

TABLE OF CONTENTS

VOLUME 1

	<u>Page</u>
ABSTRACT.....	i
EXECUTIVE SUMMARY	iii
TABLE OF CONTENTS.....	ix
LIST OF MAPS	xvii
LIST OF FIGURES	xix
LIST OF TABLES.....	xx
ABBREVIATIONS AND ACRONYMS	xxv
CHAPTER 1 — INTRODUCTION.....	1-1
1.1 PROJECT LOCATION, SETTING, AND HISTORY OF PRIOR DEVELOPMENT.....	1-1
1.2 OVERVIEW OF THE PROPOSED PROJECT	1-3
1.3 PURPOSE AND NEED FOR THE PROJECT	1-4
1.4 DECISIONS TO BE MADE.....	1-5
1.5 REGULATORY SETTING.....	1-5
1.5.1 Federal Permits, Authorizations, and Coordination.....	1-6
1.5.2 Wyoming BLM Mitigation Guidelines and Practices for Surface Disturbing and Disruptive Activities	1-9
1.5.3 Conformance with BLM Pinedale and Green River Resource Management Plans.....	1-9
1.5.4 State and Local Permits, Authorization, and Coordination.....	1-11
CHAPTER 2 — ALTERNATIVES.....	2-1
2.1 PUBLIC PARTICIPATION AND IDENTIFICATION OF KEY ISSUES	2-1
2.1.1 Public Scoping	2-1
2.1.2 Key Issues	2-2
2.2 DEVELOPMENT OF ALTERNATIVES	2-4
2.2.1 Summary of Alternatives Analyzed in the DEIS	2-4
2.2.2 Publication of the DEIS, Public Meetings, and Public Comments	2-6
2.2.3 Alternatives Considered and Eliminated from Detailed Study	2-7
2.2.3.1 DEIS Alternatives Not Carried Forward for Final Analysis.....	2-7
2.2.3.2 Other Alternatives Considered and Eliminated from Detailed Study...	2-8
2.3 ALTERNATIVES CARRIED FORWARD FOR FINAL ANALYSIS.....	2-9
2.3.1 Features Common to All Alternatives Carried Forward for Final Analysis	2-9
2.3.1.1 General Features	2-9
2.3.1.2 Conditions of Approval	2-10
2.3.2 Features Common to the Proposed Action, Alternative B, and the Preferred Alternative.....	2-11

	<u>Page</u>
2.4 ALTERNATIVES ANALYZED IN DETAIL	2-12
2.4.1 No Action Alternative – Reject Operators’ Proposal.....	2-12
2.4.2 Proposed Action.....	2-14
2.4.3 Alternative A – Maximize Mineral Resource Recovery.....	2-15
2.4.4 Alternative B – Minimize Surface Disturbance	2-16
2.4.5 BLM Preferred Alternative	2-18
2.4.5.1 Outcome-Based Performance Objectives	2-20
2.4.5.2 Required Operating Procedures and Best Management Practices	2-21
2.4.5.3 Site-Specific Conditions of Approval, Mitigation Monitoring, Surveying, and Best Management Practices.....	2-25
2.5 SUMMARY OF ENVIRONMENTAL IMPACTS	2-25
CHAPTER 3 — AFFECTED ENVIRONMENT.....	3-1
3.1 PHYSICAL RESOURCES	3-3
3.1.1 Climate	3-3
3.1.2 Air Quality	3-4
3.1.2.1 Concentrations	3-6
3.1.2.2 Visibility.....	3-6
3.1.2.3 Deposition	3-9
3.1.3 Topography	3-19
3.1.4 Geology.....	3-19
3.1.4.1 Mineral Resources	3-20
3.1.4.2 Geologic Hazards.....	3-26
3.1.4.3 Paleontological Resources	3-28
3.1.5 Soils.....	3-29
3.1.6 Water Resources	3-36
3.1.6.1 Surface Water	3-36
3.1.6.2 Groundwater	3-41
3.1.7 Noise and Odor	3-45
3.2 BIOLOGICAL RESOURCES	3-47
3.2.1 Vegetation	3-47
3.2.1.1 Plant Communities.....	3-47
3.2.1.2 Riparian and Wetland Areas	3-52
3.2.1.3 Noxious Non-Native, and Invasive Plant Species	3-53
3.2.2 Wildlife and Fisheries	3-53
3.2.2.1 Big Game/Other Mammals.....	3-53
3.2.2.2 Birds.....	3-57
3.2.2.3 Amphibians and Reptiles	3-66
3.2.2.4 Fisheries.....	3-66
3.2.3 Threatened, Endangered, Proposed, and Candidate Species and BLM Wyoming Sensitive Species.....	3-66
3.2.3.1 Black-footed Ferret.....	3-66
3.2.3.2 Bald Eagle.....	3-67
3.2.3.3 Colorado River Endangered Fish Species	3-68
3.2.3.4 Ute Ladies’ -Tresses	3-68
3.2.3.5 BLM Wyoming Sensitive Species.....	3-68
3.2.4 Wild Horses.....	3-71
3.3 CULTURAL AND HISTORICAL RESOURCES	3-71
3.3.1 Introduction.....	3-71

