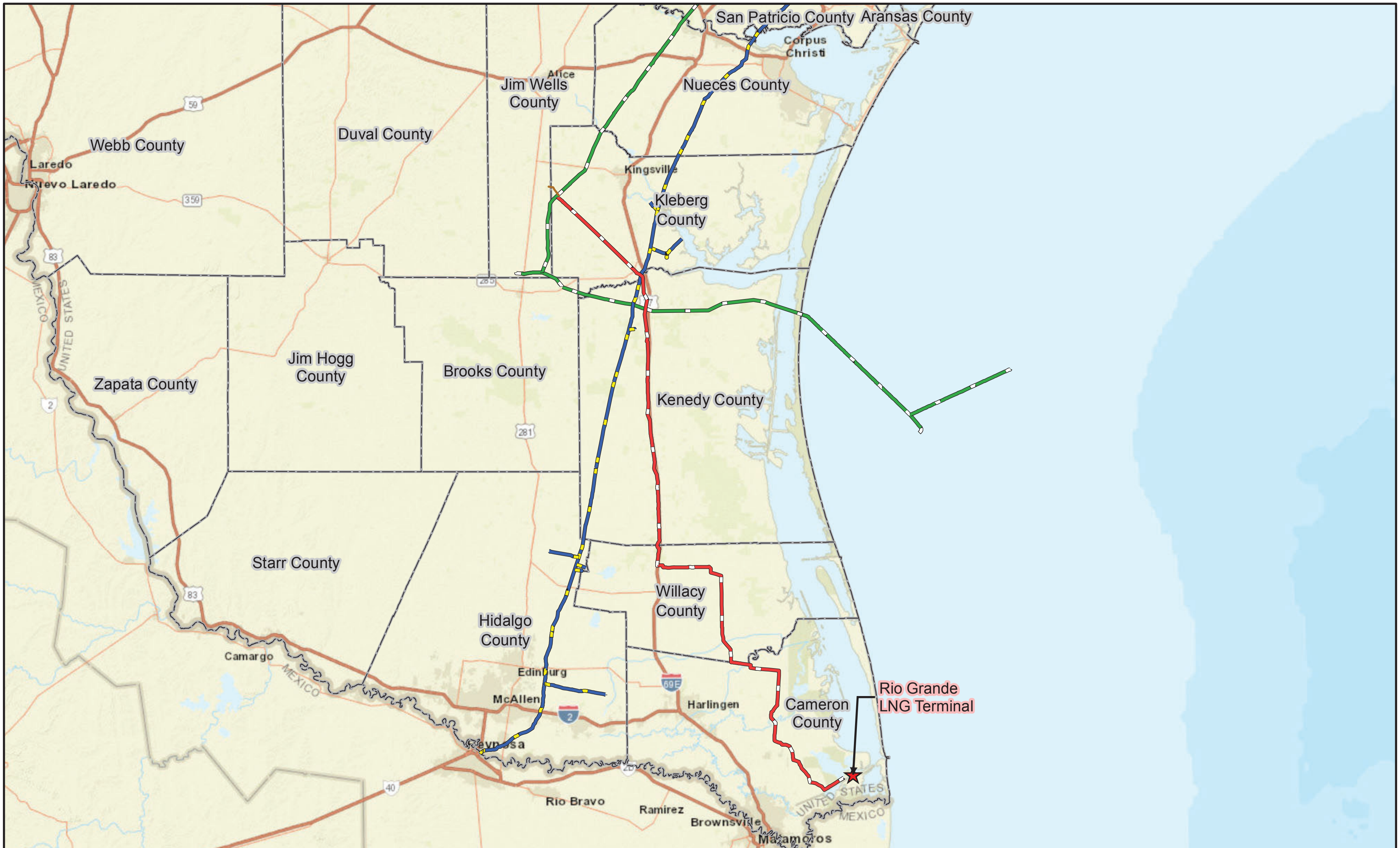
3.2.2 Pipeline System Alternatives

To serve as a viable system alternative to the Rio Bravo 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 pipelines.

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 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.



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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[16] 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 system includes 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 Rio Bravo Pipeline System near MP 25.0. The NPIL is a gathering pipeline for the Transco mainline that crosses the proposed Rio Bravo 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) constructed the new 165-mile-long intrastate natural gas pipeline (Valley Crossing Pipeline or VCP) from the Agua Dulce Hub to Brownsville that is providing service to Mexico's Comisión Federal de Electricidad (CFE). The VCP, regulated by the RRC, connects to the 1,000-foot-long Border Crossing Project (FERC Docket No. CP17-19-000) that connects 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 VCP is designed to transport 2.6 Bcf/d and connect with the Sur de Texas – Tuxpan pipeline which extends into Mexico. The project was placed into service in February 2019.

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

Rio Grande LNG Project

VCP System Alternative

Figure 3.2.2-2

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 transmits 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 pipeline system as an alternative to the proposed pipeline.

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

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Scale: 1:2,500,000

Rio Grande LNG Project

Alternative Terminal Sites
Along The Texas Coast

Figure 3.3.1-1

We received a comment to analyze Port Mansfield as an alternative location for the LNG facility. Port Mansfield is about 37 miles north of the proposed location in Willacy County, Texas. Port Mansfield is a small port used primarily for fishing and recreational boating. The channel leading to the harbor is for shallow-draft vessels; however, the Willacy County Navigation District is seeking funds to have the COE dredge the channel to a depth of 14 feet which is still too shallow for LNG carriers, which require a channel depth of at least 42 feet. Additionally, the harbor can only accommodate vessels up to 60 feet in length and has a depth of 12 feet upon approach and 6 feet dockside (Waterway Guide 2018). The harbor lacks a large enough tract of land and is surrounded by residential properties in the immediate vicinity. For these reasons we did not include Port Mansfield in our alternatives analysis.

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.

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. 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. Additionally, we received a comment to site liquefaction and storage facilities away from the marine facilities in an effort to avoid impacts on wetlands. However, given the amount of wetlands in the immediate vicinity of the BSC and the Laguna Atascosa National Wildlife Refuge directly north of the proposed LNG Terminal, associated facilities would have to be at a minimum 10 miles northwest of the proposed location, which is not practicable for operations.

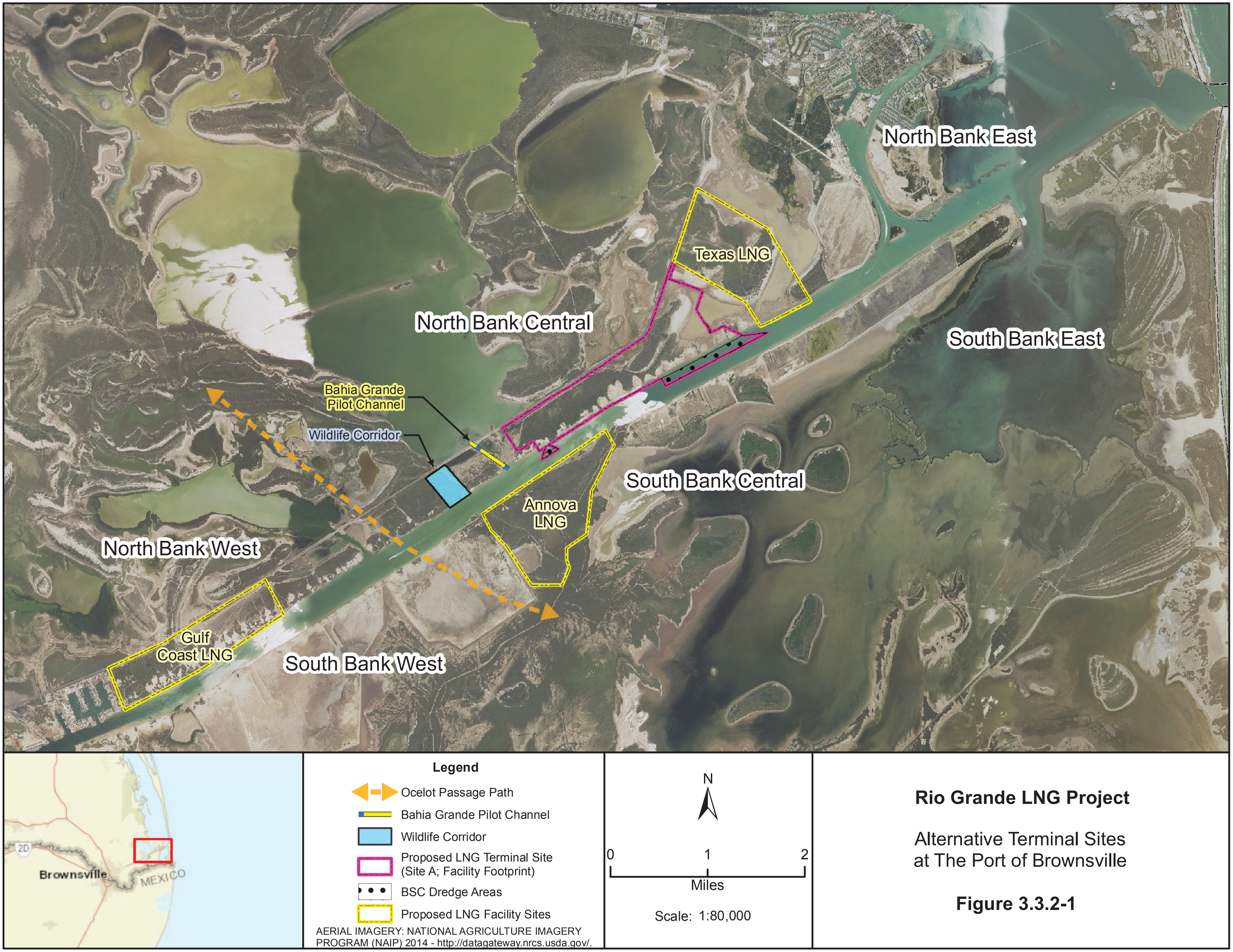
RG LNG originally evaluated six areas (three areas along the north bank and three areas along the south bank) identified by the BND along the BSC for the siting of the LNG Terminal site (see figure 3.3.2-1). Each of these six areas met many of the key siting criteria discussed above. However, the following 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).

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.

Another 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.



Rio Grande LNG Project

Alternative Terminal Sites
at The Port of Brownsville

Figure 3.3.2-1

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 may 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 may be used to supply an estimated 3.5 mcy of fill material for grading and site preparation at the LNG Terminal site.

To access the Port Isabel dredge pile, RG LNG originally 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 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.

3.4.1 Temporary Haul Road via Dump Truck

RG LNG originally 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 was planned to 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.

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 on 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	182.3	284.0	Not evaluated	142.9	Not evaluated
Direct impacts on lomas[d]	Yes	Yes	Yes	Not Evaluated	Yes	Not evaluated
Open water impacts (acres)	37.3	106.1	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.

d TPWD 2019; see EIS sections 3.5.1.2 and 4.7.1.4.

To maintain tidal flow and minimize potential erosion and sedimentation into adjacent wetlands, RG LNG had 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 was proposed for restoration to pre-construction conditions, with vegetated areas being allowed to revegetate naturally. RG LNG was 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 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, we recommended in the draft EIS that RG LNG conduct a feasibility assessment for transporting fill material from the Port Isabel dredge pile to the LNG Terminal site via the existing system of roads or via barges. As a result of these assessments, as discussed below, RG LNG is no longer pursuing use of the temporary haul road and currently proposes to transport fill material via barge, if necessary.

3.4.2 State Highway 48 via Dump Truck

During assessment of the originally proposed temporary haul road, discussed above, 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 would also be true for the temporary haul road); however, we found that use or improvement of existing infrastructure is environmentally preferable to construction of the temporary haul road that would traverse wetlands and waterbodies, even with RG LNG's additional proposed mitigation measures. Therefore, we included a recommendation in the draft EIS for RG LNG to file additional information so that we could further evaluate this alternative. RG LNG met with TxDOT in November 2018 to discuss road improvements and traffic mitigation for the Project; however, based on additional consideration, RG LNG has determined that use of SH-48 would not be the most practicable alternative and is now pursuing the barge alternative, as discussed below.

3.4.3 Brownsville Ship Channel via Barge (Proposed Action)

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 haul road's impacts on wetlands and open waters, and the need for additional truck traffic along existing roadways. As a result of our recommendation in the draft EIS, RG LNG has eliminated from consideration the temporary haul road and use of the existing highway system for transport of fill material from the Port Isabel dredge pile, and is currently conducting an analysis of the barge transport alternative for feasibility of use.

3.5 PIPELINE CONFIGURATION AND ROUTE ALTERNATIVES

3.5.1 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.

3.5.2 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. 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. 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.

Three tracts crossed by the pipeline between MP 113.0 and MP 116.5 were identified as being managed by the NRCS and the Farm Service Agency (FSA) as State Acres for Wildlife Enhancement (SAFE) as part of the CRP. Consultation between the FSA and RB Pipeline indicated that these parcels have been designated for the protection of ocelot habitat. We recommended in the draft EIS that RB Pipeline minimize impacts on these tracts. Subsequently, RB Pipeline in discussions with landowners, FSA and NRCS personnel, reviewed a pipeline route variation that would minimize impacts on the CRP-SAFE habitat. The variation, at its greatest distance, is about 1,500 feet west of the original alignment and is about 2.4 miles in total length. The variation increases the overall distance of the pipeline right-of-way by about 0.2 mile and increases the amount of forested land affected by construction by about 4 acres; however, the benefit of minimizing the CRP easements and ocelot habitat is environmentally preferable compared to the small addition of land disturbance that would be required for the longer length of right-of-way.

