

TABLE OF CONTENTS

Creole Trail LNG Terminal and Pipeline Project Draft Environmental Impact Statement

	<u>Page</u>
TABLE OF CONTENTS.....	i
LIST OF APPENDICES	vii
LIST OF TABLES	viii
LIST OF FIGURES	xi
ACRONYMS AND ABBREVIATIONS	xii
EXECUTIVE SUMMARY	ES-1
PROJECT IMPACTS	ES-2
ALTERNATIVES CONSIDERED	ES-9
PUBLIC INVOLVEMENT AND AREAS OF CONCERN	ES-10
MAJOR CONCLUSION	ES-11
1.0 INTRODUCTION	1-1
1.1 PROJECT PURPOSE AND NEED	1-2
1.2 PURPOSE AND SCOPE OF THIS STATEMENT	1-3
1.3 PERMITS, APPROVALS, AND REGULATORY REQUIREMENTS	1-3
1.4 PUBLIC REVIEW AND COMMENT	1-5
1.5 NONJURISDICTIONAL FACILITIES	1-9
2.0 DESCRIPTION OF THE PROPOSED ACTION	2-1
2.1 PROPOSED FACILITIES.....	2-1
2.1.1 LNG Terminal.....	2-1
2.1.1.1 Marine and Unloading Facilities	2-4
2.1.1.2 LNG Storage Tanks	2-5
2.1.1.3 Vaporization System	2-7
2.1.1.4 Vapor Handling System	2-7
2.1.1.5 Utilities	2-8
2.1.1.6 Buildings	2-8
2.1.1.7 Stormwater Handling and Pollution Prevention.....	2-9
2.1.2 LNG Ships	2-9
2.1.3 Pipelines.....	2-13
2.1.4 Aboveground Facilities.....	2-13
2.2 LAND REQUIREMENTS	2-15
2.2.1 LNG Terminal Facilities	2-16
2.2.2 Pipeline and Associated Aboveground Facilities	2-16
2.3 CONSTRUCTION PROCEDURES.....	2-23
2.3.1 LNG Terminal Facilities	2-24
2.3.1.1 Site Preparation	2-24
2.3.1.2 Site Fill	2-24
2.3.1.3 Marine Facilities	2-25
2.3.1.4 LNG Storage Facilities	2-26
2.3.2 Pipelines and Associated Aboveground Facilities	2-30
2.3.2.1 General Pipeline Construction Techniques	2-31

TABLE OF CONTENTS (cont'd)

2.3.2.2	Special Pipeline Construction Techniques	2-35
2.3.2.3	Aboveground Facilities	2-41
2.4	CONSTRUCTION SCHEDULE.....	2-41
2.5	ENVIRONMENTAL COMPLIANCE, INSPECTION, AND MITIGATION MONITORING.....	2-41
2.6	OPERATION AND MAINTENANCE PROCEDURES.....	2-42
2.6.1	LNG Terminal Facilities	2-42
2.6.2	LNG Ships	2-44
2.6.3	Pipeline and Associated Aboveground Facilities	2-44
2.7	SAFETY CONTROLS	2-44
2.7.1	LNG Terminal Facilities	2-44
2.7.1.1	Spill Containment.....	2-45
2.7.1.2	Hazard Detection System	2-46
2.7.1.3	Fire Protection System	2-46
2.7.1.4	Fail-Safe Shutdown	2-47
2.7.1.5	Security System.....	2-48
2.7.2	Pipeline and Associated Aboveground Facilities	2-48
2.7.2.1	Corrosion Protection and Detection System.....	2-48
2.7.2.2	Emergency Response Procedures	2-48
2.8	FUTURE PLANS AND ABANDONMENT	2-49
2.8.1	LNG Terminal.....	2-49
2.8.2	Pipeline Facilities.....	2-49
3.0	ALTERNATIVES.....	3-1
3.1	NO ACTION OR POSTPONED ACTION ALTERNATIVE	3-1
3.1.1	Energy Source Alternatives	3-2
3.1.2	Energy Conservation Alternatives	3-3
3.2	SYSTEM ALTERNATIVES.....	3-4
3.2.1	Use of Other Existing, Approved, or Proposed Onshore LNG Terminals.....	3-7
3.2.1.1	Cameron LNG Terminal.....	3-7
3.2.1.2	Sabine Pass LNG Terminal	3-8
3.2.1.3	Golden Pass LNG Terminal	3-8
3.2.1.4	Freeport LNG Terminal.....	3-8
3.2.1.5	Cheniere Corpus Christi LNG Terminal	3-9
3.2.1.6	Vista del Sol LNG Terminal.....	3-9
3.2.1.7	Ingleside Energy Center LNG Terminal	3-9
3.2.1.8	Proposed Onshore LNG Terminals under Review	3-10
3.2.2	Use of Approved or Proposed Offshore LNG Terminals	3-10
3.2.2.1	Gravity Based Structures	3-11
3.2.2.2	Reuse of Existing Oil/Gas/Mining Platforms	3-12
3.2.2.3	LNG Regasification Vessels.....	3-12
3.2.2.4	Floating, Storage, and Regasification Unit (FSRU)	3-13
3.2.2.5	Discussion of Offshore Alternatives.....	3-13
3.2.2.6	Conclusions on Offshore Technology	3-15
3.3	ONSHORE LNG TERMINAL SITE ALTERNATIVES	3-15
3.3.1	Regional Selection	3-15
3.3.2	Port Selection.....	3-16
3.3.3	Site Selection	3-17
3.3.4	Conclusions Regarding Onshore Location Alternatives	3-21