	<u>Page</u>
3.3.2	Site Types..... 3-73
3.3.3	Native American Sensitive Sites and Traditional Cultural Properties 3-74
3.3.4	Culture History Context and Chronology 3-74
3.3.5	Geomorphology 3-80
3.3.6	Discovered Sites..... 3-80
3.3.7	Highly Sensitive Archaeological Locales 3-81
3.3.7.1	Sand Draw/Bull Draw Divide..... 3-82
3.3.7.2	Sand Draw Playa Complex..... 3-82
3.3.7.3	Central Sand Draw..... 3-84
3.4	SOCIOECONOMICS 3-85
3.4.1	Study Area..... 3-85
3.4.2	Demography..... 3-86
3.4.2.1	Population Dynamics and Census Data 3-86
3.4.2.2	Income, Poverty, and Unemployment 3-88
3.4.2.3	Workforce Age, Gender, and Disabilities..... 3-92
3.4.3	Housing..... 3-92
3.4.3.1	Lincoln County 3-93
3.4.3.2	Sublette County 3-95
3.4.3.3	Sweetwater County..... 3-96
3.4.4	Social Traditions 3-98
3.4.5	Quality of Living..... 3-99
3.4.5.1	Crime 3-99
3.4.5.2	Infrastructure..... 3-100
3.4.5.3	Cost of Living and Inflation..... 3-102
3.4.5.4	Education 3-103
3.4.6	Wages and Personal Income 3-106
3.4.7	Industry and Economy 3-108
3.4.7.1	Overview..... 3-108
3.4.7.2	Wyoming Industry and Industry Employment 3-108
3.4.7.3	Industry Employment 3-108
3.4.7.4	Industry Earnings..... 3-112
3.4.8	Taxes and Revenues..... 3-114
3.4.9	Study Area Taxes and Revenues..... 3-121
3.4.9.1	Availability of Information..... 3-121
3.4.9.2	State Royalties 3-122
3.4.9.3	Ad Valorem Valuation and Taxes Levied 3-123
3.4.9.4	Sales, Use, and Lodging Tax Collections 3-123
3.4.10	Recreation Economics 3-123
3.4.10.1	Nonconsumptive Recreation..... 3-123
3.4.10.2	Hunting 3-123
3.4.10.3	Value of Recreational Use..... 3-125
3.4.11	Environmental Justice 3-128
3.5	LAND USE..... 3-128
3.5.1	Land Status/Prior Rights 3-128
3.5.2	Livestock/Grazing Management 3-128
3.5.3	Recreation 3-133
3.5.4	Transportation 3-136
3.6	VISUAL RESOURCES..... 3-136
3.7	HAZARDOUS MATERIALS 3-138

	<u>Page</u>
3.8 COMPENSATORY MITIGATION	3-138
CHAPTER 4 — ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES ... 4-1	
4.1 PHYSICAL RESOURCES	4-3
4.1.1 Climate	4-3
4.1.2 Air Quality	4-3
4.1.2.1 No Action Alternative.....	4-14
4.1.2.2 Proposed Action.....	4-15
4.1.2.3 Alternative A	4-16
4.1.2.4 Alternative B.....	4-17
4.1.2.5 BLM Preferred Alternative	4-19
4.1.2.6 Cumulative Impacts	4-20
4.1.2.7 Unavoidable Adverse Impacts	4-25
4.1.3 Topography	4-25
4.1.3.1 No Action Alternative.....	4-25
4.1.3.2 The Proposed Action	4-25
4.1.3.3 Alternative A	4-25
4.1.3.4 Alternative B.....	4-26
4.1.3.5 BLM Preferred Alternative.....	4-26
4.1.3.6 Cumulative Impacts	4-26
4.1.3.7 Unavoidable Adverse Impacts	4-27
4.1.4 Mineral Resources.....	4-27
4.1.4.1 No Action Alternative.....	4-28
4.1.4.2 The Proposed Action	4-28
4.1.4.3 Alternative A	4-28
4.1.4.4 Alternative B.....	4-28
4.1.4.5 BLM Preferred Alternative.....	4-29
4.1.4.6 Cumulative Impacts	4-29
4.1.4.7 Unavoidable Adverse Impacts	4-29
4.1.5 Geologic Hazards	4-29
4.1.6 Paleontological Resources	4-30
4.1.6.1 No Action Alternative.....	4-31
4.1.6.2 The Proposed Action	4-31
4.1.6.3 Alternative A	4-31
4.1.6.4 Alternative B.....	4-31
4.1.6.5 BLM Preferred Alternative.....	4-31
4.1.6.6 Cumulative Impacts	4-31
4.1.6.7 Unavoidable Adverse Impacts	4-32
4.1.7 Soils.....	4-32
4.1.7.1 No Action Alternative.....	4-34
4.1.7.2 The Proposed Action	4-34
4.1.7.3 Alternative A	4-37
4.1.7.4 Alternative B.....	4-37
4.1.7.5 BLM Preferred Alternative.....	4-37
4.1.7.6 Cumulative Impacts	4-38
4.1.7.7 Unavoidable Adverse Impacts	4-39
4.1.8 Surface Water and Groundwater	4-39
4.1.8.1 No Action Alternative.....	4-43
4.1.8.2 The Proposed Action	4-43

