FINAL
Environmental Impact Statement for the West Antelope II Coal Lease Application
WYW163340

Volume 1 of 2
Chapters 1 – 8

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

December 2008

MISSION STATEMENT

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

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United States Department of the Interior

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DEC 08 2008

Dear Reader:

The Bureau of Land Management (BLM) has prepared this Final Environmental Impact Statement (EIS) to document and disclose the results of an environmental analysis of an application received by BLM to lease a tract of Federal coal, the West Antelope II Tract, to the Antelope Mine in the Wyoming Powder River Basin. A copy of this document is provided for your review. The Final EIS may also be reviewed on the BLM Wyoming website at: http://www.blm.gov/wy/st/en/info/NEPA/cfodocs/West_Antelope_II.html.

Copies of the Final EIS are also available for public inspection at the following BLM offices:

Bureau of Land Management
Wyoming State Office
5353 Yellowstone Road
Cheyenne, WY 82009

Bureau of Land Management
Casper Field Office
2987 Prospector Drive
Casper, Wyoming 82604

The Draft EIS was published in February 2008 and the 60-day comment period on the draft document ended on April 8, 2008. A formal public hearing on this application to lease Federal coal was held at 7 p.m. on March 24, 2008, at the Best Western Douglas Inn, 1450 Riverbend Drive, Douglas, Wyoming. The purpose of the hearing was to receive comments on the proposed coal lease sale, on the fair market value, and on the maximum economic recovery of the Federal coal resources included in the tract. Four individuals presented statements at the formal hearing and 14 comment letters were received by the BLM on the Draft EIS during the 60-day public review period. A summary of the statements presented at the formal public hearing and the comment letters received on the Draft EIS during the 60-day public review period have been published as part of the Final EIS.

A 30-day review period on this Final EIS will commence on the date the Environmental Protection Agency publishes a Notice of Availability in the Federal Register. The BLM will also publish a Notice of Availability in the Federal Register. Press releases will be submitted to local and state media outlets once the notice is published to notify the public of the final date that comments will be accepted. All comments received will be considered in preparation of the Record of Decision (ROD) for this EIS.

If you wish to comment on the Final EIS, your comments should relate directly to the document. We request that you make your comments as specific as possible and that you cite the location or locations in the EIS on which you are commenting. The agencies involved in preparing this

Final EIS are required to respond in the ROD to all substantive comments submitted on the Final EIS. Substantive comments should: (1) give any new information that could alter conclusions; (2) show why or how analysis or assumptions in the Final EIS are flawed; (3) show errors in data, sources, or methods; or (4) request clarifications that bear on conclusions. Opinions or preferences will not receive a formal response. However, they will be considered and included as part of the BLM decisionmaking process.

This Final EIS was prepared pursuant to the National Environmental Policy Act and applicable regulations, and other applicable statutes, to address possible environmental and socioeconomic impacts that could result from this project. This Final EIS is not a decision document. Its purpose is to inform the public and the agency decisionmakers of the impacts of leasing the West Antelope II Tract of Federal coal to the existing Antelope Mine in the Wyoming Powder River Basin and to evaluate alternatives to leasing the Federal coal included in the tract as applied for.

Comments, including names, street addresses, and e-mail addresses of respondents, will be available for public review at the BLM office address listed below during regular business hours (7:45 a.m.-4:30 p.m.), Monday through Friday, except holidays, and will be published as part of the Final EIS. Individual respondents may request confidentiality. If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

Please send written comments to: Bureau of Land Management, Casper Field Office, Attn: Sarah Bucklin, 2987 Prospector Drive, Casper, WY 82604. Written comments may also be e-mailed to the attention of Sarah Bucklin at "casper_wymail@blm.gov." E-mailed comments must include the name and mailing address of the commentor to receive consideration. Written comments may also be faxed to (307) 261-7587.

If you have any questions or would like to obtain additional copies of this Final EIS, please contact Sarah Bucklin at (307) 261-7541, or at the above address.

Sincerely,

for Robert A. Bennett
State Director

FINAL ENVIRONMENTAL IMPACT STATEMENT
WEST ANTELOPE II COAL LEASE APPLICATION
CONVERSE AND CAMPBELL COUNTIES, WYOMING
ABSTRACT

Lead Agency: USDI Bureau of Land Management Casper Field Office
Casper, Wyoming

Cooperating Agencies: USDI Office of Surface Mining Reclamation and Enforcement
Western Region, Denver, Colorado

USDA Forest Service Medicine Bow-Routt National Forests and
Thunder Basin National Grassland, Douglas, Wyoming

Wyoming Department of Environmental Quality
Land Quality Division and Air Quality Division
Cheyenne, Wyoming

Converse County Board of Commissioners, Douglas, Wyoming

For Further Information, Contact: Sarah Bucklin
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Abstract: This Final Environment Impact Statement (EIS) assesses the environmental consequences of decisions to hold a competitive, sealed-bid sale and issue a lease for a tract of federal coal located adjacent to an existing surface coal mine in Converse and Campbell Counties, Wyoming, subject to standard and special lease stipulations. The West Antelope II Lease by Application (LBA) tract, as applied for by Antelope Coal Company, includes approximately 4,108.6 acres containing approximately 429.7 million tons of in-place federal coal. Antelope Coal Company, the operator of the adjacent Antelope Mine, proposes to mine the tract as a maintenance lease for the existing mine, if a lease sale is held and they acquire the lease.