TABLE OF CONTENTS (cont'd)

3.4	FACILITY LAYOUT ALTERNATIVES	3-22
3.5	DREDGED MATERIAL PLACEMENT AREA ALTERNATIVES	3-22
3.6	PIPELINE ALTERNATIVES	3-25
	3.6.1 System Alternatives	3-25
	3.6.1.1 Use of Existing Pipeline Systems.....	3-25
	3.6.1.2 Use of Approved or Proposed Pipeline Systems	3-26
	3.6.2 Route Alternatives	3-26
	3.6.2.1 Segment 2 Route Alternatives	3-27
	3.6.2.2 Segment 3 Route Alternatives	3-34
	3.6.2.3 Hackberry Lateral Route Alternatives.....	3-42
	3.6.3 Route Variations	3-45
4.0	ENVIRONMENTAL ANALYSIS	4-1
4.1	GEOLOGIC RESOURCES	4-4
	4.1.1 Geologic Setting	4-4
	4.1.2 Mineral Resources	4-5
	4.1.3 Geologic Hazards.....	4-9
	4.1.3.1 Seismicity	4-9
	4.1.3.2 Faulting.....	4-10
	4.1.3.3 Soil Liquefaction	4-11
	4.1.3.4 Subsidence.....	4-11
	4.1.3.5 Flooding.....	4-12
	4.1.3.6 Shoreline Erosion	4-13
	4.1.3.7 Slope Stability and Load-Bearing Capacity	4-14
	4.1.3.8 Biogenic Gas	4-15
	4.1.4 Paleontological Resources	4-16
4.2	SOILS	4-16
	4.2.1 Soil Resources.....	4-17
	4.2.1.1 Soil Characteristics	4-19
	4.2.1.2 Prime Farmland	4-20
	4.2.1.3 Hydric Soils	4-20
	4.2.1.4 Compaction Potential	4-21
	4.2.1.5 Erosion.....	4-21
	4.2.1.6 Revegetation	4-22
	4.2.1.7 Soil Contamination.....	4-22
	4.2.1.8 Aboveground Facilities	4-23
	4.2.2 Subsurface Sediments	4-23
4.3	WATER RESOURCES	4-26
	4.3.1 Groundwater	4-26
	4.3.1.1 Hydrogeologic Setting.....	4-26
	4.3.1.2 Water Wells and Springs	4-27
	4.3.1.3 Potential Effects of Project Construction	4-29
	4.3.1.4 Project Groundwater Requirements.....	4-30
	4.3.1.5 Contaminated Groundwater.....	4-31
	4.3.2 Surface Water	4-31
	4.3.2.1 Construction Impacts.....	4-32
	4.3.2.2 Hydrostatic Testing	4-39
	4.3.2.3 Operational Impacts.....	4-41
4.4	WETLANDS	4-43

TABLE OF CONTENTS (cont'd)