	<u>Page</u>
4.1.8.3	Alternative A 4-44
4.1.8.4	Alternative B..... 4-44
4.1.8.5	BLM Preferred Alternative..... 4-45
4.1.8.6	Cumulative Impacts 4-46
4.1.8.7	Unavoidable Adverse Impacts 4-47
4.1.9	Noise and Odor 4-47
4.1.9.1	No Action Alternative..... 4-48
4.1.9.2	The Proposed Action 4-49
4.1.9.3	Alternative A 4-49
4.1.9.4	Alternative B..... 4-49
4.1.9.5	BLM Preferred Alternative..... 4-49
4.1.9.6	Cumulative Impacts 4-50
4.1.9.7	Unavoidable Adverse Impacts 4-50
4.2	BIOLOGICAL RESOURCES 4-50
4.2.1	Vegetation 4-50
4.2.1.1	No Action Alternative..... 4-52
4.2.1.2	Proposed Action..... 4-52
4.2.1.3	Alternative A 4-53
4.2.1.4	Alternative B..... 4-53
4.2.1.5	BLM Preferred Alternative..... 4-53
4.2.1.6	Cumulative Impacts 4-54
4.2.1.7	Unavoidable Adverse Impacts 4-55
4.2.2	Wildlife and Fisheries 4-55
4.2.2.1	No Action Alternative..... 4-67
4.2.2.2	The Proposed Action 4-67
4.2.2.3	Alternative A 4-68
4.2.2.4	Alternative B..... 4-68
4.2.2.5	BLM Preferred Alternative..... 4-68
4.2.2.6	Cumulative Impacts 4-68
4.2.2.7	Unavoidable Adverse Impacts 4-72
4.2.3	Threatened, Endangered, Proposed, and Candidate and BLM Wyoming Sensitive Species..... 4-73
4.2.3.1	Threatened, Endangered, Proposed, and Candidate Species 4-73
4.2.3.2	BLM Wyoming Sensitive Species 4-74
4.2.3.3	No Action Alternative..... 4-75
4.2.3.4	The Proposed Action 4-76
4.2.3.5	Alternative A 4-76
4.2.3.6	Alternative B..... 4-76
4.2.3.7	BLM Preferred Alternative..... 4-76
4.2.3.8	Cumulative Impacts 4-77
4.2.3.9	Unavoidable Adverse Impacts 4-77
4.2.4	Wild Horses..... 4-77
4.2.4.1	No Action Alternative..... 4-78
4.2.4.2	The Proposed Action 4-78
4.2.4.3	Alternative A 4-78
4.2.4.4	Alternative B..... 4-79
4.2.4.5	BLM Preferred Alternative..... 4-79
4.2.4.7	Unavoidable Adverse Impacts 4-79

	<u>Page</u>
4.3 CULTURAL AND HISTORICAL RESOURCES	4-79
4.3.1 No Action Alternative	4-82
4.3.2 The Proposed Action	4-82
4.3.3 Alternative A	4-83
4.3.4 Alternative B	4-83
4.3.5 BLM Preferred Alternative	4-83
4.3.6 Cumulative Impacts	4-83
4.3.7 Unavoidable Adverse Impacts	4-84
4.4 SOCIOECONOMICS	4-84
4.4.1 No Action Alternative	4-92
4.4.2 Proposed Action	4-94
4.4.3 Alternative A	4-94
4.4.4 Alternative B	4-95
4.4.5 BLM Preferred Alternative	4-95
4.4.6 Cumulative Impacts	4-96
4.4.7 Unavoidable Adverse Impacts	4-96
4.4.8 Environmental Justice	4-97
4.5 LAND USE	4-97
4.5.1 Status/Ownership	4-98
4.5.1.1 No Action Alternative	4-99
4.5.1.2 The Proposed Action	4-99
4.5.1.3 Alternative A	4-99
4.5.1.4 Alternative B	4-99
4.5.1.5 BLM Preferred Alternative	4-99
4.5.1.6 Cumulative Impacts	4-100
4.5.1.7 Unavoidable Adverse Impacts	4-100
4.5.2 Livestock/Grazing Management	4-100
4.5.2.1 No Action Alternative	4-101
4.5.2.2 The Proposed Action	4-101
4.5.2.3 Alternative A	4-102
4.5.2.4 Alternative B	4-103
4.5.2.5 BLM Preferred Alternative	4-103
4.5.2.6 Cumulative Impacts	4-104
4.5.2.7 Unavoidable Adverse Impacts	4-104
4.5.3 Recreation	4-104
4.5.3.1 No Action Alternative	4-105
4.5.3.2 The Proposed Action	4-105
4.5.3.3 Alternative A	4-106
4.5.3.4 Alternative B	4-106
4.5.3.5 BLM Preferred Alternative	4-106
4.5.3.6 Cumulative Impacts	4-106
4.5.3.7 Unavoidable Adverse Impacts	4-107
4.5.4 Transportation	4-107
4.5.4.1 No Action Alternative	4-108
4.5.4.2 The Proposed Action	4-108
4.5.4.3 Alternative A	4-109
4.5.4.4 Alternative B	4-109
4.5.4.5 BLM Preferred Alternative	4-109
4.5.4.6 Cumulative Impacts	4-109