This Final EIS describes the physical, biological, cultural, historic, and socioeconomic resources in and around the existing mine and the LBA tract. The alternatives in the Final EIS consider the impacts of leasing the tract as it was applied for, leasing a reconfigured tract in order to avoid bypassing federal coal or to increase competitive interest in the tract, and not leasing the tract. The focus for the impact analysis was based upon resource issues and concerns identified during previous coal leasing analyses and public scoping conducted for this lease application. Potential concerns related to development include impacts to groundwater, air quality, wildlife, cultural resources, climate change, and cumulative impacts related to ongoing surface coal mining and other proposed development in the Powder River Basin of Wyoming.

This Final EIS, in compliance with Section 7(c) of the Endangered Species Act (as amended), identifies any endangered or threatened species which are likely to be affected by the Proposed Action.

The Final EIS is open for a 30-day review period beginning on the date that the U.S. Environmental Protection Agency publishes the Notice of Availability in the *Federal Register*. Comments that are postmarked or received on or before the end of the 30-day review period will be considered in the preparation of the Record of Decision.

WEST ANTELOPE II COAL LEASE APPLICATION
FINAL ENVIRONMENTAL IMPACT STATEMENT

Prepared by

EDE Consultants
Sheridan, Wyoming

Under the Direction of

U.S. Department of the Interior
Bureau of Land Management
Casper Field Office
Casper, Wyoming

and

Cooperating Agencies

U.S. Department of Interior
Office of Surface Mining
Reclamation and Enforcement
Western Region
Denver, Colorado

U.S. Department of Agriculture
Forest Service
Medicine Bow-Routt National Forests and
Thunder Basin National Grassland
Douglas, Wyoming

Wyoming Department of Environmental Quality
Land Quality Division and Air Quality Division
Cheyenne, Wyoming

Converse County Board of Commissioners
Douglas, Wyoming

December 2008

TABLE OF CONTENTS

VOLUME 1

EXECUTIVE SUMMARY ES-1

1.0 INTRODUCTION 1-1
- 1.1 Background 1-1
- 1.2 Purpose and Need for Action 1-9
- 1.3 Regulatory Authority and Responsibility 1-11
- 1.4 Relationship to BLM Policies, Plans, and Programs 1-12
- 1.5 Conformance with Existing Land Use Plans 1-13
- 1.6 Consultation and Coordination 1-17

2.0 PROPOSED ACTION AND ALTERNATIVES 2-1
- 2.1 Proposed Action 2-4
  - 2.1.1 Regulatory Compliance, Mitigation and Monitoring 2-8
  - 2.1.2 Hazardous and Solid Waste 2-14
- 2.2 Alternative 1 2-15
- 2.3 Alternative 2 (BLM's Preferred Alternative) 2-18
- 2.4 Alternative 3 2-23
- 2.5 Alternative 4 2-24
- 2.6 Alternative 5 2-25
- 2.7 Summary of Alternatives and Environmental Consequences 2-27
  - 2.7.1 Background 2-27
  - 2.7.2 Summary of Alternatives 2-27

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES 3-1
- 3.1 General Setting 3-5
  - 3.1.1 Climate and Meteorology 3-5
- 3.2 Topography and Physiography 3-5
  - 3.2.1 Affected Environment 3-5
  - 3.2.2 Environmental Consequences 3-7
    - 3.2.2.1 Proposed Action and Alternatives 1 and 2 3-7
    - 3.2.2.2 No Action Alternative 3-8
  - 3.2.3 Regulatory Compliance, Mitigation and Monitoring 3-9
  - 3.2.4 Residual Impacts 3-9
- 3.3 Geology, Mineral Resources, and Paleontology 3-9
  - 3.3.1 General Geology and Coal Resources 3-9
    - 3.3.1.1 Affected Environment 3-9
    - 3.3.1.2 Environmental Consequences 3-13
      - 3.3.1.2.1 Proposed Action and Alternatives 1 and 2 3-13
      - 3.3.1.2.2 No Action Alternative 3-13
    - 3.3.1.3 Regulatory Compliance, Mitigation and Monitoring 3-13
    - 3.3.1.4 Residual Impacts 3-14

TABLE OF CONTENTS (Continued)