4.4.1	Affected Wetlands	4-43
4.4.1.1	LNG Terminal	4-45
4.4.1.2	Pipeline	4-45
4.4.2	Wetland Construction Procedures.....	4-47
4.4.3	Aquatic Resources Mitigation Plan	4-56
4.5	VEGETATION	4-59
4.5.1	Habitat/Community Types.....	4-59
4.5.1.1	LNG Terminal	4-60
4.5.1.2	Pipeline	4-61
4.5.2	Vegetative Communities of Special Concern	4-62
4.5.3	Invasive Plant Species	4-62
4.6	WILDLIFE AND AQUATIC RESOURCES	4-63
4.6.1	Terrestrial Wildlife Resources	4-63
4.6.1.1	Potential Project Impacts on Terrestrial Wildlife	4-67
4.6.1.2	Unique or Sensitive Wildlife Habitats.....	4-68
4.6.2	Aquatic Resources	4-69
4.6.2.1	Fish and Invertebrates.....	4-69
4.6.2.2	Commercial and Recreational Fisheries	4-71
4.6.2.3	Construction Impacts on Aquatic Resources.....	4-73
4.6.2.4	Hydrostatic Testing	4-77
4.6.2.5	Spills	4-77
4.6.2.6	Operational Impacts on Aquatic Resources.....	4-77
4.6.3	Essential Fish Habitat	4-79
4.6.3.1	Federally Managed Species	4-80
4.6.3.2	Potential Construction Effects on EFH	4-85
4.6.3.3	Potential Operational Impacts on EFH.....	4-90
4.7	THREATENED AND ENDANGERED SPECIES.....	4-92
4.7.1	Federally Listed Threatened and Endangered Species	4-92
4.7.1.1	Marine Mammals and Sea Turtles.....	4-93
4.7.1.2	Birds	4-101
4.7.1.3	Fish	4-103
4.7.1.4	Plants	4-103
4.7.1.5	DMPA Alternatives	4-104
4.7.2	State-Listed Species	4-104
4.7.3	Conclusions and Recommendations	4-105
4.8	LAND USE, RECREATION, AND VISUAL RESOURCES	4-105
4.8.1	Land Use	4-106
4.8.1.1	LNG Terminal	4-107
4.8.1.2	Pipelines	4-108
4.8.2	Residences and Planned Residential Development	4-117
4.8.2.1	LNG Terminal	4-118
4.8.2.2	Pipelines	4-118
4.8.3	Public Interest and Recreation Areas	4-120
4.8.3.1	Creole Nature Trail National Scenic Byway	4-121
4.8.3.2	Cameron National Wildlife Refuge	4-121
4.8.3.3	Crown Point Distinctive Site	4-122
4.8.3.4	Louisiana Great Gulf Coast Birding Trail	4-122
4.8.3.5	Barnes Creek Savannah Natural Area	4-122
4.8.3.6	Natural and Scenic Rivers	4-123

TABLE OF CONTENTS (cont'd)

4.8.3.7	Zydeco Cajun Prairie Scenic Byway	4-123
4.8.3.8	Other Special Interest Areas	4-123
4.8.4	Commerical and Recreational Fishing.....	4-123
4.8.5	Visual Resources.....	4-124
4.8.6	Coastal Zone Management	4-125
4.8.7	Hazardous Waste Sites.....	4-126
4.9	SOCIOECONOMIC RESOURCES	4-126
4.9.1	Population	4-127
4.9.2	Employment and Economy.....	4-128
4.9.3	Housing.....	4-130
4.9.4	Infrastructure and Public Services	4-132
4.9.5	Transportation and Traffic	4-133
4.9.6	Tax Revenues.....	4-137
4.10	CULTURAL RESOURCES	4-137
4.10.1	Results of Cultural Resources Survey.....	4-138
4.10.2	Consultation with Louisiana State Historic Preservation Officer.....	4-139
4.10.3	Unanticipated Discovery Plan	4-139
4.10.4	Native American Consultation.....	4-140
4.10.5	General Impact and Mitigation	4-140
4.11	AIR QUALITY AND NOISE	4-141
4.11.1	Air Quality	4-141
4.11.1.1	Regional Climate	4-141
4.11.1.2	Existing Air Quality	4-141
4.11.1.3	Regulatory Requirements for Air Quality	4-143
4.11.1.4	Air Quality Impacts and Mitigation.....	4-148
4.11.1.5	Alternative LNG Vaporization Technologies.....	4-152
4.11.2	Noise	4-153
4.11.2.1	Noise Regulations.....	4-153
4.11.2.2	Existing Noise Levels.....	4-154
4.11.2.3	Noise Impacts and Mitigation.....	4-157
4.12	RELIABILITY AND SAFETY	4-164
4.12.1	LNG Hazards	4-165
4.12.2	Cryogenic Design and Technical Review	4-166
4.12.3	Storage and Retention Systems.....	4-172
4.12.4	Siting Requirements – Thermal and Dispersion Exclusion Zones	4-177
4.12.4.1	Regulatory Requirements	4-177
4.12.4.2	Impoundment Systems and Design Spills	4-179
4.12.5	Marine Safety.....	4-182
4.12.5.1	Calcasieu Ship Channel	4-189
4.12.5.2	Requirements for LNG Ship Operations	4-193
4.12.5.3	LNG Ship Safety	4-196
4.12.5.4	Conclusions on Marine Traffic Safety.....	4-202
4.12.6	Terrorism and Security Issues.....	4-202
4.12.7	Pipeline Facilities.....	4-204
4.12.7.1	Safety Standards	4-204
4.12.7.2	Pipeline Accident Data	4-207
4.12.7.3	Impact on Public Safety.....	4-210
4.12.8	Conclusions on Safety Issues.....	4-210
4.13	CUMULATIVE IMPACTS	4-212