We further reviewed the pipeline crossing of the Loma de Yeguas (MP 132.5) in response to comments on the draft EIS from the TPWD, which requested either a pipeline shift or a change in construction methods at this location to avoid impact on the loma. Lomas are clay dunes that developed through wind-driven depositional processes and support specific vegetation communities (Bowler 1973). Regarding a pipeline shift, at this location the proposed pipeline is collocated within a corridor established for the linear utilities along SH-48. As this corridor includes multiple planned facilities, as well as a recently constructed pipeline (the VCP), the habitat has already been disturbed. Further, changing the current construction method over the loma from open cut to an HDD would require placing HDD drill pits in the wetlands on either side of the loma. Given that the proposed route is collocated with an existing pipeline and the loma has already been disturbed, we do not find an environmental benefit to modifying the pipeline route or construction method. Lomas are further discussed in section 4.7.1.4 as an important habitat for ocelots.

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.

3.6.1 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.

3.6.2 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. A comment was received on the draft EIS requesting Compressor Station 3 be moved to affect no wetlands; however, to do this would require moving the compressor station at least 10 miles northwest of its proposed location. 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, and concluded that siting the compressor station outside of the terminal site would result in more impacts on wetlands. Further, wetland impacts are being considered by the COE based on the permit application filed by RG Developers. 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 Project, such as within the footprint of the LNG Terminal. When determining the significance of an impact, we consider the duration of the impact; the geographic, biological, and/or social context in which the impact would occur; and the magnitude and intensity of the impact. The duration, context, and magnitude of impacts vary by resource and therefore significance varies accordingly.

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 federal 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 (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 relocated 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, 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, and Booster Stations 1 and 2</u>, RB Pipeline should file with the Secretary results of its geotechnical investigations and recommended site preparation and foundation designs that RB Pipeline will adopt, stamped and sealed by the professional engineer-of-record licensed in the state where the Project is being constructed, for each site, that incorporates the results of geotechnical investigations; and**

- **<u>Prior to construction of each of the HDD locations,</u> RB Pipeline should file with the Secretary of the Commission (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, for review and written approval by the Director of the OEP.**

4.1.2 Mineral Resources

Non-fuel mineral resources produced in Texas consist mainly of cement, crushed stone, sand, and gravel (USGS 2015a). The nearest non-fuel 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 MPs 45.1 and 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, in accordance with the Project-specific Plan and Procedures. 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 879.8 acres of the soils that would be affected by the pipeline facilities are designated as prime or important farmland, of which 97.3 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 519.5 acres and 741.0 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	0.0	207.4	0.0	708.2	708.2
MOF and berthing / turning basin dredge area	68.7	0.0	0.0	0.0	0.0	0.0
Port of Brownsville temporary storage area	20.8	0.0	14.6	0.0	20.8	20.8
Port Isabel temporary storage area	4	0.0	4.0	4.0	4.0	4.0
Port Isabel dredge pile	293.4	0.0	293.4	293.4	293.4	293.4
Bulk water loading area	0.1	0.0	0.1	0.0	0.1	0.1
LNG Terminal Total	1,137.4	0.0	519.5	297.4	1,026.5	1,026.5
PIPELINE FACILITIES						
Pipeline System and ATWS						
Header System and Pipeline 1[h]						
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	1,941.0	612.8	518.1	660.3	1,924.0	936.6
Pipeline 1 ATWS	47.7	22.2	11.5	6.8	46.0	20.7
Subtotal	2,021.6	664.6	541.9	670.3	2,002.9	957.3
Pipeline 2[h]						
Pipeline 2 ROW	1,941.0	612.8	518.1	660.3	1,924.0	936.6
Pipeline 2 ATWS	47.7	22.2	11.5	6.8	46.0	20.7
Subtotal	1,988.7	635.0	529.6	667.1	1,970.0	957.3
Access Roads[i]						
Header System Access Roads	15.8	14.5	3.4	0.0	15.8	0.0
Pipelines 1 and 2 Access Roads	104.0	39.8	23.2	38.4	99.7	40.6
Subtotal	119.8	54.3	26.6	38.4	115.5	40.6
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[j]						
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[k]	2,624.7	879.8	741.0	898.6	2,601.7	1,225.4
Pipeline 2 Total[l]	2,562.2	824.6	716.4	892.8	2,539.2	1,225.4
Pipelines 1 and 2[m]	2,562.2	824.6	716.4	892.8	2,539.2	1,225.4
Pipeline System Total[n]	2,624.7	879.8	741.0	898.6	2,601.7	1,225.4
Rio Grande LNG Project Total[n]	3,762.1	879.8	1,260.5	1,196.0	3,628.2	2,251.9

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 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).

i 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.

j 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.

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

l All impacts associated with construction of Pipeline 2, including right-of-way, ATWS, access roads, contractor/pipe yards, aboveground facilities, and access roads (acreages associated with the Header System and its components are excluded).

m 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. This total excludes acreages associated with the Header System and its facilities.

n 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, 297.4 and 898.6 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 1,026.5 acres of soils at the LNG Terminal site and 2,601.7 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 1,026.5 acres of soils affected by the LNG Terminal and 1,225.4 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 (as necessary, 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.[17] 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 and the Port Isabel dredge pile (if necessary). 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.

The Port Isabel dredge pile would potentially 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[18] 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 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

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17 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.

18 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.

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*[19] 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:**

- **Prior to construction of the Project, 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

Header System and Pipeline 1

As shown in table 4.2.1-1, construction workspace for the Header System and Pipeline 1 would impact prime and important farmland (664.6 acres), hydric soils (541.9 acres), soils susceptible to wind erosion (670.3 acres), compaction prone soils (2,002.9 acres), and soils with revegetation limitations (957.3 acres). Following construction of Pipeline 1, the right-of-way would be restored to pre-construction conditions and seeded per NRCS recommendations.

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

19 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.

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

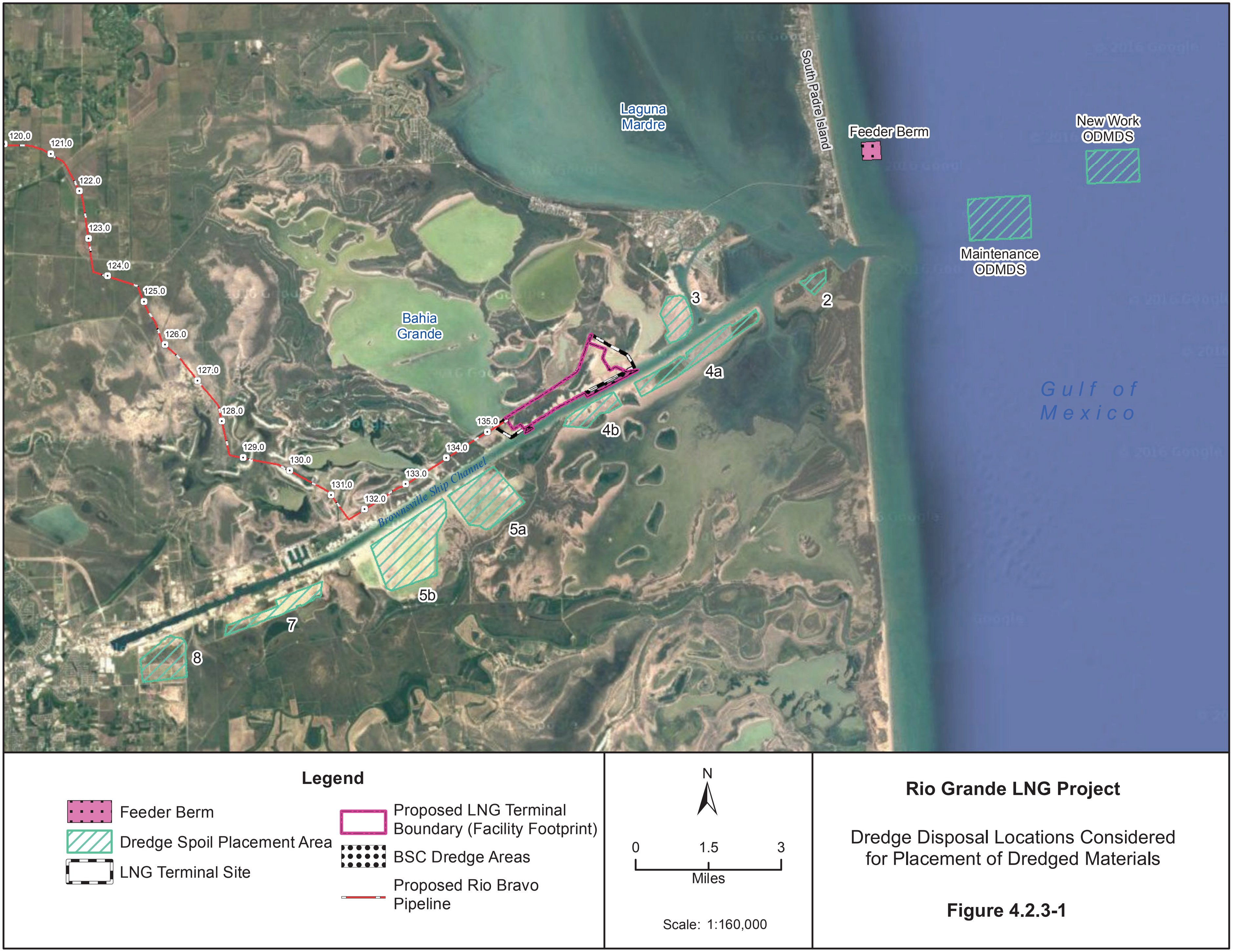
RB Pipeline proposes to use a total of 64 roads (including 52 temporary and 12 permanent access roads) to access the right-of-way during construction. Expansion of two existing, permanent access roads and construction of five new, permanent access roads would result in permanent impacts on soils, similar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



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 MPs 0.0 to 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 MPs 0.0 to approximate 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 cleanup 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. 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

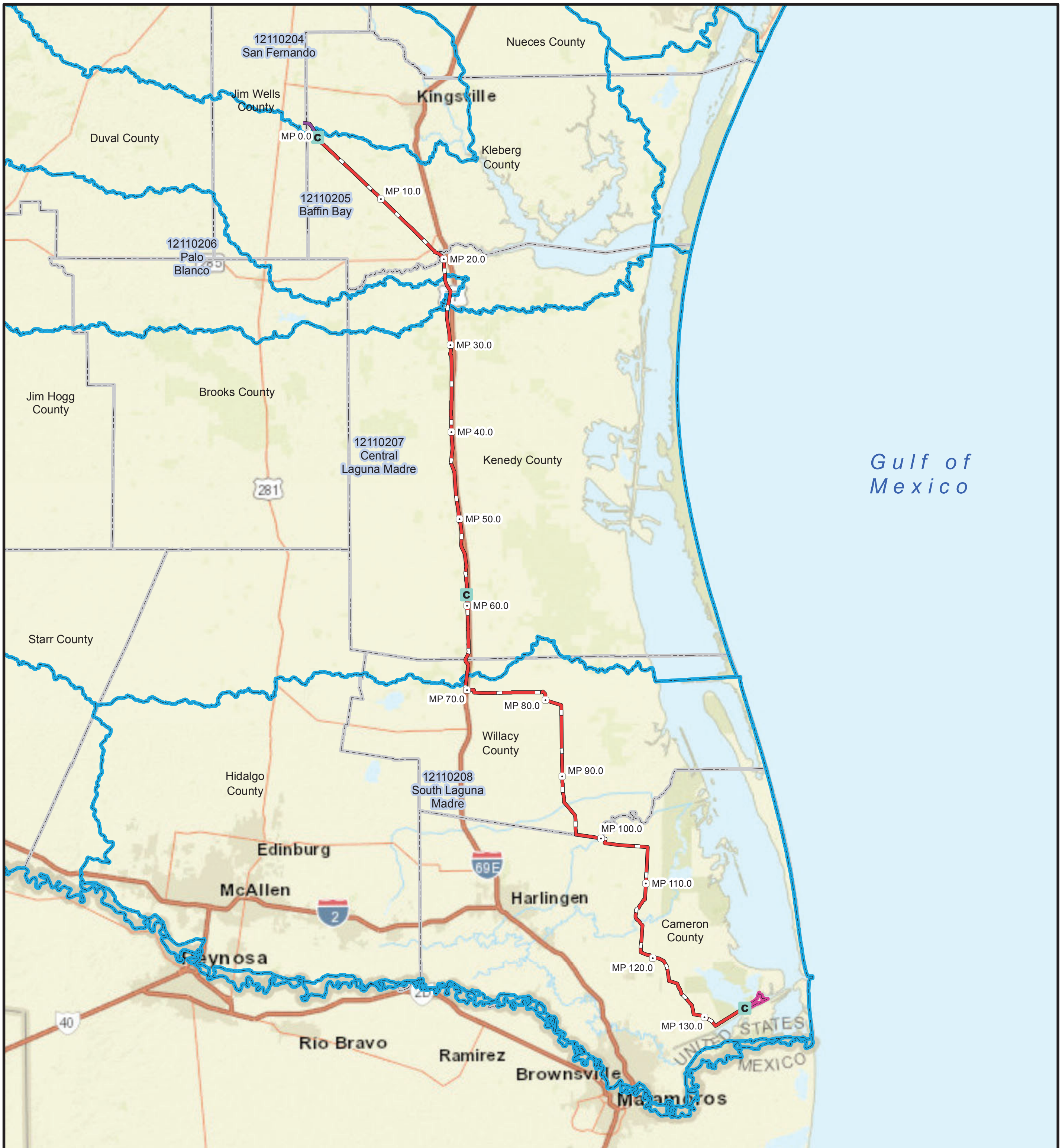
RB Pipeline would require the use of new and existing temporary and permanent access roads for construction and operation. The access roads would be in the same general vicinity of the Pipeline System, and eight water supply wells are within 200 feet of proposed access roads (see table 4.3.1-1). The 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.