3.3.2 Other Mineral Resources 3-14
3.3.2.1 Affected Environment 3-14
3.3.2.1.1 Conventional Oil and Gas 3-14
3.3.2.1.2 Coal Bed Natural Gas (CBNG) .. 3-15
3.3.2.1.3 Other Minerals 3-16
3.3.2.2 Environmental Consequences 3-17
3.3.2.2.1 Proposed Action and Alternatives 1 and 2 3-17
3.3.2.2.2 No Action Alternative 3-18
3.3.2.3 Regulatory Compliance, Mitigation and Monitoring 3-18
3.3.2.4 Residual Impacts 3-19
3.3.3 Paleontology 3-19
3.3.3.1 Affected Environment 3-19
3.3.3.2 Environmental Consequences 3-21
3.3.3.2.1 Proposed Action and Alternatives 1 and 2 3-21
3.3.3.2.2 No Action Alternative 3-21
3.3.3.3 Regulatory Compliance, Mitigation and Monitoring 3-22
3.3.3.4 Residual Impacts 3-22
3.4 Air Quality 3-22
3.4.1 Background 3-22
3.4.1.1 Emissions Sources 3-23
3.4.2 Particulate Emissions 3-25
3.4.2.1 Affected Environment for Particulate Emissions 3-25
3.4.2.2 Environmental Consequences Related to Particulate Emissions 3-28
3.4.2.2.1 Proposed Action and Alternatives 1 and 2 3-29
3.4.2.2.2 No Action Alternative 3-33
3.4.2.3 Regulatory Compliance, Mitigation, and Monitoring for Particulate Emissions 3-33
3.4.3 Emissions of Nitrogen Oxides 3-38
3.4.3.1 Affected Environment for NO_x Emissions 3-38
3.4.3.1.1 Site Specific NO_x Emissions 3-38
3.4.3.2 Environmental Consequences Related to Short-Term NOx Emissions 3-39
3.4.3.2.1 Proposed Action and Alternatives 1 and 2 3-41
3.4.3.2.2 No Action Alternative 3-42
3.4.3.3 Regulatory Compliance, Mitigation, and Monitoring for NO_x Emissions 3-42
3.4.4 Visibility 3-45
3.4.4.1 Affected Environment for Visibility 3-45

TABLE OF CONTENTS (Continued)

3.4.4.2 Environmental Consequences for Visibility .. 3-47
3.4.4.2.1 Proposed Action and Alternatives 1 and 2 3-47
3.4.4.2.2 No Action Alternative 3-49
3.4.4.3 Regulatory Compliance, Mitigation, and Monitoring for Visibility Impacts 3-49
3.4.5 Acidification of Lakes 3-50
3.4.5.1 Affected Environment 3-50
3.4.5.2 Environmental Consequences 3-51
3.4.5.2.1 Proposed Action and Alternatives 1 and 2 3-51
3.4.5.2.2 No Action Alternative 3-51
3.4.5.3 Regulatory Compliance, Mitigation, and Monitoring 3-52
3.4.6 Residual Impacts to Air Quality 3-52
3.5 Water Resources 3-52
3.5.1 Groundwater 3-52
3.5.1.1 Affected Environment 3-52
3.5.1.1.1 Recent Alluvium 3-54
3.5.1.1.2 Wasatch Formation 3-54
3.5.1.1.3 Anderson Coal 3-55
3.5.1.1.4 Canyon Coal 3-57
3.5.1.1.5 Subcoal Fort Union Formation .. 3-58
3.5.1.2 Environmental Consequences 3-58
3.5.1.2.1 Proposed Action and Alternatives 2 and 3 3-58
3.5.1.2.2 No Action Alternative 3-63
3.5.1.3 Regulatory Compliance, Mitigation and Monitoring 3-63
3.5.2 Surface Water 3-64
3.5.2.1 Affected Environment 3-64
3.5.2.2 Environmental Consequences 3-66
3.5.2.2.1 Proposed Action and Alternatives 1 and 2 3-66
3.5.2.2.2 No Action Alternative 3-67
3.5.2.3 Regulatory Compliance, Mitigation and Monitoring 3-68
3.5.3 Water Rights 3-68
3.5.3.1 Affected Environment 3-68
3.5.3.2 Environmental Consequences 3-69
3.5.3.2.1 Proposed Action and Alternatives 1 and 2 3-69
3.5.3.2.2 No Action Alternative 3-69
3.5.3.3 Regulatory Compliance, Mitigation and Monitoring 3-70
3.5.4 Residual Impacts 3-71

TABLE OF CONTENTS (Continued)