TABLE OF CONTENTS (cont'd)

4.13.1	Water Resources	4-217
4.13.2	Wetlands	4-219
4.13.3	Biological Resources	4-220
4.13.4	Land Use, Recreation, and Visual Resources	4-222
4.13.5	Socioeconomics	4-223
4.13.5.1	Employment and Housing	4-223
4.13.5.2	Vehicular Traffic	4-224
4.13.5.3	Infrastructure and Public Services	4-224
4.13.5.4	LNG Ship Traffic	4-224
4.13.6	Shoreline Erosion.....	4-225
4.13.7	DMPAs	4-225
4.13.8	Air Quality and Noise	4-226
5.0	CONCLUSIONS AND RECOMMENDATIONS	5-1
5.1	SUMMARY OF THE STAFF'S ENVIRONMENTAL ANALYSIS	5-1
5.1.1	Infrastructure Facilities	5-1
5.1.2	Geology.....	5-1
5.1.3	Soils and Sediments	5-2
5.1.4	Water Resources	5-3
5.1.5	Wetlands	5-5
5.1.6	Vegetation.....	5-6
5.1.7	Wildlife and Aquatic Resources	5-6
5.1.8	Threatened and Endangered Species	5-9
5.1.9	Land Use, Recreation, and Visual Resources	5-9
5.1.10	Socioeconomics	5-11
5.1.11	Cultural Resources.....	5-11
5.1.12	Air Quality and Noise	5-12
5.1.13	Alternatives.....	5-13
5.1.14	Reliability and Safety.....	5-14
5.1.15	Cumulative Impacts	5-15
5.2	FERC STAFF'S RECOMMENDED MITIGATION.....	5-15

TABLE OF CONTENTS (cont'd)

APPENDIX A	DRAFT ENVIRONMENTAL IMPACT STATEMENT DISTRIBUTION LIST
APPENDIX B	FACILITY LOCATION MAPS
APPENDIX C	WATERBODIES CROSSED BY THE CREOLE TRAIL PIPELINE
APPENDIX D	WETLANDS AFFECTED BY CONSTRUCTION AND OPERATION OF THE PROPOSED CREOLE TRAIL PIPELINE FACILITIES
APPENDIX E	DRAFT AQUATIC RESOURCES MITIGATION PLAN
APPENDIX F	OYSTER ASSESSMENT AND SUBSTRATE CHARACTERIZATION FOR THE PROPOSED CHENIERE CREOLE TRAIL PIPELINE LOCATED IN CALCASIEU LAKE IN CAMERON PARISH, LOUISIANA
APPENDIX G	ESSENTIAL FISH HABITAT REPORTS: CREOLE TRAIL LNG TERMINAL AND CHENIERE CREOLE TRAIL PIPELINE PROJECT
APPENDIX H	VESSEL STRIKE AVOIDANCE AND INJURED/DEAD PROTECTED SPECIES REPORTING
APPENDIX I	LAND USE OF TEMPORARY WORKSPACES LOCATED ALONG THE PROPOSED CREOLE TRAIL PIPELINE
APPENDIX J	REFERENCES AND CONTACTS
APPENDIX K	LIST OF PREPARERS