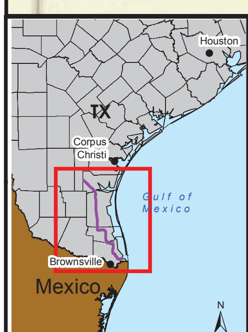
While construction of the Rio Grande LNG Project could result in temporary impacts on groundwater quality and recharge, implementation of RG Developers' Plan and Procedures and SPCC Plans would reduce the potential for groundwater impacts, including contamination. During operations, the relatively small 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 (Facility Footprint)
- 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.

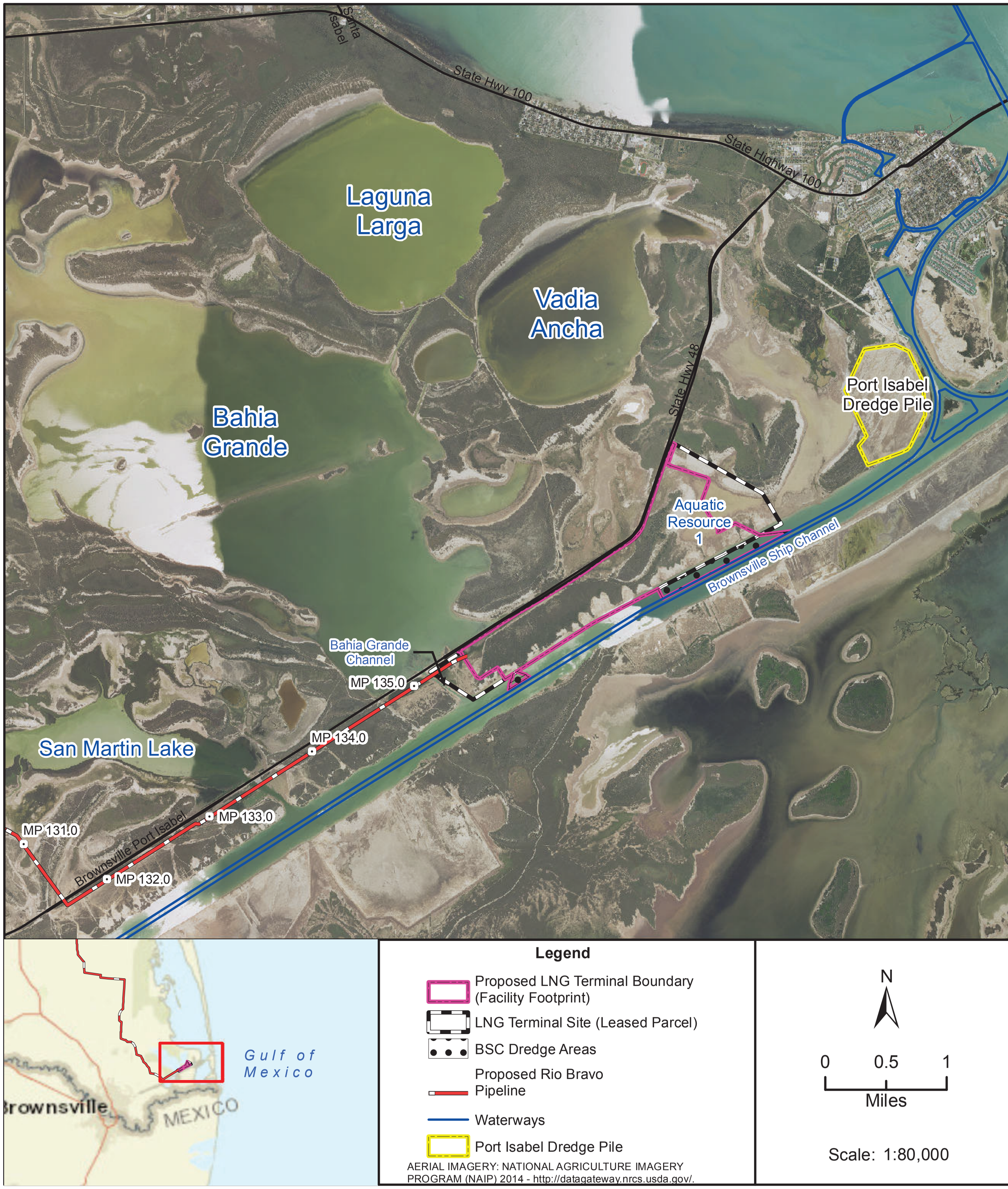
Additional water quality criteria are also designated for chemical parameters, pH, temperature, toxic materials, and nutrient content. In addition, some water quality designations are presumed for certain categories of waterbodies, even where they are not designated as segments. For example, all tidal 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. 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 National Wildlife Refuge (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, 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. Some areas along pipeline reroutes have been surveyed since that time, but landowner access for surveys along the entire Project has not been granted. 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 offsite 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.

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 public comments. Current speed within the BSC and marine facilities was predicted under four configurations that include the proposed Project facilities: existing BSC conditions; deepening the main channel of the BSC to -52 feet MLLW; widening the turn at the Brazos Santiago Pass; and widening the Bahia Grande Channel. 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. The expansion of the Bahia Grande Channel would increase the current speed through the channel by an average of about 17 percent. The purpose of the Bahia Grande Channel widening planned by the FWS, NMFS, TxDOT, the Laguna Atascosa NWR, Cameron County, and the BND would be to increase tidal exchange between the BSC and the Bahia Grande, and this increase would not be the result of the proposed Project. Further, RG LNG conducted sediment modeling to determine shoaling rates within the marine facilities. The results of sediment modeling are described below.

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[20] 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. 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

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[20] 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.

Material Management Plan.[21] The BSC is already subject to maintenance dredging by the COE, 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.

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21 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.

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 LNG's 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).

The Coast Guard's ballast water management regulations (33 CFR 151.2025 and 46 CFR 162) established a standard for the allowable concentration of living organisms in ships' ballast water discharged into waters of the United States. The Coast Guard also established engineering requirements and an approval process for ballast water treatment systems installed on ships. All ships calling on U.S. ports must either carry out open sea exchange of ballast water or ballast water treatment, in addition to fouling and sediment management, and document these activities in the ship's log book. In 2017, the International Convention for the Control and Management of Ships' Ballast Water and Sediments developed measures that must be implemented to minimize the potential for introduction of non-native species through ballast water. These measures have since been adopted by the International Maritime Organization (IMO) and are required to be implemented in all ships engaged in international trade.

While the open sea exchange of ballast water has been used in the past and reduces the potential for non-native species introductions, on-board ballast water treatment systems are more effective at removing non-native species from ballast water. There are two different standards that ships must meet. All new ships must meet the "D-2" performance standard, which establishes the maximum number of viable organisms allowed to be discharged in ballast water. Conformity with the D-2 standard requires ships to utilize on-board ballast water treatment systems. Existing ships that do not currently have on-board ballast water treatment systems must continue to, at a minimum, conduct open sea exchanges of ballast water ("D-1" standard). Eventually, all ships will be required to conform with the D-2 standard. The timetable for conformity with the D-2 standard for existing ships is based on the date of the ship's International Oil Pollution Prevention Certificate renewal survey, which occurs every 5 years (IMO 2017). Therefore, most ships calling on the Project, estimated to begin in Year 4 of construction, would be expected to have conformed to D-2 standards. Additional details regarding ballast water management systems are provided in section 4.6.2.

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.

<u>Site Construction and Stormwater Runoff</u>

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 backup 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[22] 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 the TPWD regarding water withdrawal to identify requirements and mitigation measures for withdrawal.

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22 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.

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. In its comments on the draft EIS, the FWS expressed concern that any spills of hazardous materials could enter the Bahia Grande Channel and contaminate the wetlands and surface water in the Bahia Grande. In addition to the measures in RG LNG's SPCC Plan, construction of the levee during Stage 1 of construction would further protect the Bahia Grande Channel from potential contamination during construction and operations. Given the impact minimization and mitigation measures described above, 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

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

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 63 waterbodies, including 21 perennial streams, 19 intermittent streams, 10 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), 34 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. 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 62 of the waterbodies crossed by Pipeline 1 using the same methods. One waterbody would be crossed using a different method: 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 29 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. As described in section 4.6.2.2, RB Pipeline must cross all waterbodies with perceptible flow between November 1 and January 31 in accordance with TPWD recommendations and for the protection of aquatic resources. As identified in the Project-specific Procedures, if a need is identified to install waterbody crossings outside of this period, RB Pipeline would coordinate with the FWS and TPWD to obtain approval and submit appropriate documentation to FERC for our review. 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. RB Pipeline anticipates that four of the nine intermittent waterbodies would be dry at the time of crossing; the remainder are farm ponds and reservoirs that would not be flowing at the time of construction, although high water levels could be present. In accordance with RB Pipeline's Procedures, site-specific crossing plans for all major waterbodies would be provided for FERC review prior to construction. 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,[23] 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 4.1.1.1. Two waterbodies crossed by the Project are regulated by the IBWC; North Floodway at MP 93.4 and Arroyo Colorado at MP 100.1), both of which would be crossed by HDD. RB Pipeline consulted with the IBWC to identify regulated waterbodies and to determine whether the proposed crossing methods are sufficient to minimize impacts. The IBWC expressed concern regarding the potential for inadvertent returns in jurisdictional waterbodies and the stability of the waterbody levees during crossing. RB Pipeline indicated that it would design these HDDs to adhere to IBWC's criteria and plans to submit its permit application for crossing these waterbodies to the IBWC in the second quarter of 2019. Crossing of the North Floodway and Arroyo Colorado would not commence prior to the IBWC issuing a permit for these crossings. Further, we have recommended in section 4.1.1.1 that RB Pipeline file the geotechnical surveys and final design details with FERC prior to construction of each HDD.

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23 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.

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 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). In response to our recommendation in the draft EIS to further justify certain ATWS, RB Pipeline has withdrawn its request for two ATWS located in ephemeral waterbodies. We have reviewed the currently requested deviations from our Procedures, listed in appendix F, and find them to be acceptable.

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.

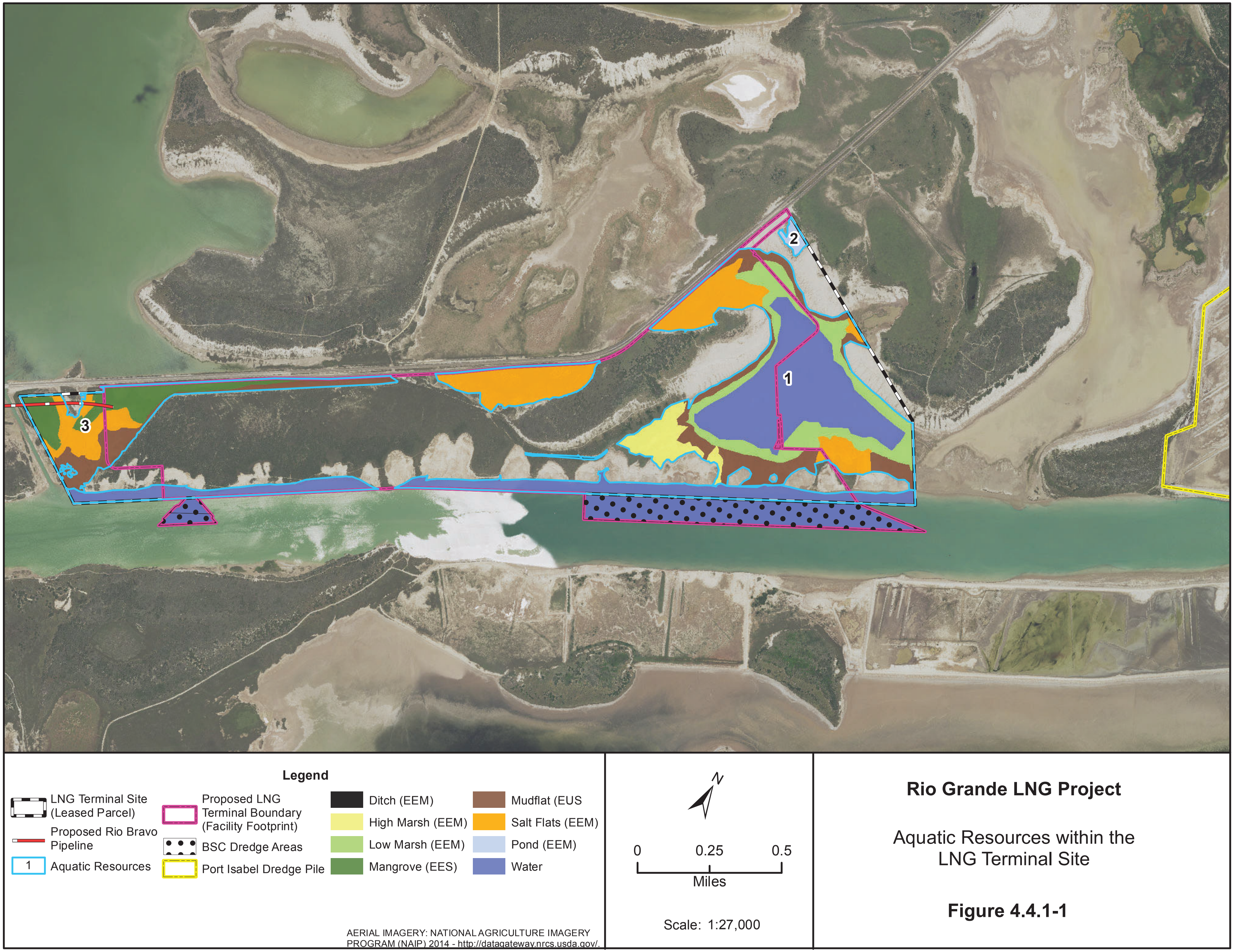
4.4.1.1 LNG Terminal

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 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.