3.6 Alluvial Valley Floors 3-71
3.6.1 Affected Environment 3-71
3.6.2 Environmental Consequences 3-72
3.6.2.1 Proposed Action and Alternatives 1 and 2 3-72
3.6.2.2 No Action Alternative 3-74
3.6.3 Regulatory Compliance, Mitigation and Monitoring 3-75
3.6.4 Residual Impacts 3-75
3.7 Wetlands 3-75
3.7.1 Affected Environment 3-75
3.7.2 Environmental Consequences 3-78
3.7.2.1 Proposed Action and Alternatives 1 and 2 3-78
3.7.2.2 No Action Alternative 3-78
3.7.3 Regulatory Compliance, Mitigation and Monitoring 3-79
3.7.4 Residual Impacts 3-79
3.8 Soils 3-80
3.8.1 Affected Environment 3-80
3.8.2 Environmental Consequences 3-82
3.8.2.1 Proposed Action and Alternatives 1 and 2 3-82
3.8.2.2 No Action Alternative 3-83
3.8.3 Regulatory Compliance, Mitigation and Monitoring 3-83
3.8.4 Residual Impacts 3-84
3.9 Vegetation 3-84
3.9.1 Affected Environment 3-84
3.9.2 Environmental Consequences 3-87
3.9.2.1 Proposed Action and Alternatives 1 and 2 3-87
3.9.2.2 No Action Alternative 3-89
3.9.3 Threatened, Endangered, Proposed, and Candidate Plant Species, and BLM Sensitive Species 3-90
3.9.4 Regulatory Compliance, Mitigation and Monitoring 3-90
3.9.5 Residual Impacts 3-91
3.10 Wildlife 3-91
3.10.1 General Setting 3-91
3.10.1.1 Affected Environment 3-91
3.10.1.2 Environmental Consequences 3-93
3.10.1.2.1 Proposed Action and Alternatives 1 and 2 3-93
3.10.1.2.2 No Action Alternative 3-94
3.10.2 Big Game 3-95
3.10.2.1 Affected Environment 3-95
3.10.2.2 Environmental Consequences 3-96
3.10.2.2.1 Proposed Action and Alternatives 1 and 2 3-96
3.10.2.2.2 No Action Alternative 3-97
3.10.3 Other Mammals 3-97
3.10.3.1 Affected Environment 3-97
3.10.3.2 Environmental Consequences 3-101

TABLE OF CONTENTS (Continued)

3.10.3.2.1 Proposed Action and Alternatives 1 and 2 3-101
3.10.3.2.2 No Action Alternatives 3-101
3.10.4 Raptors 3-101
3.10.4.1 Affected Environment 3-101
3.10.4.2 Environmental Consequences 3-103
3.10.4.2.1 Proposed Action and Alternatives 1 and 2 3-103
3.10.4.2.2 No Action Alternative 3-104
3.10.5 Upland Game Birds 3-104
3.10.5.1 Affected Environment 3-104
3.10.5.2 Environmental Consequences 3-107
3.10.5.2.1 Proposed Action and Alternatives 1 and 2 3-107
3.10.5.2.2 No Action Alternative 3-110
3.10.6 Other Birds 3-110
3.10.6.1 Affected Environment 3-110
3.10.6.2 Environmental Consequences 3-114
3.10.6.2.1 Proposed Action and Alternatives 1 and 2 3-114
3.10.6.2.2 No Action Alternative 3-116
3.10.7 Amphibians, Reptiles, and Aquatic Species 3-116
3.10.7.1 Affected Environment 3-116
3.10.7.2 Environmental Consequences 3-117
3.10.7.2.1 Proposed Action and Alternatives 1 and 2 3-117
3.10.7.2.2 No Action Alternative 3-118
3.10.8 Threatened, Endangered, Proposed, and Candidate Animal Species, and BLM Sensitive Species 3-118
3.10.9 Regulatory Compliance, Mitigation and Monitoring ... 3-118
3.10.10 Residual Impacts 3-120
3.11 Land Use and Recreation 3-121
3.11.1 Affected Environment 3-121
3.11.2 Environmental Consequences 3-129
3.11.2.1 Proposed Action and Alternatives 1 and 2 3-129
3.11.2.2 No Action Alternative 3-130
3.11.3 Regulatory Compliance, Mitigation and Monitoring ... 3-131
3.11.4 Residual Impacts 3-131
3.12 Cultural Resources 3-131
3.12.1 Affected Environment 3-131
3.12.2 Environmental Consequences 3-140
3.12.2.1 Proposed Action and Alternatives 1 and 2 3-140
3.12.2.2 No Action Alternative 3-140
3.12.3 Native American Consultation 3-141

TABLE OF CONTENTS (Continued)