TABLES

<u>Number</u>	<u>Title</u>	<u>Page</u>
1.3-1	Major Permits, Approvals, and Consultations for the Creole Trail Project.....	1-6
1.4-1	Issues Identified During the Public Scoping Process for the Creole Trail LNG Project.....	1-8
2.1.2-1	Typical LNG Ship Characteristics.....	2-12
2.1.4-1	Aboveground Facilities Associated with the Creole Trail Project	2-14
2.2-1	Summary of Land Requirements Associated with the Creole Trail Pipeline Facilities	2-15
2.3.2-1	Pipeline Construction Spreads.....	2-30
2.7.1-1	Federal Siting and Design Requirements for LNG Facilities	2-45
3.1.1-1	Estimated Air Emissions by Fossil Fuel Type for Electric Power Generation.....	3-2
3.2-1	Recently Approved and Proposed LNG Import Terminals in the Gulf of Mexico	3-6
3.3.3-1	Potential Alternative LNG Sites Within the Selected Port Regions.....	3-17
3.6.2-1	Environmental Comparison of Alternative 1 and the Proposed Creole Trail Pipeline Route	3-27
3.6.2-2	Environmental Comparison of Alternative 2 and the Proposed Creole Trail Pipeline Route	3-29
3.6.2-3	Environmental Comparison of Alternative 3 and the Proposed Creole Trail Pipeline Route	3-31
3.6.2-4	Environmental Comparison of Alternative 4 and the Proposed Creole Trail Pipeline Route	3-32
3.6.2-5	Environmental Comparison of Alternative 5 and the Proposed Creole Trail Pipeline Route	3-34
3.6.2-6	Environmental Comparison of Alternative 6 and the Proposed Creole Trail Pipeline Route	3-35
3.6.2-7	Environmental Comparison of Alternative 7 and the Proposed Creole Trail Pipeline Route	3-37
3.6.2-8	Environmental Comparison of Alternative 8 and the Proposed Creole Trail Pipeline Route	3-40
3.6.2-9	Environmental Comparison of Hackberry Alternatives 1 and 2 and the Proposed Hackberry Lateral Route	3-44
3.6.3-1	Proposed Creole Trail Pipeline Route Variations	3-47
4.1.2-1	Oil and Gas Wells Within 0.25 Mile of the Proposed Creole Trail LNG Terminal Property.....	4-6
4.1.2-2	Oil and Gas Wells Within 150 feet of the Proposed Creole Trail Pipelines.....	4-8
4.2.1-1	Acreage of Soil Characteristics Affected by the Creole Trail Pipeline Right-of-Way	4-19
4.3.2-1	Waterbodies Proposed to be Crossed Using the Horizontal Directional Drill Method Along the Creole Trail Pipeline	4-36
4.3.2-2	Hydrostatic Test Water Sources and Potential Discharge Locations for the Creole Trail Pipelines.....	4-41
4.4-1	Common Wetland Species Identified in Delineations within the Creole Trail Project Area.....	4-44
4.4.1-1	Wetlands Affected by Construction and Operation of the Proposed Creole Trail LNG Terminal	4-45
4.4.1-2	Wetlands Affected by Construction and Operation of the Proposed Creole Trail Pipeline	4-46
4.4.2-1	Approval or Denial of Requested Variances from FERC Procedures.....	4-49
4.4.2-2	Additional Temporary Work Spaces Proposed to be In or Within 50 Feet of Wetlands	4-51
4.6.1-1	Habitats and Typical Non-Fish Wildlife Species Found within the Project Area.....	4-64

TABLES (cont'd)