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.



Rio Grande LNG Project

Aquatic Resources within the LNG Terminal Site

Figure 4.4.1-1

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. Some areas along pipeline reroutes have been surveyed since that time, but landowner access for surveys along the entire Project has not been granted. 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).

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 facilities (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 327.7 acres of wetlands would be within the construction footprint of the Rio Grande LNG Terminal and pipeline facilities. Impacts would include 9.9 acres of palustrine forested (PFO) wetlands, 23.3 acres of palustrine scrub-shrub (PSS) and estuarine scrub-shrub (ESS) wetlands, and 240.4 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 289.7 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 107.3 would be maintained as PEM/PSS within the pipeline right-of-way in accordance with the Project-specific Procedures (including 7.8 acres of PFO wetlands, 3.5 acres of PSS wetlands, and 96.0 acres of emergent [PEM and EEM] wetlands and mudflats [EUS]).

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
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**	**114.9**	**114.9**	**19.8**	**19.8**	**47.7**	**47.7**	**182.4**	**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	41.8	38.0	3.5	3.5	9.9	7.8	70.7	53.9	0.0	0.0	5.6	4.1	131.5	107.3
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	0.0	0.0	4.9	0.0	0.0	0.0	0.6	0.0	5.5	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	***42.0***	***38.0***	***3.5***	***3.5***	***9.9***	***7.8***	***83.5***	***53.9***	***0.0***	***0.0***	***6.3***	***4.1***	***145.3***	***107.3***
Pipeline 2[g]														
Pipeline ROW	55.3	49.3	0.0	0.0	0.0	0.0	70.7	53.9	0.0	0.0	5.6	4.1	131.5	107.3
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	0.0	0.0	4.9	0.0	0.0	0.0	0.6	0.0	5.5	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	***55.5***	***49.3***	***0.0***	***0.0***	***0.0***	***0.0***	***83.5***	***53.9***	***0.0***	***0.0***	***6.3***	***4.1***	***145.3***	***107.3***
Pipeline Facilities Total[h]	**42.0**	**38.0**	**3.5**	**3.5**	**9.9**	**7.8**	**83.5**	**53.9**	**0.0**	**0.0**	**6.3**	**4.1**	**145.3**	**107.3**
Rio Grande LNG Project Total[h]	**42.0**	**38.0**	**3.5**	**3.5**	**9.9**	**7.8**	**198.4**	**168.8**	**19.8**	**19.8**	**54.0**	**51.8**	**327.7**	**289.7**

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.

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.

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.[24]

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 originally proposed to use a temporary haul road during construction for dump trucks to access the Port Isabel dredge pile, which would have affected 9.4 acres of wetlands and mud flats outside the boundary of the LNG Terminal site. We reviewed RG LNG's proposal and determined that construction of the temporary haul road through wetlands was not adequately justified. We therefore recommended in the draft EIS that RG LNG conduct a feasibility

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24 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.

assessment for transporting fill material from the Port Isabel dredge pile (if necessary) to the LNG Terminal site via the existing system of roads or via barges. As a result of our recommendation in the draft EIS, RG LNG is no longer pursuing use of the temporary haul road, thus the associated wetland impacts would be avoided (see section 3.4).

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

Header System and Pipeline 1

The Header System would not cross any wetlands. Construction workspace for Pipeline 1 would impact a total of 137.0 acres of wetlands, including 9.9 acres of PFO wetlands, 3.5 acres of PSS wetlands, and 117.4 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 107.3 acres of wetlands within the permanent footprint of the pipeline facilities, 7.8 acres would be PFO and 3.5 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 137.0 acres of wetlands, including 130.9 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.

We received comments on the draft EIS that RG LNG's wetland restoration plans are not adequate to return the Project area to pre-construction conditions. 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. These measures would ensure adequate wetland restoration following construction of the Pipeline System.

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,[25] 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,[26] and submitted a revised Section 404/10 application to the COE on May 2, 2018. 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;

[25] 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.

[26] 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.

- 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);
- 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, and RB Pipeline would be required to meet applicable CWA Section 404 permit requirements. 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

Section VI.A.6 of the FERC Procedures specifies that aboveground facilities 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).

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. Since the issuance of the draft EIS, RB Pipeline has removed an ATWS located in a PFO wetland that we determined was not adequately justified; that ATWS has also been removed from appendix F. We have reviewed the locations in appendix F and find them to be acceptable.

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[27] as part of its initial permit application to the COE, and provided a detailed Mitigation Alternatives Analysis[28] 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 and FWS) 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). Although RG LNG's proposed mitigation is discussed below, multiple agencies have expressed concern with this proposal and are coordinating with RG LNG to develop appropriate mitigation.

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.

We received multiple comments on the draft EIS expressing concern that the proposed preservation of wetlands within the Loma Ecological Preserve would not be sufficient to offset wetland losses at the LNG Terminal site since new wetlands would not be created and the

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27 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.

28 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.

wetlands at the Loma Ecological Preserve are protected while under lease to the FWS. The COE has not approved RG LNG's Conceptual Mitigation Plan and is working with RG Developers, in conjunction with the FWS, 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.

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, 7.8 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 recommendation, 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).

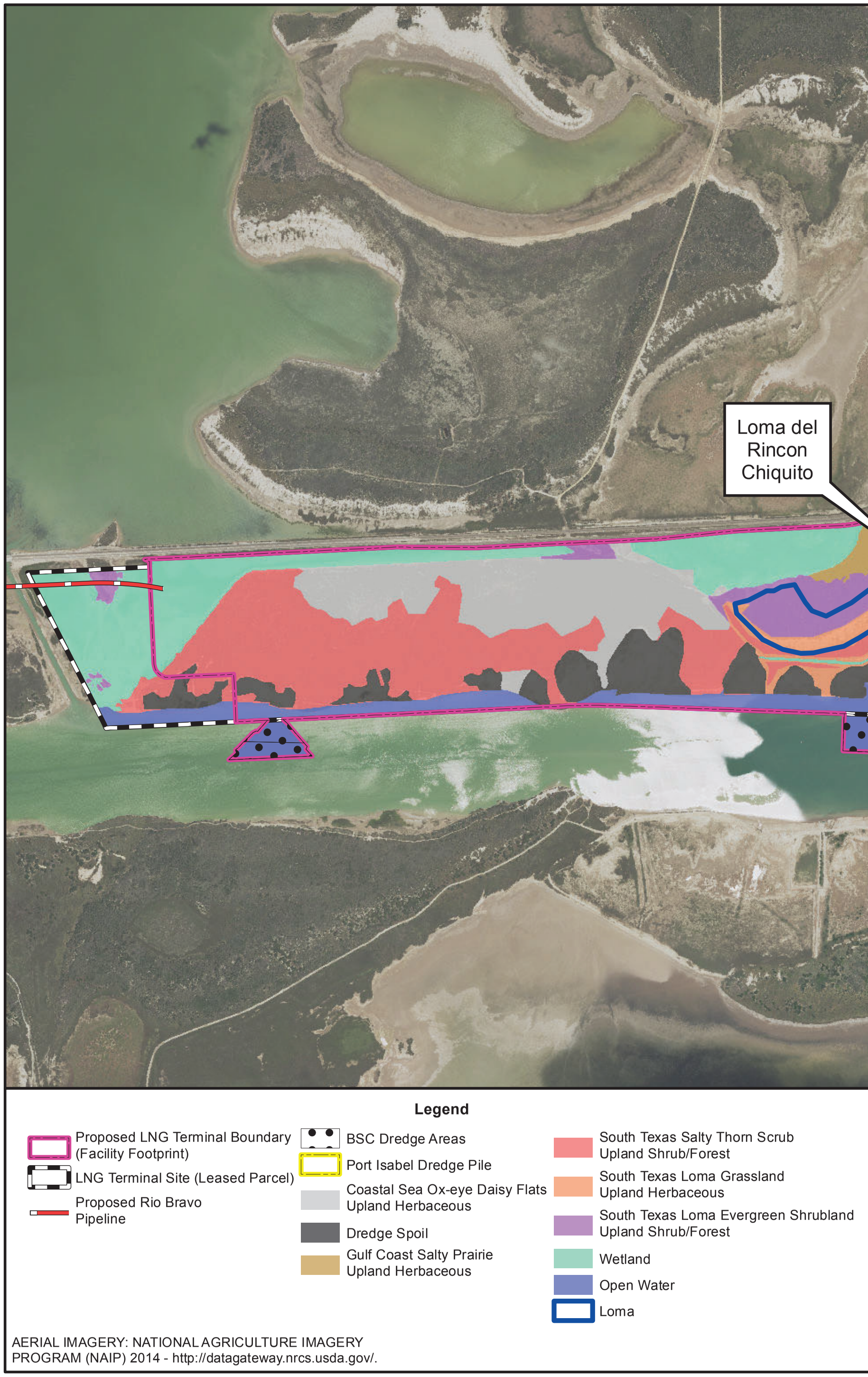
Table 4.5-1 Vegetation Communities Crossed by the Proposed Rio Grande LNG Project			
Vegetation Community	**Habitat Description and Typical Vegetation**	**Present at LNG Terminal Site**	**Present along Pipeline System**
Upland Herbaceous (Open) Land			
South Texas Loma Grassland	Grassland occurs in slightly 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.			

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.

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.



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**
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	***210.4***	***191.5***	***189.1***	***189.1***	***162.5***	***162.5***	***19.8***	***19.8***	***0.0***	***0.0***	***581.9***	***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	814.6	492.2	442.2	275.6	118.2	95.5	13.4	11.3	514.5	321.2	**1,902.9**	**1,195.8**
Pipeline 1 ATWS	4.4	0.0	15.9	0.0	5.5	0.0	0.0	0.0	19.4	0.0	**45.2**	**0.0**
Subtotal	***828.4***	***497.1***	***481.2***	***287.5***	***123.7***	***95.5***	***13.4***	***11.3***	***533.9***	***321.2***	***1,980.6***	***1,212.7***

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	1,256.8	767.8	0.0	0.0	131.6	106.8	0.0	0.0	514.5	321.2	**1,902.9**	**1,195.8**
Pipeline 2 ATWS	20.2	0.0	0.0	0.0	5.6	0.0	0.0	0.0	19.4	0.0	**45.2**	**0.0**
Subtotal	***1,276.9***	***767.7***	***0.0***	***0.0***	***137.2***	***106.8***	***0.0***	***0.0***	***533.9***	***321.2***	***1,947.9***	***1,195.8***
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	73.3	4.8	1.8	0.6	8.3	0.0	<0.1	0.0	0.5	0.0	**84.0**	**5.4**
Subtotal	***74.0***	***5.4***	***2.0***	***0.8***	***8.3***	***0.0***	***<0.1***	***0.0***	***0.5***	***0.0***	***84.9***	***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[b]												
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**
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**

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
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[c]	**1,097.1**	**544.8**	**542.5**	**338.5**	**132.0**	**95.5**	**13.5**	**11.3**	**670.4**	**321.6**	**2,455.5**	**1,311.7**
Pipeline 2 Total[d]	**1,599.2**	**858.7**	**0.0**	**0.0**	**145.5**	**106.8**	**0.0**	**0.0**	**670.4**	**321.6**	**2,415.2**	**1,287.1**
Pipelines 1 and 2[e]	**1,085.7**	**537.9**	**513.6**	**320.8**	**132.0**	**95.5**	**13.5**	**11.3**	**670.4**	**321.6**	**2,415.2**	**1,287.1**
Pipeline System Total[f]	**1,097.1**	**544.8**	**542.5**	**338.5**	**132.0**	**95.5**	**13.5**	**11.3**	**670.4**	**321.6**	**2,455.5**	**1,311.7**
Rio Grande LNG Project Total[f]	**1,307.6**	**736.3**	**731.5**	**527.5**	**294.5**	**258.0**	**33.3**	**31.1**	**670.4**	**321.6**	**3,037.2**	**1,874.5**

[a] Acreages for the LNG Terminal include those acreages associated with Compressor Station 3 and the marine facilities.

[b] 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.

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

[d] 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 (acreages associated with the Header System and its components are excluded). 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.

[e] 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.

[r] 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

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). Neither NWR would be directly affected by construction, although the pipelines would cross in close proximity to both (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, and the Port Isabel dredge pile (if necessary). 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.

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 (44.7 percent), agricultural land (27.3 percent), upland shrub/forest land (22.1 percent), emergent wetlands (5.4 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 3,037.2 acres of vegetation would be within the construction footprint of the LNG Terminal site and pipeline facilities. Following construction, approximately 1,162.7 acres would be restored to pre-construction conditions. A total of 1,874.5 acres would be within the operational footprint of the Project, of which 662.0 acres would be permanently converted to developed land and 1,212.5 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 areas would not be directly affected by Project construction.

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 1,980.6 acres of vegetation, including 828.4 acres of upland herbaceous land, 533.9 acres of agricultural land, 481.2 acres of upland shrub/forest land, 123.7 acres of emergent wetlands, and 13.4 acres of shrub/forested wetlands. Following construction, 497.1 acres of upland herbaceous land, 321.2 acres of agricultural land, 287.5 acres of upland shrub/forest land, 95.5 acres of emergent wetlands, and 11.3 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 66.0 percent of the Pipeline System 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 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 fencelines 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.

Access Roads

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 fenceline 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 3, 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[29] 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:

- 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

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29 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.

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 MPs 26.2 to 29.0 (TXNDD 2017).