3.12.4 Regulatory Compliance, Mitigation and Monitoring... 3-141
3.12.5 Residual Impacts ... 3-142
3.13 Visual Resources ... 3-142
3.13.1 Affected Environment ... 3-142
3.13.2 Environmental Consequences ... 3-144
3.13.2.1 Proposed Action and Alternatives 1 and 2.. 3-144
3.13.2.2 No Action Alternative ... 3-144
3.13.3 Regulatory Compliance, Mitigation and Monitoring... 3-144
3.14.4 Residual Impacts ... 3-145
3.14 Noise ... 3-145
3.14.1 Affected Environment ... 3-145
3.14.2 Environmental Consequences ... 3-145
3.14.2.1 Proposed Action and Alternatives 1 and 2.. 3-145
3.14.2.2 No Action Alternative ... 3-147
3.14.3 Regulatory Compliance, Mitigation and Monitoring... 3-147
3.14.4 Residual Impacts ... 3-147
3.15 Transportation ... 3-147
3.15.1 Affected Environment ... 3-147
3.15.2 Environmental Consequences ... 3-148
3.15.2.1 Proposed Action and Alternatives 1 and 2.. 3-148
3.15.2.2 No Action Alternative ... 3-151
3.15.3 Regulatory Compliance, Mitigation and Monitoring... 3-151
3.15.4 Residual Impacts ... 3-151
3.15.4.1 Coal Loss During Transport ... 3-151
3.16 Hazardous and Solid Waste ... 3-154
3.16.1 Affected Environment ... 3-154
3.16.2 Environmental Consequences ... 3-154
3.16.2.1 Proposed Action and Alternatives 1 and 2.. 3-154
3.16.2.2 No Action Alternative ... 3-154
3.16.3 Regulatory Compliance, Mitigation and Monitoring... 3-155
3.16.4 Residual Impacts ... 3-155
3.17 Socioeconomics ... 3-155
3.17.1 Local Economy ... 3-156
3.17.1.1 Affected Environment ... 3-156
3.17.1.2 Environmental Consequences ... 3-159
3.17.1.2.1 Proposed Action and Alternatives 1 and 2 ... 3-159
3.17.1.2.2 No Action Alternative ... 3-160
3.17.2 Population ... 3-160
3.17.2.1 Affected Environment ... 3-160
3.17.2.2 Environmental Consequences ... 3-161
3.17.2.2.1 Proposed Action and Alternatives 1 and 2 ... 3-161
3.17.2.2.2 No Action Alternative ... 3-162
3.17.3 Employment ... 3-162
3.17.3.1 Affected Environment ... 3-162

TABLE OF CONTENTS (Continued)

3.17.3.2 Environmental Consequences 3-163
3.17.3.2.1 Proposed Action and Alternatives 1 and 2 3-163
3.17.3.2.2 No Action Alternative 3-163
3.17.4 Housing 3-163
3.17.4.1 Affected Environment 3-163
3.17.4.2 Environmental Consequences 3-165
3.17.4.2.1 Proposed Action and Alternatives 1 and 2 3-165
3.17.4.2.2 No Action Alternative 3-165
3.17.5 Local Government Facilities and Services 3-165
3.17.5.1 Affected Environment 3-165
3.17.5.2 Environmental Consequences 3-168
3.17.5.2.1 Proposed Action and Alternatives 1 and 2 3-168
3.17.5.2.2 No Action Alternative 3-168
3.17.6 Social Setting 3-168
3.17.6.1 Affected Environment 3-168
3.17.6.2 Environmental Consequences 3-168
3.17.6.2.1 Proposed Action and Alternatives 1 and 2 3-168
3.17.6.2.2 No Action Alternative 3-169
3.17.7 Environmental Justice 3-169
3.17.7.1 Affected Environment 3-169
3.17.7.2 Environmental Consequences 3-170
3.17.7.2.1 Proposed Action and Alternatives 1 and 2 3-170
3.17.7.2.2 No Action Alternative 3-170
3.17.8 Regulatory Compliance, Mitigation and Monitoring... 3-170
3.17.9 Residual Effects 3-170
3.17.9.1 Human Health Impact Assessment 3-170
3.18 The Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity 3-171
3.18.1 Local Area 3-172
3.18.2 Greenhouse Gas Emissions 3-173
3.19 Irreversible and Irretrievable Commitments of Resources..... 3-175

4.0 CUMULATIVE ENVIRONMENTAL CONSEQUENCES 4-1
4.1 Past, Present, and Reasonably Foreseeable Development 4-2
4.1.1 Coal Development 4-4
4.1.1.1 Coal Mine Development 4-4
4.1.1.2 Coal-Related Development 4-12
4.1.1.2.1 Coal Transportation 4-12
4.1.1.2.2 Electric Power Generation 4-13
4.1.1.2.3 Transmission Lines 4-15

TABLE OF CONTENTS (Continued)