Number	Title	Page
4.6.2-1	Representative Game and Commercial Aquatic Species Known to Occur in Creole Trail Project Area	4-71
4.6.3-1	Invertebrate and Fish Species Managed by the Gulf of Mexico Fishery Management Council for which Essential Fish Habitat has been Identified.....	4-80
4.6.3-2	Summary of EFH Categories Potentially Used by Specific Life Stages of Federally Managed Fish Species	4-81
4.6.3-3	Relative Abundance of EFH Designated Species within the Project Area	4-81
4.6.3-4	EFH Affected by Construction and Operation of the Proposed Creole Trail LNG Terminal	4-85
4.6.3-5	Potential EFH Affected by Construction and Operation of the Proposed Creole Trail Pipelines.....	4-88
4.7-1	Federally Listed Endangered or Threatened Species Potentially Occurring in the Project Area	4-94
4.8.1-1	Land Use Affected by Construction and Operation of the Proposed Creole Trail Project.....	4-106
4.8.1-2	Land Use Affected by Construction and Operation of the Proposed Creole Trail Pipelines.....	4-109
4.8.1-3	Existing Rights-of-Way Paralleled by the Proposed Creole Trail Pipeline Route	4-111
4.8.1-4	Acres of Land Affected by Construction and Operation of the Aboveground Facilities and Wareyards of the Proposed Creole Trail Pipelines	4-112
4.8.1-5	Access Roads Required for the Proposed Creole Trail Project	4-114
4.8.2-1	Structures Within 50 feet of the Proposed Creole Trail Pipeline Construction Work Areas	4-119
4.8.3-1	Recreational and Public Interest Areas Within 0.25 mile of the Proposed Creole Trail Project.....	4-121
4.8.7-1	Hazardous Waste Sites Within 0.25 Mile of Segment 3 of the Proposed Creole Trail Pipeline	4-126
4.9.1-1	Population Conditions in the Vicinity of the Proposed Creole Trail Project	4-127
4.9.2-1	Employment Conditions in the Vicinity of the Proposed Creole Trail Project	4-129
4.9.3-1	General Housing Conditions in the Vicinity of the Proposed Creole Trail Project.....	4-130
4.9.3-2	Unoccupied Housing Characteristics in the Vicinity of the Creole Trail Project.....	4-131
4.11.1-1	National Ambient Air Quality Standards and Local Background Data for the Project Area	4-142
4.11.1-2	Estimated Emissions by Year from LNG Terminal and Pipeline Construction	4-150
4.11.1-3	Estimated Stationary Source and Marine Vessel Emissions for Operation of the Creole Trail LNG Terminal.....	4-151
4.11.2-1	Measured Daytime and Nighttime Noise Levels at Nearest NSA.....	4-155
4.11.2-2	Noise Sensitive Areas Near Proposed Meter Facilities	4-155
4.11.2-3	Estimated Construction Equipment Noise.....	4-157
4.11.2-4	Predicted L _{dn} Noise Levels at Nearest Noise Sensitive Areas During HDD Operations ...	4-160
4.11.2-5	Equipment Quantities and Sound Power Levels Used in Noise Modeling	4-163
4.11.2-6	Predicted L _{dn} Noise Levels at Nearest Noise Sensitive Areas Associated with the LNG Terminal	4-163
4.12.4-1	Impoundment Areas	4-180
4.12.4-2	Thermal Exclusion Zones.....	4-181
4.12.5-3	Minimum Striking Speed to Penetrate LNG Cargo Tanks.....	4-198
4.12.5-4	LNG Spills on Water	4-201

TABLE OF CONTENTS (cont'd)

4.12.7-1	Natural Gas Service Incidents by Cause	4-208
4.12.7-2	Outside Forces Incidents by Cause (1970-1984).....	4-209
4.12.7-3	External Corrosion by Level of Control (1970-1984).....	4-209
4.12.7-4	Annual Average Fatalities - Natural Gas Transmission and Gathering Systems	4-210
4.12.7-5	Nationwide Accidental Deaths	4-211
4.13-1	Existing, Approved, or Proposed Activities that Could Contribute to Cumulative Impacts Associated with Construction of the Creole Trail Project	4-213
4.13-2	Resources of Concern that Could be Affected by Construction or Development of Existing, Approved, or Proposed Projects or Activities in the Vicinity of the Creole Trail Project.....	4-214
4.13-3	Environmental Resources That Would Be Cumulatively Affected During Construction and Operation of Projects in the Vicinity of the Proposed Creole Trail Project.....	4-218