In its comments on the draft EIS, the TPWD expressed concern for rare plants, in general, that may be present within Project workspaces, and recommended that topsoil segregation be conducted over the entire pipeline right-of-way. According to the TPWD, this topsoil segregation would ensure that good soil and native seed bank, potentially including rare species, remains intact and viable. Although RB Pipeline has already proposed to segregate topsoil (ditch plus spoil side method) in cultivated or rotated croplands, managed pastures, and other areas at the landowner's or land management agency's request, as well as over the ditch in non-saturated wetlands, it may not be practical to segregate topsoil for the entire Pipeline System. Therefore, **we recommend that:**

- **<u>Prior to construction of the Rio Bravo Pipeline</u>, RB Pipeline should consult with the TPWD to determine specific locations along the pipeline right-of-way that may warrant topsoil segregation based on the probable presence of rare plant species. Copies of consultation with the TPWD, along with any additional areas warranting topsoil segregation, should be filed with the Secretary, for review and written approval by the Director of OEP.**

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. In addition, Loma de las Yeguas would be crossed by the Pipeline System near MP 132.5, resulting in direct impacts on the habitat; we assessed alternative routing and crossing methods for this loma in section 3.5.1.2. 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). Finalized mitigation plans for the loss of potential ocelot habitat such as south Texas salty thornscrub would be determined through completion of the ESA consultation process as described in section 4.7.1.4.

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, and in consideration of our recommendation, 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 3,220.1 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 1,164.2 acres would be restored to pre-construction conditions. A total of 2,055.9 acres would be within the operational footprint of the Project, of which 830.6 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 1,219.1 acres would be maintained as herbaceous or scrub-shrub land within the pipeline rights-of-way.

LNG Terminal

<u>General Impacts</u>

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, and the Port Isabel dredge pile (if necessary). 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). 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. In response to comments on the draft EIS from the TPWD, RG Developers indicated that the EI would periodically inspect the inside of the fenceline after it is erected to identify and relocate trapped wildlife as practicable and in accordance with Project permits.

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 L and section 4.8.2.1); these renderings indicate that impacts from ground-level receptors (e.g., terrestrial wildlife) would not be significant. Nighttime 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). The TPWD, in its comments on the draft EIS, recommended that RG Developers incorporate additional measures, including the use of low-mounted lights, low lighting levels, and non-LED lights or lowest color temperatures, to further minimize the effects of lighting on wildlife, including migratory birds. RG Developers confirmed that these requests would be implemented to the extent feasible when accounting for safety and security requirements of the facility, and will share the terminal lighting plan and any future updates on lighting with the TPWD. In light of the expressed concerns of the FWS and TPWD during the review process, and the potential for lighting to affect migratory and federally listed birds, **we recommend that:**

- **<u>Prior to construction of the LNG Terminal</u>, RG LNG should consult with the TPWD and FWS to finalize nighttime lighting plans to minimize impacts on wildlife to the greatest extent practical. The final plans and copies of consultation with the agencies should be filed with the Secretary for review and written approval by the Director of OEP.**

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 1,998.5 acres of wildlife habitat, including 828.4 acres of upland herbaceous land, 533.9 acres of agricultural land, 481.2 acres of upland shrub/forest land, 123.7 acres of emergent wetlands, and 13.4 acres of shrub/forested wetlands, and 7.9 acres of open water. Following construction, 497.1 acres of upland herbaceous land, 321.2 acres of agricultural land, 287.5 acres of upland shrub/forest land, 95.5 acres of emergent wetlands, 11.3 acres of shrub/forested wetlands within the permanent easement would be restored to pre-construction conditions but would be subject to routine maintenance; 6.5 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 66.0 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. Further, RG Developers would include wildlife awareness training that would instruct Project contractors to avoid negatively affecting wildlife encountered during construction, and emphasize their "no kill" policy.

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 74.0 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 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 BCC (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).[30] 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

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30 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.

observed decreased throughout the survey period, with 814 birds observed on April 26, 614 on 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 plans to survey the Port Isabel dredge pile 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)[31] 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

[31] 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.

- selectively clear areas deemed most valuable to migratory bird nesting (shrubland and grassland loma habitat) outside of the FWS-recommended window; or
- 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 the 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, including our recommendation to finalize lighting plans in coordination with the TPWD and FWS (see section 4.6.1.2), we have determined that the overall increase in nighttime lighting during 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, 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. In addition, the TPWD has recommended 150-foot buffers to be implemented around active nests. Therefore, **we recommend that:**

- **<u>Prior to construction of the Project</u>, RG Developers should consult with the FWS and TPWD 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 the FWS and TPWD with the Secretary.**

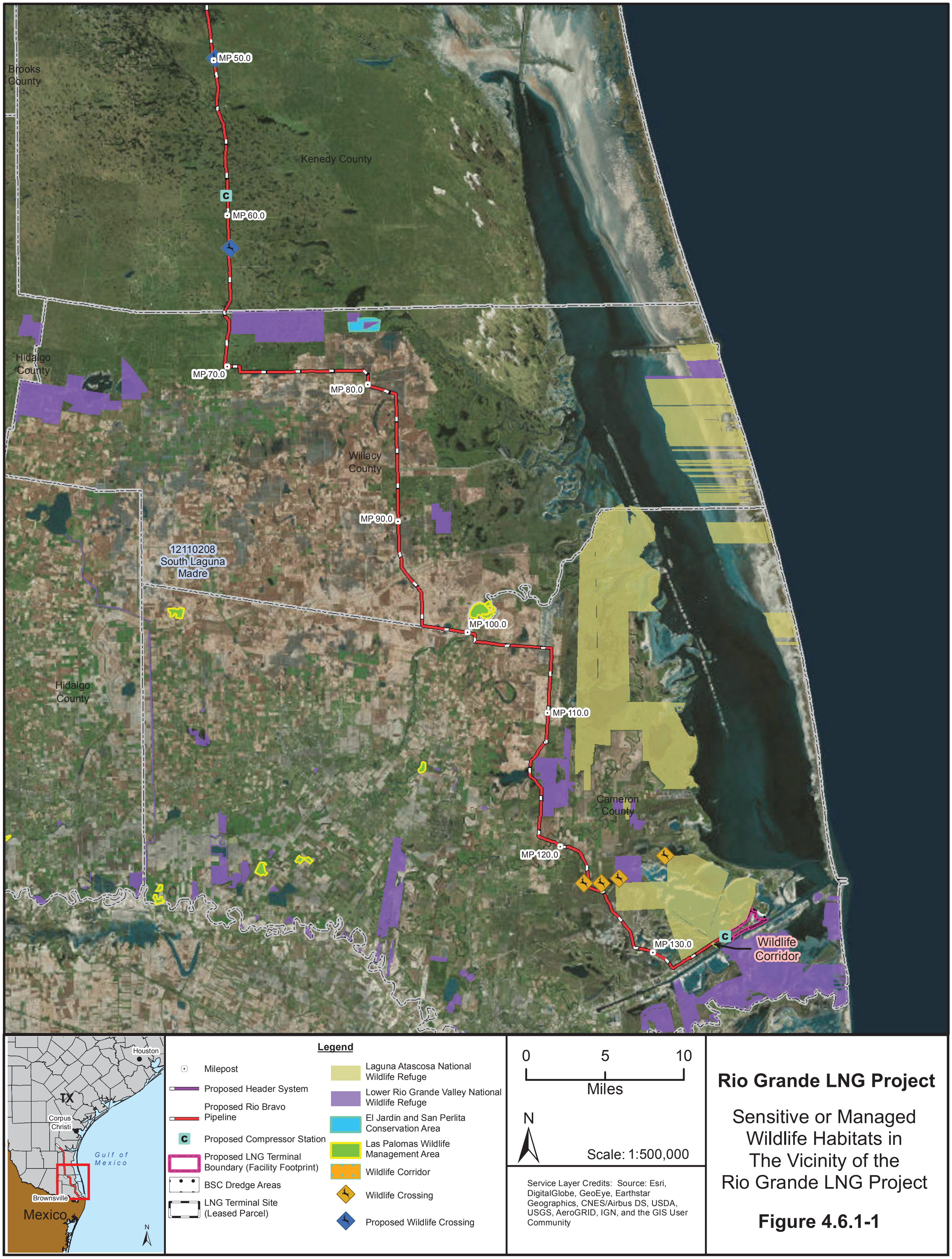
4.6.1.4 Sensitive or Managed Wildlife Habitats

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 the TPWD's Las Palomas Wildlife Management Area 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 MPs 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.



Rio Grande LNG Project

Sensitive or Managed Wildlife Habitats in The Vicinity of the Rio Grande LNG Project

Figure 4.6.1-1

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.

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 115.3 to 117.1; however, in response to our recommendations in the draft EIS, RB Pipeline has minimized impacts on the NWR and adjacent conservation easements by adopting a route variation that increased the separation between the Pipeline System and NWR from MPs 112.9 to 115.3, reconfiguring HDD workspaces to avoid direct impacts on the NWR, and decreasing the construction footprint from 125 feet wide to 75 feet wide where adjacent to the NWR. As discussed above for the Laguna Atascosa NWR, HDD construction near NWR boundaries at MPs 115.6 and 116.4 would also generate elevated noise levels for up to 10 weeks within the NWR. 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 HDD crossings at MPs 115.6 and 116.4, RB Pipeline should 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.**

In consideration of Project modifications and with adherence to our recommendation, 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 the FWS as a wildlife corridor to connect habitat for the federally endangered ocelot (*Leopardus pardalis*) on either side of SH-48 via a wildlife crossing under the highway. 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 crossing under SH-48, additional wildlife crossings are completed, or planned for installation by TxDOT, in consideration of recommendations from the FWS, under SH-100 and U.S. Highway 77. The Pipeline System would cross SH-100 at MP 124.8. The two closest wildlife crossings along SH-100 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). During coordination after issuance of the draft EIS, the FWS indicated that there are also two planned wildlife crossings along U.S. Highway 77 (see figure 4.6.1-1). These two crossings would be about 550 feet east of MP 49.9 and 430 feet east of MP 62.1; however, as the crossings have not yet been constructed, the location of the openings in relation to the proposed pipelines are not known.

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). In its comments on the draft EIS, the TPWD reiterated its concerns for migrating monarch butterflies (*Danaus plexippus*) and the need to augment larval feeding and adult nectaring opportunities, and recommended that RG Developers incorporate native milkweed (*Asclepias* spp.) and nectar plants where appropriate and sustainable.

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 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). Native pollinators also need a diversity of flowering (nectar-producing) plants and nesting sites to be successful and provide an energy source for local and migrating pollinators. The FWS and TPWD indicated concerns with the specific species that would be included in the seed mixes. Following issuance of the draft EIS, RG Developers consulted with the FWS regarding the use of seed mixes; coordination on the final seed mixes is ongoing, and RG Developers will coordinate with the Caesar Kleberg Wildlife Research Institute at the FWS' recommendation. Further, in response to the TPWD's comments on the draft EIS regarding specific plant species for the benefit of monarch butterflies and their larvae, RG Developers committed to incorporating monarch butterfly-friendly species into their revegetation plan, where possible.

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 consultation with the FWS. 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. Disturbed areas would be routinely monitored until restoration and revegetation were successful in accordance with the Project-specific Plan and Procedures. 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.

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.		

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).

LNG Terminal

Habitat for aquatic resources includes estuarine emergent wetlands, mudflats, and open water habitat within the LNG Terminal site 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. Neither the storage areas nor the Port Isabel dredge pile would affect waterbodies or wetlands.

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). Public comments on the draft EIS also stated that the Project would have adverse impacts on seagrasses in the Bahia Grande. No seagrasses are currently mapped in the Bahia Grande, nor is the Bahia Grande identified as an area containing seagrass in the TPWD’s 2012 update to its Seagrass Conservation Plan (Onuf et al. 2012, TPWD 2019); however, anecdotal records indicate that earlier restoration efforts have resulted in some seagrasses growing in the interior of the wetland unit (Brownsville Herald 2017).

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).

Portions of the BSC, the Bahia Grande Channel, 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) function as 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 EEM 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. Further, any seagrasses in the Bahia Grande are anecdotally noted to be in the interior of the system, indicating that any increase in suspended sediments through the channel would likely settle prior to reaching seagrass beds. Impacts from turbidity in the general Project area during dredging would be minimized through RG LNG's adherence to applicable permit requirements (see section 4.3.2.2).

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.

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.

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^2s)[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[f]	185 to 195	198 to 210
36- to 48-inch concrete pile (impact hammer)[e]	166[f]	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 pile-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.

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; all sizes)	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 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 and salinity 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[32] that prevent the introduction of exotic species such as:

- limiting the concentration of living organisms in ballast water;

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32 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.

- 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.

In addition, the Coast Guard has established engineering requirements and an approval process for ballast water treatment systems installed on ships (see section 4.3.2.2). The Sierra Club commented that the draft EIS did not consider the efficacy and timeline for implementing these regulations, which went into effect in 2012. As described in section 4.3.2.2, most ships calling on the Project would be expected to conform with applicable standards. Prior to ballast water treatment, the Coast Guard mandates a ballast water exchange process for vessels arriving in U.S. ports, which includes the complete exchange of ballast water in the open ocean at least 200 miles from U.S. waters. The ballast water exchange was reported to reduce organisms by 88 to 99 percent; ballast water treatment would further reduce the organisms in ballast water (National Research Council 2011). While these requirements may not eliminate all risk of invasive species entering U.S. waters, they would minimize the risk of introducing invasive species into the Project area.

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 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 the 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. As discussed in section 4.6.1.2, we have also recommended that RG Developers coordinate with the TPWD and FWS to finalize lighting plans. 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 63 waterbodies, including 21 perennial streams, 19 intermittent streams, 10 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. 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 62 of the waterbodies crossed by Pipeline 1 using the same methods. One waterbody would be crossed using a different method: 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,[33] 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.