4.1.1.2.4 Coal Conversion Technology 4-15
4.1.2 Oil and Gas Development 4-17
4.1.2.1 Conventional Oil and Gas 4-17
4.1.2.2 CBNG Development 4-18
4.1.2.3 Oil and Gas Related Development 4-19
4.1.2.3.1 Pipelines 4-20
4.1.2.3.2 Refineries 4-22
4.1.3 Other Development Activity 4-22
4.1.3.1 Other Mining 4-22
4.1.3.2 Industrial Manufacturing 4-23
4.1.3.3 Reservoirs 4-23
4.1.3.4 Other Non-Energy Development 4-24
4.2 Cumulative Environmental Consequences 4-25
4.2.1 Topography and Physiography 4-27
4.2.2 Geology, Mineral Resources, and Paleontology 4-29
4.2.2.1 Coal 4-29
4.2.2.2 Oil and Gas 4-29
4.2.2.3 Other Mineral Resources 4-30
4.2.2.4 Paleontology 4-30
4.2.3 Air Quality 4-31
4.2.4 Water Resources 4-41
4.2.4.1 Groundwater 4-41
4.2.4.2 Surface Water 4-51
4.2.5 Alluvial Valley Floors 4-56
4.2.6 Soils 4-57
4.2.7 Vegetation, Wetlands and Riparian Areas 4-58
4.2.7.1 Vegetation 4-58
4.2.7.2 Special Status Plant Species 4-59
4.2.7.3 Noxious and Invasive Weed Species 4-59
4.2.7.4 Wetland and Riparian Species 4-62
4.2.8 Wildlife and Fisheries 4-62
4.2.8.1 Game Species 4-63
4.2.8.2 Non-game Species 4-66
4.2.8.3 Fisheries 4-67
4.2.8.4 Special Status Species 4-70
4.2.9 Land Use and Recreation 4-73
4.2.9.1 Grazing and Agriculture 4-74
4.2.9.2 Urban Use 4-74
4.2.9.3 Recreation 4-75
4.2.10 Cultural Resources and Native American Concerns 4-77
4.2.10.1 Prehistoric Sites 4-77
4.2.10.2 Historic Sites 4-79
4.2.10.3 Native American Traditional Cultural Places 4-79
4.2.10.4 Site Protection 4-79
4.2.11 Transportation and Utilities 4-79

TABLE OF CONTENTS (Continued)

4.2.12 Socioeconomics 4-82
4.2.12.1 Employment and the Economic Base 4-83
4.2.12.2 Labor Market Conditions 4-85
4.2.12.3 Personal Income 4-86
4.2.12.4 Population and Demographics 4-86
4.2.12.5 Housing 4-89
4.2.12.6 Public Education 4-92
4.2.12.7 Facilities and Services 4-93
4.2.12.8 Fiscal Conditions 4-95
4.2.12.9 Social Setting 4-97
4.2.13 Coal Mining and Coal-Fired Power Plant Related Emissions and By-Products 4-99
4.2.13.1 Global Climate Change and Greenhouse Gas Emissions 4-100
4.2.13.2 Mercury, Coal Combustion Residues, and Other By-Products 4-110

5.0 CONSULTATION AND COORDINATION 5-1

6.0 REFERENCES CITED 6-1

7.0 GLOSSARY 7-1

8.0 INDEX 8-1

LIST OF TABLES

Table ES-1. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for West Antelope II LBA Tract and Antelope Mine - Assuming Average Annual Post-2006 Coal Production is 36 mmt ES-7
Table ES-2. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for West Antelope II LBA Tract and Antelope Mine - Assuming Average Annual Post-2006 Coal Production is 42 mmt ES-8
Table ES-3. Projected Maximum Potential Near-field Impacts ES-20
Table ES-4. Modeled Change in Visibility Impacts at Class I and Sensitive Class II Areas ES-21
Table ES-5. Recent and Projected PRB Population ES-22
Table 1-1. Leases Issued and Exchanges Completed Since Decertification, Powder River Basin, Wyoming 1-4
Table 1-2. Pending LBAs and Exchanges, Powder River Basin, Wyoming 1-7
Table 2-1. Regulatory Compliance, Mitigation and Monitoring Measures for Surface Coal Mining Operations Required by SMCRA and State Law for all Alternatives 2-9

TABLE OF CONTENTS (Continued)