	<u>Page</u>
4.5.4.7 Unavoidable Adverse Impacts	4-109
4.6 VISUAL RESOURCES	4-110
4.6.1 No Action Alternative	4-110
4.6.2 The Proposed Action	4-110
4.6.3 Alternative A	4-111
4.6.4 Alternative B	4-111
4.6.5 BLM Preferred Alternative	4-111
4.6.6 Cumulative Impacts	4-111
4.6.7 Unavoidable Adverse Impacts	4-112
4.7 HAZARDOUS MATERIALS	4-112
4.7.1 No Action Alternative	4-113
4.7.2 The Proposed Action	4-113
4.7.3 Alternative A	4-113
4.7.4 Alternative B	4-113
4.7.5 BLM Preferred Alternative	4-114
4.7.6 Cumulative Impacts	4-114
4.7.7 Unavoidable Adverse Impacts	4-114
4.8 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES	4-114
4.9 SHORT-TERM USE OF THE ENVIRONMENT VS. LONG-TERM PRODUCTIVITY	4-115
CHAPTER 5 — ADDITIONAL POTENTIAL MITIGATION, MONITORING MEASURES, AND COMPENSATORY MITIGATION MEASURES	5-1
5.1 ADDITIONAL MITIGATION/MONITORING OPPORTUNITIES	5-1
5.1.1 Air Quality	5-2
5.1.1.1 BLM Goals and Performance Objectives	5-2
5.1.1.2 Mitigation and Monitoring	5-2
5.1.2 Topography	5-6
5.1.3 Paleontology	5-6
5.1.4 Soil Resources	5-6
5.1.5 Surface Water Resources	5-7
5.1.6 Vegetation, Including TEP&C and BWS Plant Species	5-7
5.1.7 Wildlife, Including TEP&C and BWS Animal Species	5-8
5.1.8 Cultural Resources	5-8
5.1.9 Land Use/Livestock Grazing	5-9
5.1.10 Land Use/Recreation	5-9
5.1.11 Land Use/Transportation	5-9
5.1.12 Visual Resource	5-10
5.1.13 Health and Safety/Hazardous Materials	5-10
5.1.14 Other Actions	5-10
5.2 COMPENSATORY (OFF-SITE) MITIGATION	5-11
5.2.1 Operator-proposed CM	5-11
5.2.2 Other Compensatory Mitigation Ideas	5-13
CHAPTER 6 — CONSULTATION AND PREPARERS	6-1
CHAPTER 7 — REFERENCES	7-1
CHAPTER 8 — GLOSSARY	8-1

VOLUME 2

- APPENDIX A – BLM STANDARD STIPULATION/MITIGATION REQUIREMENTS
- APPENDIX B – JONAH INFILL DRILLING PROJECT DEVELOPMENT PROCEDURES
TECHNICAL SUPPORT DOCUMENT
 Subappendix DP-A – Transportation Plan
 Subappendix DP-B – Reclamation Plan
 Subappendix DP-C – Hazardous Materials Management Summary
- APPENDIX C – OPERATOR-COMMITTED PRACTICES
- APPENDIX D – SCOPING ISSUES AND CONCERNS
- APPENDIX E – EROSION, SEDIMENT TRANSPORT AND SALINITY MODELING
TECHNICAL REPORT
- APPENDIX F – ADAPTIVE MANAGEMENT IN THE JONAH INFILL DRILLING PROJECT
AREA
- APPENDIX G – SUMMARY OF IMPACTS ACROSS ALTERNATIVES
- APPENDIX H – U.S. FISH AND WILDLIFE SERVICE LETTER INITIATING FORMAL
CONSULTATION
- APPENDIX I – CULTURAL RESOURCES AND HISTORIC OVERVIEW
- APPENDIX J – AIR QUALITY IMPACT TABLES

LIST OF MAPS

	<u>Page</u>
1.1. Jonah Infill Drilling Project Location, Sublette County, Wyoming, 2006	1-2
2.1. Jonah Infill Drilling Project Area, Sublette County, Wyoming, 2006.....	2-13
3.1. Air Quality Modeling Domain (Cumulative Impact Assessment Area) Depicting Class I and Other Sensitive Areas and Lakes, Jonah Infill Drilling Project, 2005	3-7
3.2. Area Topography, Jonah Infill Drilling Project Area, Sublette County, Wyoming, 2006.....	3-21
3.3. Surface Geology, Jonah Infill Drilling Project Area, Sublette County, Wyoming, 2006.....	3-22
3.4. Bedrock Geology, Jonah Infill Drilling Project Area, Sublette County, Wyoming, 2006.....	3-23
3.5. Mineral Resources/Geologic Hazards and Paleontological/Cultural Resources Cumulative Impact Assessment Areas, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	3-25
3.6. Soil Types (coarse-scale) within the Soils Cumulative Impact Assessment Area, Jonah Infill Drilling Project, Wyoming, 2006.....	3-31
3.7. Soils Types (Fine-Scale) within the Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	3-33
3.8. Surface Water Resources in the Jonah Infill Drilling Project and Associated Cumulative Impact Assessment Areas (Project-affected Watersheds), Jonah Infill Drilling Project, Wyoming, 2006	3-37
3.9. Cumulative Impact Assessment Area (Project-affected Watersheds) for Surface Water, Soils, Vegetation, and Fisheries, Jonah Infill Drilling Project, Wyoming, 2006.....	3-38
3.10. Estimated Steady-State Groundwater Levels (Potentiometric Surface), Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	3-42
3.11. Vegetation Communities (Course-Scale) in the Jonah Infill Drilling Project Area and Cumulative Impact Assessment Area, Sublette and Sweetwater Counties, Wyoming, 2006....	3-48
3.12. Project Area Vegetation Types (Finely Mapped), Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	3-50
3.13. Sublette Herd Unit and Pronghorn Migration Routes, Cumulative Impact Assessment Area, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	3-55
3.14. General Wildlife Species Cumulative Impact Assessment Area, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	3-56