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[33] 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. RB Pipeline has stated it would complete in-water construction activities between June 1 and November 30 for the protection of warmwater fishes. However, section V.B.1 of FERC's Plan states that this crossing timing requirement applies unless expressly permitted or further restricted by the appropriate federal or state agency. In its comments on the draft EIS, the TPWD recommended that waterbodies be crossed between November and January (the driest period in south Texas). Therefore, RB Pipeline must cross all waterbodies with perceptible flow between November 1 and January 31. The TPWD also added that if crossings cannot be done "in the dry" RB Pipeline should coordinate with the TPWD. In any case, and as identified in the Project-specific Procedures, if a need is identified to install waterbody crossings outside of the designated period, RB Pipeline would coordinate with the FWS and TPWD to obtain approval and submit appropriate documentation to FERC for review. 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 section 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 incorporated EFH consultation for the Rio Grande LNG Project with the interagency coordination procedures required under NEPA. As such, we requested that NMFS consider the draft EIS, and RG Developers' draft EFH Assessment, as our initiation of EFH consultation. We have updated our EFH Assessment based on additional Project information from RG Developers and recommendations by NMFS. Our final EFH Assessment is provided in appendix M. On February 15, 2019, NMFS issued a letter concurring with our conclusion that impacts on open water EFH would be temporary and minor, and does not have EFH conservation recommendations for the Project.[34] Therefore, consultation under the MSFCMA is complete.

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 could potentially serve 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. However, as described below, many of these habitats have been isolated from tidal exchange; this hydrologic isolation precludes many of the estuarine marsh and unconsolidated bottom habitats in the Project area from designation as EFH (see appendix M).

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. Without regular tidal exchange, evaporation likely leads to hypersaline and anoxic conditions and therefore these wetlands do not function as EFH.

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 EEMs, 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 and, similar to the EEM described above, do not function as EFH.

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[34] NMFS' letter documenting completion of consultation 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 20190222-5030.

Legend

- Proposed LNG Terminal Boundary (Facility Footprint)
- LNG Terminal Site (Leased Parcel)
- Proposed Rio Bravo Pipeline
- BSC Dredge Areas
- Port Isabel Dredge Pile
- Emergent Marsh
- Soft Bottom
- Sand/Shell Bottom
- Mangrove
- Open Water

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

N

0 0.5 1
Miles

Scale: 1:50,000

Rio Grande LNG Project

Aquatic Habitat in the Rio Grande LNG Project Area

Figure 4.6.2-1

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.						

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 isolated open water lagoon at the LNG Terminal site (Aquatic Resource 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). While the Bahia Grande Channel is connected with the Gulf of Mexico via tidal exchange and functions as EFH (see below), the open water lagoon (Aquatic Resource 1) is isolated and does not provide suitable EFH for managed species.

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. Open water habitat at the Channel to San Martin Lake and Bahia Grande Channel as well as in the BSC functions as EFH.

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 meet the definition for EFH. The total acreages of each habitat 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. However, only open water areas in the Project vicinity are subject to tidal exchange and function as EFH. The primary impact from construction of the LNG Terminal would include the loss and conversion of open water areas as described in sections 4.3.2 and 4.4.

In addition, 127.1 acres of open water EFH would be within construction workspaces for the LNG Terminal. 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 EEM and 10.6 acres of soft-bottom habitat (mudflats). The wetlands at the LNG Terminal site are isolated from regular tidal exchange and, as described above, do not function as EFH.

Table 4.6.3-2 Essential Fish Habitat Types affected by Construction and Operation of the Rio Grande LNG Terminal[a]						
Facility	**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[b]	357.2
Offsite storage/parking	0.0	0.0	0.0	0.0	0.0	0.0
Port Isabel dredge pile[c]	--	--	--	--	--	--
Bulk water loading area	0.0	0.0	0.0	0.0	0.0	0.0
Total	**114.9**	**19.8**	**47.7**	**47.7**	**127.1**	**357.2**

a Any discrepancies with the acres of EFH included in appendix M are due to rounding. Although each identified category is an EFH type, only open water habitats at the LNG Terminal site function as EFH.

b 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 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 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 any future EFH consultation in this regard will conclude that any impacts at offshore dredged material placement areas would be adequately minimized.

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 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 existing EFH and the species and life stages that utilize EFH would be temporary, but minor.

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. These wetlands and mudflats are irregularly inundated and therefore, in the absence of regular tidal exchange and similar to the isolated wetlands of the LNG Terminal site, do not function as EFH. 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.

The Pipeline System would avoid impacts on EFH within the Channel to San Martin Lake and the Bahia Grande Channel 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. 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 temporary, 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. Consultation under the MSFCMA is complete, and given the temporary, minor impacts on EFH, NMFS does not have EFH conservation recommendations for the Project.

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 or under review 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 20 federally listed threatened and endangered species, 2 species that are candidates for listing under the ESA, 2 species proposed for federal listing[35], 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.

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[35] The eastern black rail was proposed for listing as threatened by the FWS on October 9, 2018, and could be present in Texas. The Gulf of Mexico Bryde's whale was proposed for listing as endangered by NMFS on December 8, 2016 and could be present in Gulf waters.

Table 4.7-1
Federal Special Status 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					
Eastern black rail, *Laterallus jamaicensis*	Proposed Threatened	--	Cameron, Kenedy, Kleberg, Willacy	LNG Terminal and pipeline facilities	*Not Likely to Adversely Affect.* Known to occur along the northern extent of the Project area, and potentially occurs in the vicinity of the LNG Terminal. Suitable habitat within the operational footprint of the Project would be lost, but adjacent suitable habitat would remain.
Northern aplomado falcon, *Falco femoralis septentrionalis*	Endangered	Endangered	Cameron, Kenedy, Kleberg, Willacy	LNG Terminal and pipeline facilities	*Not Likely to Adversely Affect.* Year-round residents in Cameron County. Active nests would be avoided, and RG Developers would implement Project-specific BMPs to avoid or minimize indirect impacts. We have recommended that updated nest data be obtained prior to construction. We also note that any "take" of northern aplomado falcons at the terminal site is already covered under a Safe Harbor Agreement between the FWS, Peregrine Fund, and BND.
Piping plover, *Charadrius melodus*	Threatened	Threatened	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	LNG Terminal	*Not Likely to Adversely Affect* piping plovers and critical habitat. Winters in the general Project area where critical habitat is designated; however, abundant habitat is present in the Project area and no direct impacts on critical habitat would occur.
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.

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
Mammals					
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.
Gulf Coast jaguarundi, *Herpailurus yagouaroundi cacomitli*	Endangered	Endangered	Cameron, Jim Wells, Kenedy, Kleberg, Willacy	LNG Terminal and pipeline facilities	*Likely to Adversely Affect*. Although there is a lack of confirmed sightings for this species, its range and habitat usage overlaps that of the ocelot and there would be a direct loss of potential habitat 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.

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
Plants (continued)					
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.
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 19 of the federally listed or proposed species in table 4.7-1. We have determined that the Project *is likely to adversely affect* the ocelot (endangered) and Gulf Coast jaguarundi (endangered), and request to enter formal consultation for these two 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.

In October of 2018, we requested that NMFS and the FWS concur with our determinations of effect for the Project, and requested that FWS develop a Biological Opinion indicating whether the Project is likely to jeopardize the continued existence of federally listed species. At the time of this writing, NMFS is continuing to review our BA. On November 28, 2018, the FWS provided preliminary comments on our BA requesting additional information; these requests and the corresponding information are included below. We have also recommended RG Developers to file updated species information for the northern aplomado falcon 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 ridley's 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.

We received a comment on the draft EIS requesting that we further consider the potential for vessel strikes of sea turtles from LNG carriers calling at the LNG Terminal, as RG LNG could not enforce the use of NMFS' *Vessel Strike Avoidance Measures and Reporting for Mariners* on the various LNG vessels that would be serving the Project. To address this comment, we reviewed research on the impact of vessel speeds on sea turtles as well as data from the Sea Turtle Stranding and Salvage Network (STSSN). Hazel et al. (2007) conducted a field study of the effects of vessel speed on collision risks for green sea turtles. Out of 1,890 encounters with sea turtles within 33 feet of the research vessel's track, the researchers identified that the faster the boat speed (tested at 2.2, 5.9, and 10 knots), the less they were likely to observe avoidance actions by the green turtles. The results implied to the researchers that vessel operators could not rely on sea turtles to actively avoid being struck if the vessel speed exceeded 2.2 knots. The BSC has a vessel speed limit of 8 knots (NOAA n.d.), and LNG carriers in general are capable of speeds of up to 21 knots during transit in open oceans (GIIGNL n.d.), indicating that vessels not adhering to NMFS' *Vessel Strike Avoidance Measures and Reporting for Mariners* could cause collisions with sea turtles in the area.

In its comments on the draft EIS, the Sierra Club indicates that 3,390 stranded sea turtles were identified from 2010 to 2018 within Statistical Zone 21 of the Gulf of Mexico, which covers the coastal and offshore federal waters from just south of Corpus Christi Bay to the

Texas/Mexico border. As the Sierra Club notes, it can be assumed that a portion of these strandings were related to vessel impacts. Using weekly data reported from the STSSN, 355 sea turtles were stranded or salvaged in Statistical Zone 21 during 2018, 16 (or about 4 percent) of which were identified as having possible boat strike wounds (one of which was identified as having healed boat strike wounds) (STSSN 2019; please note that these data are indicated as preliminary). Each of the sea turtles identified as having possible boat strike wounds was a green sea turtle. Although boat strikes may not always be obvious as the pathway for stranding/salvage, the data indicate that boat strikes are not the leading cause of sea turtle strandings. Further, boating activities are prevalent in the inshore and offshore areas of Statistical Zone 21, indicating that the chances of an individual boat striking a sea turtle is so small as to be discountable. Therefore, the addition of 6 LNG carriers per week to BSC and Gulf waters would not be likely to adversely affect sea turtles through vessel strike.

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 $\mu Pa^2 s$)[a]	Root Mean Square Sound Level (dB RMS) (dB re 1 µPa)[b]	Peak Sound Level (dB re 1 µPa)[c]
Sheet pile (vibratory hammer / impact hammer)[d]	--	163/195	--
36- to 48-inch steel pile (impact hammer)[d]	175 to 185[e]	185 to 195	198 to 210
36- to 48-inch concrete pile (impact hammer)[d]	166[e]	176	188
Sea turtle injury	--	180	--
Sea turtle behavioral effects	--	166	--
Marine mammal temporary threshold shift (impulsive / non-impulsive noise)[f,g]	170/178[g]	--	224/ --
Marine mammal permanent threshold shift (impulsive / non-impulsive noise)[f,g]	185/198[g]		230/ --
Marine mammal behavioral effects (impulsive / non-impulsive noise)[f]	--	160/120	

Source: NMFS 2018a.

a The cumulative sound exposure level is the energy accumulated over multiple strikes or continuous vibration over a period of time.

b The RMS 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 vibratory pile-driving of a 24-inch sheet pile and impact pile-driving of steel piles (between 36 and 60 inches in diameter) and concrete piles (24-inch-diameter) for land- and marine-based pile-driving (NMFS 2018a).

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 These thresholds are 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.

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, b]		
		Steel Sheet Pile[c]	Steel Pipe Pile[d]	Concrete Pile[e]
Sea Turtles				
Behavioral (166 dB RMS)	Vibratory	0.0	--	--
	Impact	2,815.0[f]	607.0	150.9
Injury (180 dB RMS)	Vibratory	0.0	--	--
	Impact	328.1[f]	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[f]	1,522.3	383.9
Permanent threshold shift (198 dB SEL_{cum})[g, h]	Vibratory	11.2	--	--
Permanent threshold shift (185 dB SEL_{cum})[g, h]	Impact	259.8[b]	20.7	5.2

[a] Where the distance is 0.0 feet, the source level is less than the noted threshold.

[b] Values calculated using the Greater Atlantic Regional Fisheries Office acoustics tool with the Practical Spreading Loss Model for sound attenuation (NMFS 2018a), with the exception of the permanent threshold shift distances, which were calculated using NMFS' 2018 Technical Guidance user spreadsheet (NMFS 2018b).

[c] Values calculated from an impact-driven 60-inch steel pile proxy or a vibratory-driven 25-inch steel sheet proxy (NMFS 2018a). RG LNG estimates that 7 piles would be installed per day; sheet piles would require a 72 minutes of installation time (NMFS 2018b, method A.1), and traditional piles would require 300 strikes per pile (NMFS 2018b; method E.1-2).

[d] Values calculated from a 48-inch Cast in Steel Shell steel pile in 0 feet of water (NMFS 2018a). RG LNG estimates that 1 pile would be driven at a time, with 475 strikes per pile (NMFS 2018b; method E.1-2).

[e] Values calculated from a 24-inch concrete pile in 49 feet of water (NMFS 2018a). RG LNG estimates that 1 pile would be driven at a time, with 475 strikes per pile (NMFS 2018b, method E.1-2).

[f] RG LNG does not propose to install sheet piling using an impact hammer unless refusal is met with the vibratory hammer.

[g] Injury thresholds for permanent threshold shifts were obtained through use of the Technical Guidance user spreadsheet, tab E.1-2 (NMFS 2018b).

[h] Although the NMFS' 2018 Technical Guidance identifies temporary threshold shift thresholds, calculations are not yet included in the Technical Guidance user spreadsheet (NMFS 2018b); therefore, the Zones of Influence are assumed to extend some distance between the permanent threshold shift and behavioral effect ZOIs.