FIGURES

<u>Number</u>	<u>Title</u>	<u>Page</u>
2.1-1	General Project Location.....	2-2
2.1.1-1	Proposed LNG Terminal Site Plan	2-3
2.1.1-2	Conceptual design of LNG storage tank	2-6
2.2.2-1	Right-of-Way Configurations for Segments 2 and 3.....	2-17
2.2.2-2	Right-of-Way Configurations for Hackberry Lateral.....	2-21
2.3.1-1	LNG Storage Tank Construction Sequence, 1 of 2	2-28
2.3.2-1	Typical pipeline construction sequence.....	2-32
2.3.2-2	Right-of-Way Cross Section – Calcasieu Lake Construction	2-38
3.2-1	Existing, Approved, and Proposed LNG Terminals in the Gulf of Mexico	3-5
3.5-1	Dredged Material Placement Area Alternatives.....	3-24
3.6.2-1	Segment 2 Route Alternatives 1 - 5.....	3-28
3.6.2-2	Segment 3 Route Alternative 6	3-36
3.6.2-3	Segment 3 Route Alternative 7	3-38
3.6.2-4	Segment 3 Route Alternative 8	3-41
3.6.2-5	Hackberry Lateral Alternatives 1 and 2.....	3-43
4-1	Land Use Along The Calcasieu Ship Channel	4-2
4.2.2-1	Sediment Sampling Sites.....	4-25
4.11.2-1	Approximate Noise Sensitive Areas Direction and Distance	4-156
H.1	Examples of Single Containment Tanks	4-174
H.3	Examples of Double Containment Tanks.....	4-175
H.4	Examples of Full Containment Tanks	4-176
4.13-1	Reasonably Foreseeable Projects in the Cumulative Impact Analysis Area	4-216

ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
µg/m ³	micrograms per cubic meter
ABSG	ABSG Consulting Inc.
ACHP	Advisory Council on Historic Preservation
ANR	ANR Pipeline Company
API	American Petroleum Institute
AQCRs	Air quality control regions
ARMP	Aquatic Resources Mitigation Plan
ASCE	American Society of Civil Engineers
ATWS	additional temporary work space
BACT	best available control technology
Bcf/d	billion cubic feet per day
BIA	Bureau of Indian Affairs
BOG	boil-off gas
BTS	Bureau of Transportation Statistics
Btu	British thermal unit
CAA	Clean Air Act
CAAA	1990 Clean Air Act Amendments
CEII	critical energy infrastructure information
CEQ	Council on Environmental Quality
Certificate	Certificate of Public Convenience and Necessity
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CMMS	computerized maintenance management system
CO	carbon monoxide
CO ₂	carbon dioxide
Coast Guard	U.S. Coast Guard
COE	U.S. Army Corps of Engineers
Commission	Federal Energy Regulatory Commission
Cove Point	Cove Point LNG, L.P.
Creole Trail	Creole Trail LNG, L.P. and Cheniere Creole Trail Pipeline Company
Creole Trail Project	Creole Trail LNG Terminal and Pipeline Project
CWA	Clean Water Act
CZMA	Coastal Zone Management Act of 1972
CZMP	Coastal Zone Management Program
dBA	decibels on the A-weighted scale
Distrigas	Distrigas of Massachusetts
DMPA	dredged material placement area
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EFH	essential fish habitat
EI	Environmental Inspectors
EIA	U.S. Department of Energy, Energy Information Administration
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
Excelerate	Excelerate Energy, L.L.C.
FEMA	Federal Emergency Management Agency

ACRONYMS AND ABBREVIATIONS (cont'd)

FERC	Federal Energy Regulatory Commission
FPC	Federal Power Commission
FSO	Facility Security Officer
FSRU	Floating, storage, and regasification units
FWS	U.S. Fish and Wildlife Service
g	gravity
Gas Tanker	<i>International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk</i>
Code	
GBS	gravity based structure
GEP	good engineering practice
gpm	gallons per minute
HAP	hazardous air pollutant
HCAs	high consequence areas
HDD	horizontal directional drill
HEL	highly erodible land
hp	horsepower
INGAA	Interstate Natural Gas Association of America
km	kilometers
kPa	kilopascals
kV	kilovolt
LADEQ	Louisiana Department of Environmental Quality
LADNR	Louisiana Department of Natural Resources
LADOTD	Louisiana Department of Transportation and Development
LADWF	Louisiana Department of Wildlife and Fisheries
LAPDES	Louisiana Pollutant Discharge Elimination System
lb/kWh	pounds per kilowatt hour
lb/MMBtu	pound per MMBtu
L _{dn}	day-night sound level
L _{eq(24)}	24-hour equivalent sound level
LGS	Louisiana Geological Survey
LNG	liquefied natural gas
LOI	Letter of Intent
LOR	Letter of Recommendation
LSU	Louisiana State University
M&R	meter and regulation
m ³	cubic meters
MACT	Maximum Achievable Control Technology
MAOP	maximum allowable operating pressure
MARAD	Maritime Administration of the DOT
MARSEC	Homeland Security and Coast Guard Marine Security
Memorandum	Memorandum of Understanding on Natural Gas Transportation Facilities
MLG	Mean Low Gulf
MLRAs	Major Land Resource Areas
MLV	mainline valve
MMcfd	million cubic feet per day
MMI	Modified Mercalli Intensity
MP	milepost
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSO	Marine Safety Office