	<u>Page</u>
3.15. Prairie Dog Colonies, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	3-58
3.16. Raptor Cumulative Impact Assessment Area, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	3-59
3.17. Raptor Nests on or Adjacent to the Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	3-60
3.18. Greater Sage-grouse Cumulative Impact Assessment Area, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	3-61
3.19. Greater Sage-grouse Leks, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	3-63
3.20. Little Colorado Wild Horse Herd Management Area (CIAA), Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	3-72
3.21. Land Status/Prior Rights Cumulative Impact Assessment Area Boundary, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	3-129
3.22. Grazing Allotments, Jonah Infill Drilling Project Area and Cumulative Impact Assessment Area, Sublette and Sweetwater Counties, Wyoming, 2006	3-130
3.23. Recreational Cumulative Impact Assessment Area, Jonah Infill Drilling Project, Sublette and Sweetwater Counties, Wyoming, 2006	3-134
3.24. Visual Cumulative Impact Assessment Area, Jonah Infill Drilling Project, Lincoln, Sublette, and Sweetwater Counties, Wyoming, 2006	3-137
4.1. Modeled Cone of Depression for Development of 250 Wells per Year over 12.4 Years (3,100 Total Wells), Jonah Infill Drilling Project, Sublette County, Wyoming, 2005	4-42
4.2. Existing Wildlife Habitat Fragmentation (No Action), Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	4-58
4.3. Wildlife Habitat Fragmentation Expected Under Development at 16 Wells per Section (Alternative E), Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	4-59
4.4. Wildlife Habitat Fragmentation Expected Under Development at 32 Wells per Section (Alternative F), Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	4-60
4.5. Wildlife Habitat Fragmentation Expected Under Development at 64 Wells per Section (Alternative G), Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-61

LIST OF FIGURES

	<u>Page</u>
3.1. Wind Rose, Jonah Infill Drilling Project Area, Sublette County, Wyoming, 2005	3-5
3.2. Standard Visual Range for 20th% Cleanest Days, Jonah Infill Drilling Project Area, Sublette County, Wyoming (IMPROVE 2005)	3-10
3.3. Standard Visual Range for Average Days, Jonah Infill Drilling Project Area, Sublette County, Wyoming (IMPROVE 2005)	3-11
3.4. Standard Visual Range for 20th% Haziest Days, Jonah Infill Drilling Project Area, Sublette County, Wyoming (IMPROVE 2005)	3-12
3.5. Mean Annual Total Nitrogen Deposition near Pinedale, Wyoming (NADP [WY06] and CASTNET [PND165]).....	3-13
3.6. Mean Annual Total Sulfur Deposition near Pinedale, Wyoming (NADP [WY06] and CASTNET [PND165]).....	3-14
3.7. Weekly Concentrations of Nitrate near Pinedale, Wyoming (WARMS, Pinedale).....	3-15
3.8. Weekly Concentrations of Ammonium near Pinedale, Wyoming (WARMS, Pinedale)	3-16
3.9. Weekly Concentrations of Sulfur Dioxide near Pinedale, Wyoming (WARMS, Pinedale).....	3-17
3.10. Weekly Concentrations of Sulfate near Pinedale, Wyoming (WARMS, Pinedale)	3-18
3.11. Formations Underlying the Jonah Infill Drilling Project Area, Sublette Country, Wyoming, 2006	3-24
3.12. Typical Braided Stream	3-27
3.13. Typical Natural Gas Field Noise Levels, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	3-46
3.14. Typical Housepit Excavation, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	3-78

LIST OF TABLES

	<u>Page</u>
1.1. Major Federal, State, and Local Permits, Approvals, and Authorizing Actions for the Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	1-7
2.1. Comparison of Alternatives, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006 .	2-12
2.2. Surface Disturbance Allowed by the No Action Alternative, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	2-14
2.3. Surface Disturbance Allowed by the Proposed Action and Alternative A, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	2-16
2.4. Surface Disturbance Allowed by Alternative B, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	2-17
2.5. Surface Disturbance Allowed by the BLM Preferred Alternative, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	2-19
2.6. Brief Comparison of Impacts to Key Issues Across Alternatives, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	2-26
3.1. Critical Elements of the Human Environment, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005.....	3-1
3.2. Cumulative Impact Assessment Areas, Jonah Infill Drilling Project, Sublette County, Wyoming, 2005	3-2
3.3. Mean Monthly Temperature Ranges and Total Precipitation at LaBarge, Wyoming	3-3
3.4. Wind Direction Frequency Distribution, Jonah Infill Drilling Project Area, Sublette County, Wyoming, 2005.....	3-4
3.5. Wind Speed Distribution, Jonah Infill Drilling Project Area, Sublette County, Wyoming, 2005	3-4
3.6. Atmospheric Stability Class Distribution, Jonah Infill Drilling Project Area, Sublette County, Wyoming, 2005.....	3-6
3.7. Air Pollutant Background Concentrations, Wyoming and National Ambient Air Quality Standards, and Prevention of Significant Deterioration (PSD) Increments ($\mu\text{g}/\text{m}^3$).....	3-8
3.8. Monitored Background Conditions at Sensitive Lakes.....	3-19
3.9. Surface Geologic Formations Present on the Jonah Infill Drilling Project Area and Their Paleontological Potential, Sublette County, Wyoming, 2006.....	3-28