Table 2-2. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for West Antelope II LBA Tract and Antelope Mine - Assuming Average Annual Post-2006 Coal Production is 36 mmt 2-29
Table 2-3. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for West Antelope II LBA Tract and Antelope Mine - Assuming Average Annual Post-2006 Coal Production is 42 mmt 2-30
Table 2-4. Summary Comparison of Magnitude and Duration of Direct and Indirect Impacts for the Proposed Action, Alternatives 1 and 2, and the No Action Alternative for the West Antelope II LBA Tract 2-31
Table 2-5. Summary Comparison of Magnitude and Duration of Cumulative Impacts 2-37
Table 3-1. Comparison of Existing and Proposed Antelope Mine Disturbance Area and Mining Operations 3-4
Table 3-2. Comparison of Average Overburden and Coal Thicknesses and Approximate Postmining Surface Elevation Changes Under the No Action Alternative and Alternatives 1 and 2 3-8
Table 3-3. Assumed Background Air Pollutant Concentrations, Applicable AAQS, and PSD Increment Values 3-24
Table 3-4. Summary of PM_{10} Monitoring Data for the Antelope Mine 3-27
Table 3-5. Summary of PM_{10} Monitoring Data for the Wright Area Subregion 3-29
Table 3-6. Annual Ambient NO_2 Concentration Data 3-44
Table 3-7. 2003 through 2006 Annual Ambient NO_2 Concentration Data 3-44
Table 3-8. Approximate Distances and Directions from the West Antelope II General Analysis Area to Mandatory Federal Class I, Tribal Class I, and Federal Class II PSD Areas 3-46
Table 3-9. Existing Acid Neutralizing Capacity in Sensitive Lakes 3-51
Table 3-10. Water Supply Wells Possibly Subject to Drawdown if the West Antelope II LBA Tract is Mined 3-70
Table 3-11. Vegetation Types Identified and Mapped Within the West Antelope II LBA Tract Vegetation Analysis Area 3-85
Table 3-12. Distribution of Surface Ownership Within the West Antelope II LBA Tract as Applied for Under the Proposed Action and Additional Lands Added Under Alternatives 1 and 2 3-121
Table 3-13. Current Federal Oil and Gas Leases on the West Antelope II LBA Tract 3-125
Table 3-14. Cultural Sites in the West Antelope II General Analysis Area . 3-137
Table 3-15. Contribution of Coal Mining to the 2005 Assessed Valuation of Converse and Campbell Counties 3-159
Table 3-16. Projected Major Revenue Impacts from Leasing the West Antelope II LBA Tract Under the Proposed Action or Alternatives 1 and 2 3-160

TABLE OF CONTENTS (Continued)

Table 3-17. Population Change, 2000 to 2006 3-161
Table 3-18. Demographic Characteristics, 2000 3-161
Table 3-19. Total Housing Stock in 2000 and 2005 3-164
Table 3-20. Greenhouse Gas Emissions, Antelope Mine 3-174
Table 4-1. Status and Ownership of Wyoming PRB Coal Mines for 2003, the PRB Coal Review Baseline Year 4-6
Table 4-2. Baseline Year and projected Wyoming PRB Coal Mine Development, Lower Coal Production Scenario 4-10
Table 4-3. Baseline Year and Projected Wyoming PRB Coal Mine Development, Upper Coal Production Scenario 4-11
Table 4-4. Baseline Year and Projected Wyoming PRB Coal-Related Development Scenario 4-12
Table 4-5. Past, Present, and Projected Wyoming PRB Coal Mine and Coal-Related Development Scenario 4-17
Table 4-6. Baseline Year and Projected Wyoming PRB Conventional Oil and Gas Development Scenario 4-18
Table 4-7. Baseline Year and Projected CBNG Development Scenario for the Wyoming PRB 4-20
Table 4-8. Wyoming PRB Conventional Oil and Gas, CBNG, and Related Development Disturbance and Water Production 4-20
Table 4-9. Baseline Year and Projected Wyoming PRB Total Development Scenario – Task 3 Study Area 4-26
Table 4-10. Projected Maximum Potential Near-field Impacts 4-34
Table 4-11. Maximum Predicted PSD Class I and Sensitive Class II Area Impacts 4-36
Table 4-12. Modeled Change in Visibility Impacts at Class I and Sensitive Class II Areas 4-38
Table 4-13. Predicted Total Cumulative Change in Acid Neutralizing Capacity of Sensitive Lakes 4-39
Table 4-14. Recoverable Groundwater in the Fort Union/Wasatch Aquifer System 4-42
Table 4-15. Water Use as of 2002 in the Powder/Tongue River Basin 4-51
Table 4-16. Surface Water Availability in the Powder/Tongue River Basin .. 4-52
Table 4-17. Water Use as of 2002 in the Northeast Wyoming River Basins . 4-52
Table 4-18. Surface Water Availability in the Northeast Wyoming River Basins 4-53
Table 4-19. Summary of Proposed Limits for SAR and EC 4-54
Table 4-20. Potential Cumulative Disturbance to Pronghorn Ranges from Development Activities—Lower and Upper Coal Production Scenarios 4-64
Table 4-21. Potential Cumulative Disturbance to White-tailed Deer Ranges from Development Activities—Lower and Upper Coal Production Scenarios 4-64
Table 4-22. Potential Cumulative Disturbance to Mule Deer Ranges from Development Activities—Lower and Upper Coal Production Scenarios 4-65

TABLE OF CONTENTS (Continued)