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. To ensure that these elements for sea turtles (including use of biological monitors and implementation of NMFS' *Sea Turtle and Smalltooth Sawfish Construction Conditions*), as well as elements noted below for other federally or state listed species, are incorporated appropriately, **we recommend that:**

- **<u>Prior to construction of the Project</u>, RG Developers should file documentation with the Secretary, for review and written approval by the Director of OEP, demonstrating how RG Developers' commitments (as referenced in sections 4.7.1.1, 4.7.1.2, 4.7.1.4, 4.7.2.1, and 4.7.3) to implement agency recommended monitoring, avoidance, and mitigation measures for federal and state listed species have been incorporated into RG Developers' environmental training program.**

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 22 marine mammal species protected under the MMPA may occur within the BSC at the proposed terminal site and along the LNG transit routes in the Gulf of Mexico; although additional species may occur, they are considered extralimital or occasional transients within to the area (NMFS 2012, Hayes et al. 2018). 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 subtropical 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 recommendations to implement FWS-recommended training for workers at the LNG Terminal and file documentation that these materials have been incorporated into the Project's environmental training, as well as RG LNG's commitment for its support vessels 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, calving, mating, 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 eastern Gulf of Mexico (along the continental shelf) is identified as a biologically important area for Bryde's whale (NMFS 2019). The best estimate for this stock is 33 whales. This species has a high risk of extinction due to its small population size, life history characteristics, extremely limited distribution, and vulnerability to existing threats (Hayes et al. 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. The LNG carriers would use established and well-traveled shipping lanes, and 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 ship strikes are not anticipated and the Rio Grande LNG Project *is not likely to adversely affect* federally listed whales.

4.7.1.3 Birds

Eastern Black Rail

On October 9, 2018, the FWS proposed the eastern black rail (*Laterallus jamaicensis jamaicensis*) for listing as threatened under the ESA, with a final rule anticipated no later than October 2019 (83 FR 50610). Under the ESA, federal agencies are required to confer with the FWS on agency actions that may be likely to jeopardize a proposed species. The FWS would typically finalize or withdraw the listing about 12 months after the proposal depending on comments received; ESA protections become effective 30 days after the final listing rule is published.

The eastern black rail is a small secretive bird generally found within salt, brackish, and freshwater marshes across portions of the United States, Central America, and South America (FWS 2019). Eastern black rails have a broad distribution across the Atlantic Gulf Coast and eastern United States; however, this species is highly localized to marsh habitats (FWS 2019, 2018a). Black rails occupy the upper zone of marshes along the Atlantic Coast that are dominated by herbaceous species including marsh hay cordgrass (*Spartina patens*) and saltgrass (*Distichlis spicata*) that are less than 1 meter in height and intermingled with scrub-shrub species such as eastern baccharis (*Baccharis halimifolia*) and marsh elder (*Iva frutescens*) (FWS 2014, FWS 2018b). Due to their secretive nature, migration patterns for this species are poorly understood; however, it is believed that there are two populations of eastern black rail in the south-central United States. In Texas, these populations consist of a migratory, wintering population and a non-migratory population living in the state year-round (Federal Register 2018). The LNG Terminal is within the potential range for the species but outside of the known year-round range for the species, which extends along the Texas coast from the Louisiana border south to the vicinity of Baffin Bay. The Pipeline System would be within the known year-round habitat between MPs 0.0 to about 21.5 (FWS 2019).

During wintering and nesting periods, the eastern black rail remains close to the ground at its nest and flushes only short distances when pursued and will instead use dense vegetation to evade predators. Breeding occurs along the Atlantic Coast from New York to Texas (FWS 2014, FWS 2018b). Wintering and nesting habitat for the eastern black rail includes dense vegetation consisting of fine-stemmed emergent plants, such as rushes, grasses, and sedges, with high stem-densities and canopy cover. Soils within these types of habitats generally are moist to saturated with an occasional dry period interspersed with or adjacent to areas of shallow water (FWS 2018b). The eastern black rail is a ground-nesting species that uses live and dead emergent plants to construct its nest. Nest locations generally are well hidden within dense vegetation that is located atop moist soils or shallow bodies of water that are 1 to 6 centimeters in depth (FWS 2018b). Eastern black rails reproduce from approximately mid-March through August (Federal Register 2018). Additionally, this species relies on transitional zones between uplands and wetlands for refuge during flooding and high-water events (Federal Register 2018). Eastern black rails are opportunistic feeders and forage on a variety of small aquatic terrestrial invertebrates, insects, and seeds (FWS 2019, 2018b).

Primary threats to the eastern black rail include habitat loss due to continued alteration and loss of wetland habitats, land management practices that result in fire suppression (or inappropriately timed fire application that may cause direct mortalities), grazing, haying and mowing, and impounding of wetlands (Federal Register 2018). In addition, projected sea level rise and associated tidal flooding, increased temperatures, decreased precipitation, increased drought, and severe weather events producing flooding or changes in wildfire frequency and intensity are all likely to have significant impacts on eastern black rail populations and their habitat (Federal Register 2018).

As described in section 4.4.2, a total of 114.9 acres of emergent wetlands would be permanently converted to industrial/commercial land or open water at the LNG Terminal site, resulting in a permanent loss of emergent wetland habitat. The LNG Terminal is within the potential range for the species, but outside of the known year-round range. Therefore, while wetlands at the LNG Terminal site could provide suitable black rail habitat, the species is unlikely to occur onsite. Additionally, a total of 125.5 acres of palustrine and estuarine emergent wetlands are within the workspace for the Rio Bravo Pipeline System (which does cross known year-round habitat). Those wetlands would be restored to pre-construction conditions following completion of the Project, and potential impacts on eastern black rail habitat would be temporary. Further, 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, or implement its MBCP, as discussed in section 4.6.1.3.

If present onsite, 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.

Operation of the LNG Terminal would result in an increase over ambient sound levels at nearby wetland habitats, including at the Laguna Atascosa NWR (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.

Although potentially present within the Project area, particularly along the northern portion of the Pipeline System, RB Pipeline would implement its MBCP, which would minimize the potential for impacts on any nesting individuals and potential impacts on non-nesting individuals would be limited to temporary disturbance. Potential habitat would be removed at the LNG Terminal site; however, the site is outside of the known year-round habitat for the species and habitat clearing would be in accordance with RG Developers' MBCP, which would minimize the potential for impacts on nesting individuals. Therefore, we conclude that the Project *is not likely to adversely affect* the eastern black rail and its habitat.

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.[36] 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.

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

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[36] 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.

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 northern aplomado falcons. Results of survey data collected between 2000 and 2016 indicate that no northern 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 northern 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. Further the FWS, in its comments on the draft EIS, indicated that the

LNG Terminal area is covered by a Safe Harbor Agreement (an agreement between a non-federal landowner and the FWS) and associated 10(a)(1)(A) permit that allows development (and take) to occur in the area around the Port of Brownsville, where landowners (such as the BND) have opted to become sub-permittees of the Safe Harbor Agreement. 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. 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 developed a set of Project-specific northern aplomado falcon BMPs (see appendix N) that are based on the FWS' BMPs for the northern aplomado falcon,[37] as modified through discussions with the FWS and TPWD. Measures proposed to be implemented by RG Developers include, but are not limited to:

- coordinating with the FWS and Peregrine Fund to acquire the most recent nest data and consult with the FWS to determine if pre-activity surveys should be conducted in suitable habitat where nest data is lacking;
- 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;
- constructing the LNG Terminal and associated offsite facilities that are within 1 mile of active nests between August 1 and January 31 or using biological monitors during the breeding season to monitor active nests within 1.0 mile of construction activities;
- minimizing nighttime work or, when needed, using nighttime lighting that is down-shielded and of minimal wattage; and

[37] The FWS' 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.[38] 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.

- reporting all newly discovered nests to the FWS within 1 day and new northern aplomado falcon sightings within 3 days.

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. The Project-specific BMPs indicate that the most recent northern aplomado falcon nest data would be obtained prior to construction; however, the LNG Terminal and each pipeline have separate construction start dates. 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 FWS' northern aplomado falcon 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 northern aplomado falcon 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 consult with the FWS on the Project-specific northern aplomado falcon BMPs, and file with the Secretary the FWS comments and any BMP modifications, for review and written approval by the Director of OEP.**

We note that the FWS, in response to our request for Section 7 consultation, encouraged the conservation of northern aplomado falcon habitat and separately requested that RG Developers work with The Conservation Fund and The Peregrine Fund to identify and secure conservation land. RG Developers are continuing to consult with these entities regarding potential mitigation.

Given RG Developers' use of Project-specific BMPs for northern aplomado falcons, our recommendation to verify nest locations in consultation with the applicable entities, and in consideration of FWS comments on the draft EIS indicating that take is already covered under a Safe Harbor Agreement and associated 10(a)1B(1)(A) permit for property owned by the Brownsville Navigation District, we have determined that the proposed Project *is not likely to adversely affect* the northern aplomado falcon.

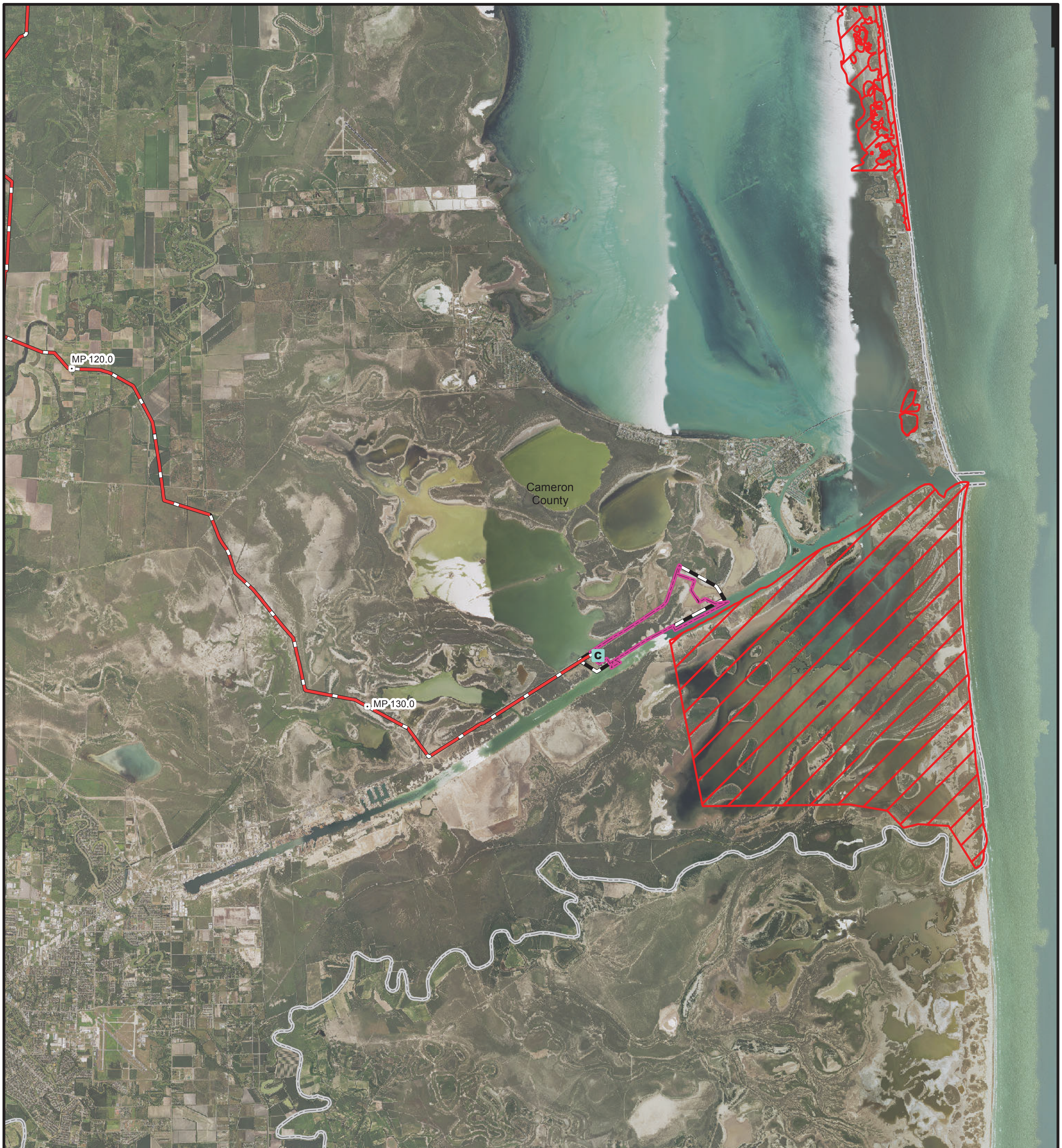
Piping Plover

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 n.d.-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). In addition, the FWS indicated that, without the periodic placement of dredged material at these locations, vegetation could grow, making the sites unsuitable as habitat. If placement areas were used in the critical habitat, the FWS found that plovers could comfortably move to adjacent habitats since they are acclimated to dynamic landscapes and moving to adjacent habitats when one habitat disappears (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 (Leased Parcel)
- Proposed LNG Terminal Boundary (Facility Footprint)
- County 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

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, 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 any 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. One study of snowy plovers in breeding areas indicates that sustained noise levels of 80 dBA would result in a "may affect" determination for snowy plovers (U.S. Marine Corps and Department of the Navy 2017); however, piping plovers do not breed in south Texas and ambient sound levels have not been identified as primary constituent elements for designating critical habitat for wintering piping plovers (65 FR 41782).

In its comments on the draft EIS, which identified the potential for noise impacts on critical habitat, the FWS indicated that the Project would not be likely to adversely affect the piping plover. In consideration of consultation with the FWS and because elevated noise levels would not preclude use of the critical habitat by winter piping plovers, we concur and conclude that the Project *is not likely to adversely affect* the piping plover or its critical habitat.

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.

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.

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; the pipelines through these parcels have been rerouted to predominantly travel adjacent to existing disturbance.