	<u>Page</u>
3.10. Soil Types in the Soil Resources Cumulative Impact Assessment Area, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	3-30
3.11. Existing Watershed Disturbance Acreage, Jonah Infill Drilling Project, Cumulative Impact Assessment Area, Sublette County, Wyoming, 2006	3-32
3.12. Soil Types1, Soil Use, and Management Considerations for Soils, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	3-34
3.13. Modeled Sediment Loss under Existing Conditions, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	3-35
3.14. Watershed Acreages, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	3-36
3.15. Produced Water Quality, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	3-44
3.16. Comparison of Measured Noise Levels with Commonly Heard Sounds, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	3-45
3.17. Acreages of Vegetation Communities in the CIAA and Vegetation Types in the JIDPA, Sublette and Sweetwater Counties, Wyoming, 2006.....	3-49
3.18. Vegetation Data, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	3-51
3.19. Greater Sage-Grouse Lek Attendance Trends, Jonah Infill Drilling Project, Sublette County, Wyoming, 1992–2004.....	3-64
3.20. Federal Threatened, Endangered, Proposed, and Candidate Species and their Potential Occurrence on the Jonah Infill Drilling Project Area, Sublette County, Wyoming, 2006.....	3-67
3.21. BLM Pinedale Field Office Sensitive Animal and Plant Species and Potential Occurrence in the Jonah Infill Drilling Project Area, Sublette County, Wyoming, 2006.....	3-69
3.22. Prehistoric Cultural Chronology for the JIDPA and Southwestern Wyoming	3-75
3.23. Historic and Projected Population	3-87
3.24. Urban and Rural Population and Density, 2000	3-88
3.25. Income, Poverty, and Unemployment	3-89
3.26. Population and Workforce, 2000	3-93
3.27. Historic and Projected Housing Availability	3-94
3.28. Authorized Building Permits, 1980–2004	3-95
3.29. Average Rental Rates, 2001–2005.....	3-97
3.30. Second Home Housing Units, Wyoming and Lincoln, Sublette, and Sweetwater Counties, 1990–2000	3-97

	<u>Page</u>
3.31. Comparative Cost of Living Index for Each Wyoming County Compared with the Statewide Average of 100.....	3-104
3.32. Annual Inflation Rates in Wyoming by Category (Statewide Average).....	3-105
3.33. CPI and Inflation Factors, 1980–2004.....	3-106
3.34. Wages and Job Numbers.....	3-106
3.35. Personal Income by Major Source.....	3-107
3.36. Wyoming Gross State Product.....	3-109
3.37. Compensation of Employees	3-110
3.38. Employment by Industry.....	3-111
3.39. Earnings by Industry	3-113
3.40. Wyoming General Fund Revenues, Fiscal Year Collections by Source.....	3-115
3.41. Summary of Mineral Severance Taxes Received by Wyoming and Directly Distributed to All Wyoming Counties and Cities and Project-Affected Counties and Cities in the Study Area.....	3-117
3.42. Summary of Federal Mineral Royalties Received by Wyoming and Directly Distributed to All Counties and Cities and Project-Affected Counties and Cities.....	3-118
3.43. Summary of State of Wyoming Mineral Royalties.....	3-118
3.44. Total PILT Payments and Total Acres.....	3-119
3.45. Total State-Assessed Mineral Production Valuations.....	3-119
3.46. Proportionate Taxable Valuation of Various Classes of Property in Wyoming, 1998–2004 .	3-120
3.47. Sales, Use, and Lodging Tax Rates by County (Effective April 1, 2003)	3-121
3.48. Estimated Annual Recreational Visitor Days, PFO Area	3-124
3.49. Herd Unit and Landownership in the JIDPA	3-124
3.50. Summary of Hunters and Hunter-Days for Potentially Project-Affected Big Game Species in the PFO Area, 2002	3-125
3.51. Summary of Potentially Project-Affected Small Game and Upland Bird Hunters and Hunter-Days in the JIDPA, 2002	3-125
3.52. Expenditures per day for Nonconsumptive Recreation, PFO Area, 1997	3-126
3.53. Total Expenditures for Hunting of Species Potentially Occurring in the Project Area, Wyoming and Study Area, 2002.....	3-127

	<u>Page</u>
3.54. Contribution of JIDPA to Hunting Revenues	3-127
3.55. Livestock/Grazing Allotments in the Jonah Infill Drilling Project Area and Cumulative Impact Assessment Area, Sublette County, Wyoming, 2006	3-131
4.1. Summary of Primary Additional Air Quality Impacts Across Alternatives, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-7
4.2. Summary of Air Quality Concentrations Impacts Across Alternatives, Jonah Infill Drilling Project, Sublette County, Wyoming, 20061	4-8
4.3. Summary of Acid Deposition Impacts Across Alternatives, Jonah Infill Drilling Project, Sublette County, Wyoming, 20061	4-9
4.4. Summary of Visibility (Regional Haze) Impacts Across Alternatives, Jonah Infill Drilling Project, Sublette County, Wyoming, 20061	4-10
4.5. Anticipated Gas and Condensate Recovery Volumes for Each Alternative, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-28
4.6. Cumulative Acreage of Disturbance in each CIAA Watershed and Including RFD, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-35
4.7. Percent of Watersheds Affected, Including Existing Disturbance, Jonah Infill Drilling Project, Sublette County, Wyoming, 20061	4-36
4.8. Total Sediment Loss in Kilograms by Alternative, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-36
4.9. Summary of Groundwater Pumping Scenarios (3,100 total wells), Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-41
4.10. Groundwater Recovery Time (3,100 Wells), Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-41
4.11. Estimated Noise Attenuation with Distance from Construction Equipment, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-48
4.12. Vegetation Type Disturbance Across Alternatives, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-51
4.13. Percent of the JIDPA Contained within Core Areas for Existing Conditions and Selected Possible Development Scenarios, Jonah Infill Drilling Project, Sublette County, Wyoming, 20061	4-57
4.14. Number and Mean Size of Core Areas in the JIDPA for Existing Conditions and Possible Development Scenarios, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-57
4.15. Potentially Disturbed Acreage in Each Wildlife CIAA, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-71