ACRONYMS AND ABBREVIATIONS (cont'd)

MSU	Marine Safety Unit
NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NGA	Natural Gas Act
NGS	National Geodetic Survey
NGVD29	National Geodetic Vertical Datum of 1929
NHPA	National Historic Preservation Act
NO ₂	nitrogen dioxide
NOAA Fisheries	U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NOI	Notice of Intent to Prepare an Environmental Impact Statement for the Proposed Creole Trail LNG and Pipeline Project, Request for Comments on Environmental Issues, and Notice of Public Scoping Meetings
NO _x	nitrogen oxides
NPC	National Petroleum Council
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	noise sensitive area
NSPS	New Source Performance Standards
NSR	New Source Review
NVIC 05-05	<i>Navigation and Vessel Inspection Circular – Guidance on Assessing the Suitability of a Waterway for Liquefied Natural Gas (LNG) Marine Traffic</i>
NWI	National Wetland Inventory
NWR	National Wildlife Refuges
O ₃	ozone
OBE	Operating Basis Earthquake
OCIMF	Oil Companies International Marine Forum
OPS	Office of Pipeline Safety
PAH	polycyclic aromatic hydrocarbons
Pb	lead
PERC	powered emergency release coupling
PGAs	peak ground accelerations
PHEL	potentially highly erodible land
PHMSA	Pipeline and Hazardous Materials Safety Administration
Plan	<i>Upland Erosion Control, Revegetation and Maintenance Plan</i>
PM ₁₀	particulate matter having an aerodynamic diameter of 10 microns or less
PM _{2.5}	particulate matter having an aerodynamic diameter of 2.5 microns or less
ppm	parts per million
Procedures	<i>Wetland and Waterbody Construction and Mitigation Procedures</i>
PSD	Prevention of Significant Deterioration
psig	pounds per square inch gauge
Quest	Quest Consultants, Inc.
RCRA	Resource Conservation and Recovery
RMP	risk management plan
RPT	rapid phase transition

ACRONYMS AND ABBREVIATIONS (cont'd)

Sandia Report	<i>Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water</i>
SCADA	Supervisory Control and Data Acquisition
SCV	submerged combustion vaporizers
Shiner Moseley	Shiner Moseley and Associates, Inc.
SHPO	State Historic Preservation Office
SIGTTO	Society of International Gas Tanker and Terminal Operators
SIS	Safety Instrumented System
SO ₂	sulfur dioxide
SOLAS	<i>International Convention for the Safety of Life at Sea</i>
SONRIS	Strategic Online Natural Resource Information System
Southern	Southern LNG Inc.
SPCC Plans	<i>Spill Prevention, Containment and Countermeasure Plans</i>
SPMS	special purpose monitoring stations
SSE	Safe Shutdown Earthquake
SSO	Ship Security Officer
STL	submerged turret loading
STV	Shell and Tube Vaporization
TCEQ	Texas Commission on Environmental Quality
TETCO	Texas Eastern Transmission Corporation
TGC	Trunkline Gas Pipeline Company
TNT	trinitrotoluene
tpy	tons per year
Transco	Transcontinental Gas Pipe Line Corporation
Trunkline	Trunkline LNG Company L.L.C.
USC	United States Code
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
Vessel	<i>Vessel Maneuvering Simulation Study for the Creole Trail LNG Terminal, Cameron, LA</i>
Maneuvering Study	
VOCs	volatile organic compounds
WEG	wind erodibility group
WSA	waterway suitability assessment
yd ³	cubic yards