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, or is planning to install, wildlife underpasses and culverts at major roadways, including SH-48, SH-100, and U.S. Highway 77. One such project included installation of a wildlife crossing 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). During coordination with the FWS, two planned wildlife crossings were identified along U.S. Highway 77, where the Pipeline System is collocated with an existing pipeline. These two crossings would be about 550 feet east of MP 49.9 and 430 feet east of MP 62.1; however, as the crossings have not yet been constructed, the location of the openings in relation to the proposed pipeline, and therefore potential conflicts between the proposed pipeline and ocelots' future use of these areas, are not known. However, we anticipate that any potential conflicts would be assessed by the FWS during development of its Biological Opinion.

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 542.5 acres of upland shrub/forest habitat, which would be temporarily disturbed during construction of the Pipeline System. Of that, 338.5 acres would be maintained in an herbaceous state for the life of the Project. The FWS, in its consultations with RG Developers after issuance of the draft EIS, indicated that the prime areas of ocelot habitat along the proposed pipeline were between MPs 70 and 115, and that the FWS is working with RG Developers to identify any specific areas of high quality habitat where impacts should be avoided or minimized. As indicated below, finalized mitigation plans for the loss of potential ocelot habitat would be determined through completion of the ESA consultation process.

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 crossing) 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 MPs 134.5 to 134.7, RB Pipeline would install the pipeline via HDD crossing methods, which would avoid surface impacts from MPs 134.4 to 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 acres 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). Final mitigation plans would be determined through completion of the ESA consultation process. Therefore, we have recommended below that RG Developers not begin construction until ESA Section 7 consultation is complete with the FWS.

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 center 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.

In November 2018, RG Developers met with the FWS to discuss habitat impacts with respect to the ocelot. The FWS requested that RG Developers mitigate for the permanent loss of ocelot habitat and recommended habitat preservation as part of the wildlife conservation corridor (Coastal Corridor acquisition project) that abuts the Laguna Atascosa NWR, Lower Rio Grande Valley NWR, and recently established conservation lands. The FWS also recommended working with the Conservation Fund to identify suitable ocelot habitat for conservation. Final mitigation requirements would be determined by the FWS in its Biological Opinion and through completion of the ESA Section 7 consultation process.

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. Further, we have recommended in section 4.6.1.2 that RG Developers coordinate with the TPWD and FWS to finalize lighting plans.

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, 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, although minimized in accordance with our recommendation in the draft EIS, the pipelines would impact CRP-SAFE land that are 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). Further, mitigation for ocelot habitat loss would also minimize impacts on potential jaguarundi habitat. We therefore find that the Project *likely to adversely affect* the Gulf Coast jaguarundi.

4.7.1.5 Amphibians

Black-spotted Newt

The black-spotted newt is under review by the 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, 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 among 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; the 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 out-compete 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:**

- **Prior to construction of the Rio Bravo Pipeline, 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 include in its filing avoidance/minimization measures that it would implement if individual plants are found, developed in consultation with the FWS, for review and written approval by the Director of OEP.**

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, and because consultation may be necessary for species proposed for listing, **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. In its comments on the draft EIS, the TPWD requested that Project contractors be provided wildlife awareness training that includes instructing contractors not to negatively impact any wildlife encountered in the construction area and emphasizing its "no kill" policy; RG Developers have confirmed that this training would be provided. We have recommended above that RG Developers file documentation to confirm these measures have been incorporated into its environmental training program.

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.

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. Non-breeding: 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 semi-arid 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 U.S. 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 saltwater; 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*	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 micro-habitats, 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.

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 further 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.

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. In its comments on the draft EIS, the TPWD expressed concern with the potential use of erosion control blankets and mats, which pose an entanglement threat to wildlife, specifically those blankets and mats that are made of plastic mesh. Although RG Developers' Plan restricts the use of synthetic mesh/netted erosion control materials in sensitive wildlife habitats, we recognize that sensitive species occur outside of designated wildlife habitats, as confirmed through review of the TPWD's species occurrence records. Therefore, **we recommend that:**

- **<u>Prior to construction of the Project</u>, RG Developers should consult with the TPWD, and file with the Secretary copies of this consultation, to specifically identify locations of sensitive habitat that may warrant the restriction of synthetic mesh/netted erosion control materials. The specific areas warranting restriction of synthetic erosion control materials, should be filed with the Secretary, for review and written approval by the Director of OEP.**

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, and with consideration of our recommendation, 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 n.d.-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, BMPs, and our recommendation regarding use of synthetic mesh/netted erosion control materials, we conclude that there would be no significant impact on state listed reptiles during construction and operation of the Project.

<u>Texas Tortoise</u>

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 n.d.-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 has previously indicated that it does not recommend relocation where an entire home range would be affected 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. 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 TAC. In response to the TPWD's comments on the draft EIS, RG Developers clarified that they will continue to work with the agency to develop a plan to minimize potential impacts on the species at the LNG Terminal site.

With implementation of the Texas Tortoise BMPs along the Pipeline System, informing contractors to check under their vehicles for wildlife prior to operating, and RG Developers' commitment to minimizing impacts on the species at the LNG Terminal site through continued coordination with the TPWD, we conclude that construction and operation of the Rio Grande LNG Project would not significantly affect the Texas tortoise.

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 22 marine mammal species protected under the MMPA may occur within the BSC at the proposed terminal site and along the LNG transit routes in the Gulf of Mexico; although additional species may occur, they are considered extralimital or occasional transients within to the area (NMFS 2012, Hayes et al. 2018). Six 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 whale and dolphin species and their potential area of occurrence along the LNG transit routes in the Gulf of Mexico 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 in the Gulf of Mexico

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
Pygmy sperm whale	*Kogia breviceps*	Gulf of Mexico
Source: Hayes et al. 2018.		

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 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 away from the vessel. Dolphins are known to ride the bows of traveling vessels, positioning themselves in such a manner so that they are lifted up and pushed forward by the circulating water generated by a vessel's bow pressure (Wursig 2009); however, dolphins and whales are also at risk of vessel strikes in the presence of large and small vessels.

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. Given RG LNG's proposed use of existing, highly traveled shipping lanes and requested implementation of NMFS' guidance for ship strike avoidance, 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 mammal stocks and that vessel strikes of individuals would be minimized to the extent practicable.

NMFS has indicated that only the bottlenose dolphin has the potential to be impacted by in-water construction at the LNG Terminal. In addition to impacts from potential vessel strikes, bottlenose 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 20.7 feet of planned activities, or within 259.8 feet if an impact hammer were required to install the sheet pile, which is not currently planned. These distances were determined using NMFS' Technical Guidance for Assessing the Impact of Anthropogenic Sound on Marine Mammals (NMFS 2018b; assumptions used for the assessment are included in table 4.7.1-2 of this EIS). The Technical Guidance provides underwater acoustic thresholds for the onset of permanent and temporary threshold shifts (changes in the threshold of audibility).

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 and the need to obtain an MMPA incidental take authorization. Further, NMFS has indicated concern with the potential entrapment of dolphins behind sheet piling that would be installed at the MOF and recommends that RG LNG implement entrapment BMPs. 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 dolphins during in-water pile-driving (including the potential for entrapment behind sheet pilings) 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 with in-water installation of the 96-inch pile would exceed injury thresholds for dolphins within 508.5 feet of pile installation (NMFS 2018b; assuming 475 strikes per pile and 1 pile installed per day) and would exceed behavioral thresholds within 6.2 miles (NMFS 2018a). If RG LNG modifies its proposed approach to include in-water pile-driving for Jetty 2, further approval from FERC would be required, and these additional impacts would need to be included in RG LNG's application to NMFS for the incidental take of marine mammals.

Given RG LNG's proposed implementation of NMFS' guidance document on vessel strike avoidance, as applicable and appropriate, and our recommendation to minimize impacts on marine mammals during in-water pile-driving through use mitigation measures determined in consultation with NMFS, take of marine mammals under the MMPA would either be avoided or minimized to the extent practical.

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 3,633.2 acres of land. Following construction, the LNG Terminal site and permanent rights-of-way would encompass about 2,149.2 acres. The remaining 1,484.0 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:[38]

- Shrub/Forest Land[39] – includes shrubland, upland forest, palustrine forested wetlands, and scrub-shrub wetlands (including mangroves);
- Open Land – includes grassland and grazing land;
- 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;

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38 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.

39 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
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***	***210.4***	***191.5***	***162.5***	***162.5***	***174.8***	***174.8***	***380.6***	***81.4***	***0.2***	***0.0***	***0.0***	***0.0***	***1,137.3***	***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	455.6	286.9	814.6	492.2	118.2	95.5	7.9	6.5	4.3	2.5	2.7	2.7	514.5	321.2	1,918.0	1,207.4
Pipeline 1 ATWS	15.9	0.0	4.2	0.0	5.5	0.0	<0.1	0.0	0.6	0.0	0.1	0.0	19.4	0.0	45.7	0.0
Subtotal	***494.6***	***298.8***	***828.4***	***497.1***	***123.7***	***95.5***	***7.9***	***6.5***	***5.0***	***2.6***	***2.9***	***2.8***	***533.9***	***321.2***	***1,996.5***	***1,224.4***
Pipeline 2																
Pipeline 2 ROW	0.0	0.0	1,256.8	767.7	131.6	106.8	7.9	6.5	4.3	2.5	2.7	2.7	514.5	321.2	1,918.0	1,207.4

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	20.1	0.0	5.6	0.0	<0.1	0.0	0.6	0.0	0.1	0.0	19.4	0.0	45.7	0.0
Subtotal	***0.0***	***0.0***	***1,276.9***	***767.7***	***137.2***	***106.8***	***7.9***	***6.5***	***4.9***	***2.5***	***2.8***	***2.7***	***533.9***	***321.2***	***1,963.6***	***1,207.4***
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	73.3	4.8	8.3	0.0	0.1	0.0	1.6	0.0	14.9	0.1	0.5	0.0	100.3	5.5
Subtotal	2.0	0.8	74.0	5.4	8.3	0.0	***0.1***	***<0.1***	6.3	4.7	18.0	1.6	0.5	0.0	109.1	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[b]																
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[c]	**555.9**	**349.8**	**1,097.2**	**544.8**	**132.0**	**95.5**	**8.0**	**6.5**	**11.5**	**7.5**	**20.9**	**4.4**	**670.4**	**321.6**	**2,495.9**	**1,330.1**
Pipeline 2 Total[d]	**0.0**	**0.0**	**1,599.2**	**858.8**	**145.5**	**106.8**	**8.0**	**6.5**	**6.7**	**2.7**	**17.7**	**2.8**	**670.4**	**321.6**	**2,447.4**	**1,299.1**
Pipelines 1 and 2[e]	**527.0**	**332.1**	**1,085.7**	**537.9**	**132.0**	**95.5**	**8.0**	**6.5**	**6.7**	**2.7**	**17.7**	**2.8**	**670.4**	**321.6**	**2,447.4**	**1,299.1**
Pipeline System Total[e]	**555.9**	**349.8**	**1,097.2**	**544.8**	**132.0**	**95.5**	**8.0**	**6.5**	**11.5**	**7.5**	**20.9**	**4.4**	**670.4**	**321.6**	**2,495.9**	**1,330.1**
Rio Grande LNG Project Total[e]	**764.8**	**558.7**	**1,307.6**	**736.3**	**294.5**	**258.0**	**182.8**	**181.2**	**392.1**	**88.9**	**21.1**	**4.4**	**670.4**	**321.6**	**3,633.2**	**2,149.2**

[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] 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.

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

[d] All impacts associated with construction of Pipeline 2, including right-of-way, ATWS, contractor/pipe yards, access roads, and aboveground facilities, which were previously disturbed during construction of Pipeline 1 (acreages associated with the Header System and its components are excluded). 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.

[e] 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.

- Industrial/Commercial – includes impervious surfaces such as roads and industrial facilities; and
- Agricultural – includes active or rotated cropland.

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 MPs 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 (44.0 percent), shrub/forest land (22.3 percent), agricultural land (26.9 percent), and non-forested wetlands (5.3 percent); the remaining 1.6 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 3,633.2 acres of land over a 7-year construction period. Of this, 2,149.2 acres would be permanently affected by operation of the Project, and 1,484.0 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 may access the Port Isabel dredge pile (293.4 acres of barren land) to obtain fill materials, and would use two offsite storage/parking areas to support construction activities. 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.

<u>Shrub/Forest Land</u>

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.

<u>Open Land</u>

Construction of the LNG Terminal would affect 210.4 acres of open land, of which 18.9 acres are associated with the offsite support facilities. 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.

<u>Non-forested Wetlands</u>

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.

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 two storage/parking areas and bulk water loading area, contain, 5.7 and less than 0.1 acre, respectively, of barren land. The Port Isabel dredge pile (293.4 acres) may be used to obtain spoil for leveling and build-up of the LNG Terminal site as described in section 2.5.1.4. Following construction, 299.2 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. 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 (MPs 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 (MPs 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 1,996.5 acres of land, consisting of 828.4 acres of open land, 533.9 acres of agricultural land, 494.6 acres of shrub/forest land (including 9.9 acres of forested wetlands), 123.7 acres of non-forested wetlands, 7.9 acres of open water, 5.0 acres of barren land, and 2.9 acres of industrial/commercial land. Following construction, 497.1 acres of open land, 321.2 acres of agricultural land, 298.8 of shrub/forest land, 95.5 acres of non-forest wetlands, 6.5 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 9.9 acres of forested wetlands would be within the permanent right-of-way and would be permanently maintained in an herbaceous state. The remaining 772.1 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. All proposed ATWSs are identified in appendix O.

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 1,224.4 acres during operation (17.0 acres for the Header System and 1,207.4 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 66.0 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 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 pipeline 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 fencelines 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 109.1 acres, including 74.0 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 96.5 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 [NSA] 1 in proximity to Booster Station 2 is discussed in section 4.11.2).

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.

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.

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 MPs 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 MPs 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 pre-construction 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,