	<u>Page</u>
4.16. Annual Cost of Natural Gas Production, Jonah Infill Drilling Project, Sublette County, Wyoming, 20061	4-87
4.17. Economic Activity from Gas Drilling Per Well, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	4-88
4.18. Economic Activity Gas Production from One BCF of Natural Gas and One MBO, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	4-88
4.19. Economic Activity per RVD from Nonconsumptive Recreation, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-89
4.20. Economic Activity per Hunter Day, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-90
4.21. Summary of Total Economic Activity Resulting from Natural Gas Development and Production over the Life of Field, Jonah Infill Drilling Project, Sublette County, 2006.....	4-93
4.22. Cumulative Acreage of Disturbance in the Recreation CIAA, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	4-107
4.23. Miles of New Roads, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006.....	4-108
4.24. Cumulative Acreage of Disturbance in the Visual Resources CIAA, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	4-112
5.1. Existing Air Quality Monitoring.....	5-3
5.2. EnCana Proposed CM Funding, Jonah Infill Drilling Project, Sublette County, Wyoming, 2006	5-13
6.1. List of Preparers and Participants, Jonah Infill, Drilling Project, 2006	6-1
6.2. Personnel Contacted or Consulted during Preparation of the Jonah Infill EIS.....	6-4
6.3. Names and Affiliations (If Known) of Those Who Submitted Written Comments during the DEIS Comment Period from February 11, 2005 through April 12, 2005.....	6-12
6.4. Air Quality-related Comments on the DEIS or Comments on the August 2005 Draft Air Quality Technical Support Document Supplement and/or the August 2005 Air Quality Impact Analysis Supplement through October 7, 2005	6-22

ABBREVIATIONS AND ACRONYMS

°F	Degrees Fahrenheit	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
µeq/l	Microequivalents per liter		
µg	Micrograms		
µg/m ³	Micrograms per cubic meter	CFR	Code of Federal Regulations
AACL	Acceptable Ambient Concentration Levels	cfs	Cubic feet per second
AASHTO	American Association of State Highway and Transportation Officials	CIAA	Cumulative impact assessment area
		CM	Compensation Mitigation
ACEC	Area of Critical Environmental Concern	CO	Carbon monoxide
		CO ₂	Carbon dioxide
ACHP	Advisory Council on Historic Preservation	COA	Condition of Approval
		COOP	University of Wyoming Cooperative Fish and Wildlife Research Unit
ADT	Average daily traffic	COE	U.S. Army Corps of Engineers
acre-ft	Acre-foot/feet	CPI-U	Consumer Price Index for all Urban Consumers
AGA	American Gas Association		
AIRFA	American Indian Religious Freedom Act	CRMP	Cultural Resource Management Plan
		CSU	Controlled Surface Use Stipulations
AJE	Annual Job Equivalent	DAT	Deposition Analysis Threshold
AML	Appropriate Management Level	dB	Decibel
ANC	Acid-neutralizing capacity	dba	A-weighted decibel
APD	Application for Permit to Drill	DEIS	Draft environmental impact statement
API	American Petroleum Institute		
API	Atmospheric pressure ionization	DM	Department Manual
AQD	Air Quality Division	DOE	U.S. Department of Energy
AQRV	Air Quality-Related Values	DOT	U.S. Department of Transportation
ARPA	Archaeological Resource Protection Act of 1979	DR	Decision Record
		dv	Deciview
ARS	Agricultural Research Service	EA	Environmental assessment
ATV	All-terrain vehicle	ED	Economically Disadvantaged
AUM	Animal unit month	EIS	Environmental impact statement
BA	Biological Assessment	EnCana	EnCana Oil and Gas (USA), Inc.
BACT	Best Available Control Technology	EO	Executive Order
bbls	Barrels	EPA	U.S. Environmental Protection Agency
BCF	Billion cubic feet	EPCA	Energy Policy Conservation Act
bcpd	Barrels of condensate per day	ESA	Endangered Species Act
BLM	Bureau of Land Management	FAR	Functioning-at-risk
BMP	Best Management Practice	FEMA	Federal Emergency Management Agency
B.P.	Before present		
BP America	BP America Production Company (formerly BP Amoco).	FLPMA	Federal Land Policy and Management Act of 1976
bpd	barrels per day	FONSI	Finding of No Significant Impact
BTU	British Thermal Unit	FR	<i>Federal Register</i>
BWS	Bureau of Land Management Wyoming Sensitive	g/hp-hr	Grams per horsepower-hour
		gal	Gallon
BWPD	Barrels of Water Per Day	GCIAA	General Cumulative Impact Assessment Area
CEQ	Council on Environmental Quality		
		GDRA	Great Divide Resource Area

GIS	Geographic information system	NAGPRA	Native American Graves and Repatriation Act
gpm	Gallons per minute	NCPA	National Cultural Programmatic Agreement
GPS	Global positioning system	n.d.	No date
GRBAC	Green River Basin Advisory Council	NED	Not Economically Disadvantaged
GRRA	Green River Resource Area	NEPA	National Environmental Policy Act of 1969
GSP	Gross State Product	NHPA	National Historic Preservation Act of 1966
H ₂ S	Hydrogen sulfide	NF	Nonfunctional
HAP	Hazardous air pollutant	NO _x	Oxides of nitrogen
hp	Horsepower	NO ₂	Nitrogen dioxide
HS-20	Refers to the AASHTO truck type and axle load rating	NOI	Notice of Intent
HUD	Department of Housing and Urban Development	NOS	Notice of Staking
I-80	Interstate 80	NPDES	National Pollutant Discharge Elimination System
IAMWG	Interagency Management Working Group	NPS	National Park Service
IDT	Interdisciplinary Team	NRHP	National Register of Historic Places
IM	Instruction Memorandum	NSO	No Surface Occupancy
IMPROVE	Interagency Monitoring of Protected Visual Environments	NTL	Notice to Lessees
IWAQM	Interagency Workgroup on Air Quality Modeling	NWI	National Wetland Inventory
JACRMA	Jonah-Anticline Cultural Resource Management Area	OHV	Off-highway vehicle
JIDPA	Jonah Infill Drilling Project area	Operators	EnCana, BP America, and other oil and gas companies working in the JIDPA
JMHCAP	Jack Morrow Hills Coordinated Action Plan	OSHA	Occupational Safety and Health Administration
JIO	Jonah Interagency Office	OVM	Organic vapor meter
kg/ha-yr	Kilogram per hectare per year	PA	Programmatic Agreements
LAC	Limit of Acceptable Change	PAPA	Pinedale Anticline Project Area
lb(s)	Pound(s)	PAWG	Pinedale Anticline Working Group
LCHMA	Little Colorado Herd Management Area	PFC	Proper functioning condition
LOP	Life-of-Project	PFO	Pinedale Field Office
LQD	Land Quality Division	PILT	Payment in lieu of taxes
MBO	Million barrels of oil	PLS/ac	Pure live seed per acre
mcf	Thousand cubic feet	PM _{2.5}	Particulate matter less than 2.5 microns in effective diameter
MCIAA	Minerals Cumulative Impact Assessment Area	PM ₁₀	Particulate matter less than 10 microns in effective diameter
MEI	Maximally exposed individual	POD	Plan of Development
MFP	Management Framework Plan	ppm	Parts per million
mg	Milligram	PRA	Pinedale Resource Area
MGD	Million gallons per day	PRBP	Powder River Basin Project
MJ2PA	Modified Jonah II Project Area	PSD	Prevention of Significant Deterioration
MLE	Most likely exposure	Pub. L.	Public Law
mmcf	Million cubic feet	RCRA	Resource Conservation and Recovery Act of 1976
mmcfd	Million cubic feet per day	RDP	Road Development Plan
MOU	Memorandum of Understanding	RFD	Reasonably Foreseeable Development
mph	Miles per hour	RMG	Reservoir Management Group
MSDS	Material Safety Data Sheet	RMP	Resource Management Plan
N ₂	Nitrogen	ROD	Record of Decision
NAAQS	National Ambient Air Quality Standards	ROS	Recreation Opportunity Spectrum
NADP	National Atmospheric Deposition Program		

ROW	Right-of-way	USDI	U.S. Department of the Interior
RSFO	Rock Springs Field Office	USDOC	U.S. Department of Commerce
RV	Recreational vehicle	USFS	U.S. Department of Agriculture, Forest Service
RVD	Recreational visitor days	USFWS	U.S. Fish and Wildlife Service
SARA	Superfund Amendments and Reauthorization Act of 1986	UW	University of Wyoming
SCADA	Supervisory Control and Data Acquisition	USGS	U.S. Geological Survey
SCBC	Sublette County Board of Commissioners	VOC	Volatile organic compounds
SCPC	Sublette County Planning Commission	VRM	Visual Resource Management
SCS	U.S. Soil Conservation Service	WAAQS	Wyoming Ambient Air Quality Standards
SHPO	State Historic Preservation Office	WAPA	Wyoming Association of Professional Archeologists
SIL	Significant Impact Level	WAQSR	Wyoming Air Quality Standards and Regulations
SMA	Surface Management Agency	WCLI	Wyoming Cost of Living Index
SO _x	Oxides of sulfur	WDA	Wyoming Department of Agriculture
SO ₂	Sulfur dioxide	WDEQ	Wyoming Department of Environmental Quality
SPCCP	Spill Prevention, Control, and Countermeasure Plan	WDERP	Wyoming Department of Employment, Research, and Planning
SPSS	Special Status Plant Species	WDOC	Wyoming Department of Commerce
SRA	Sensitive resource area	WDOE	Wyoming Department of Employment
SUP	Surface Use Plan	WDOT	Wyoming Department of Transportation
SVR	Standard visual range	WDR	Wyoming Department of Revenue
SWPPP	Stormwater Pollution Prevention Plan	WESTAR	Western States' Air Resource Council
SWREE	Southwest Regional Economic Evaluation	WGFC	Wyoming Game and Fish Commission
T&E	Threatened and endangered	WGFD	Wyoming Game and Fish Department
TCF	Trillion cubic feet	WHHMA	Wild Horse Herd Management Area
TCP	Traditional Cultural Properties	WOGCC	Wyoming Oil and Gas Conservation Commission
TCPU	Transportation, Communication, and Public Utilities	WQD	Water Quality Division
TDS	Total dissolved solids	WRCC	Western Regional Climate Center
TEC&SC	Threatened, endangered, candidate, and other species of concern	WS	Wyoming Statute
TEE	total energy efficiency	WSA	Wilderness Study Area
TEP&C	Threatened, endangered, proposed and candidate species.	WSEO	Wyoming State Engineer's Office
THK	THK Associates, Inc.	WSGS	Wyoming State Geological Survey
TLS	Timing Limitation Stipulations	WSLUC	Wyoming State Land Use Commission
TMDL	Total Maximum Daily Load	WSP	Wyoming State Protocol
TP	Transportation Plan	WUS	Waters of the U.S.
TPA	Transportation planning area	WyCAS	Wyoming Comprehensive Assessment System
TPTSD	Transportation Planning Technical Support Document	WyGIS	Wyoming Geographic Information Science Center
TPQ	Threshold planning quantity	WyNDD	Wyoming Natural Diversity Database
tpy	Tons per year		
TRC Mariah	TRC Mariah Associates Inc.		
TRPH	Total recoverable petroleum hydrocarbons		
TSP	Total suspended particulate matter		
USC	United States Code		
USDA	U.S. Department of Agriculture		