Table 4-23. Potential Cumulative Disturbance to Elk Ranges from Development Activities—Lower and Upper Coal Production Scenarios 4-65
Table 4-24. Potential Cumulative Impacts to Greater Sage-Grouse Leks from Coal Mine Development—Upper and Lower Coal Production Scenarios 4-72
Table 4-25. Land Use by Surface Ownership 4-73
Table 4-26. AUMs and Acres of Cropland Estimated Unavailable on Lands Disturbed and Not Yet Reclaimed as a Result of Development Activities 4-75
Table 4-27. Square Miles of Projected Cumulative Disturbance and Number of Potentially Affected Cultural Resource Sites in the PRB Coal Review Task 3 Study Area – Lower and Upper Coal Production Scenarios 4-78
Table 4-28. PRB Rail Lines Coal Hauling Capacity and Projected Use 4-81
Table 4-29. Recent and Projected PRB Population 4-87
Table 4-30. Rental Housing Vacancy Rates, 2004 Q4 and 2006 Q4 4-89
Table 4-31. Total Housing Stock in 2000 and 2005 4-89
Table 4-32. Monthly Housing Rents in 2006 in the PRB Study Area and Percent Change from 2004 4-90
Table 4-33. Summary of Mineral Development Tax Revenues Associated with Energy Resource Production Under the Lower Production Scenario 4-96
Table 4-34. Summary of Mineral Development Tax Revenues Associated with Energy Resource Production Under the Upper Production Scenario 4-97
Table 4-35. Projected Percent of CO_2 Emissions by Source (2007 and 2030) 4-107
Table 4-36. Projected Percent of CO_2 Emissions by Source (2007 and 2030) Under a Reduced CO_2 Emissions Scenario 4-108
Table 4-37. 2004 Percent Contribution to Worldwide Anthropogenic Mercury Emissions 4-112
Table 5-1. List of Contributors and Reviewers. 5-4
Table 5-2. List of Preparers 5-7
Table 5-3. BLM Distribution List for Coal Leasing 5-9

LIST OF FIGURES

Figure ES-1. General Location Map with Federal Coal Leases and LBA Tracts ES-2
Figure ES-2. General Analysis Area ES-3
Figure ES-3. West Antelope II LBA Preferred Alternative Tract Configuration ES-6
Figure ES-4. Maximum Modeled PM_{10} and NO_X Concentrations at the Antelope Mine Ambient Air Boundary for the Year 2012 ..... ES-11

TABLE OF CONTENTS (Continued)

Figure ES-5. Roads, Highways, Occupied Dwellings, Businesses and School Bus Stops in the Vicinity of the Antelope Mine and the West Antelope II General Analysis Area ES-12
Figure ES-6. Life of Mine Drawdown Map, Resulting from Currently Approved Mining with Addition of the West Antelope II LBA Tract ES-14
Figure 1-1. General Location Map with Federal Coal Leases and LBA Tracts 1-2
Figure 1-2. Federal Coal Leases and West Antelope II LBA Tract as Applied for 1-8
Figure 2-1. West Antelope II LBA Alternative Tract Configurations 2-3
Figure 2-2. West Antelope II LBA Preferred Alternative Tract Configuration 2-21
Figure 3-1. General Analysis Area 3-2
Figure 3-2. Wind Rose Diagram for Antelope Mine 3-6
Figure 3-3. Stratigraphic Relationships and Hydrologic Characteristics of Upper Cretaceous, Lower Tertiary, and Recent Geologic Units, PRB, Wyoming 3-10
Figure 3-4. North-South and East-West Geologic Sections, West Antelope II LBA Tract 3-12
Figure 3-5. Air Quality and Meteorological Stations at the Antelope Mine 3-26
Figure 3–6. Annual Coal Production and Overburden Removal vs. Monitored PM_{10} for the Antelope Mine 3-27
Figure 3–7. Maximum Modeled PM_{10} and NO_X Concentrations at the Antelope Mine Ambient Air Boundary for the Year 2010 3-30
Figure 3–8. Maximum Modeled PM_{10} and NO_X Concentrations at the Antelope Mine Ambient Air Boundary for the Year 2012 3-31
Figure 3–9. Roads, Highways, Occupied Dwellings, Businesses and School Bus Stops in the Vicinity of the Antelope Mine and the West Antelope II General Analysis Area 3-34
Figure 3-10. Visibility in the Badlands and Bridger Wilderness Areas 3-48
Figure 3-11. Locations of Groundwater Monitoring and Water Supply Wells at the Antelope Mine 3-53
Figure 3-12. Life of Mine Drawdown Map, Resulting from Currently Approved Mining with Addition of the West Antelope II LBA Tract 3-61
Figure 3-13. Surface Water Features Within and Adjacent to the West Antelope II Study Area 3-65
Figure 3-14. Declared Alluvial Valley Floors Within and Adjacent to the West Antelope II Study Area 3-73
Figure 3-15. Wetlands and Other Waters Within the West Antelope II General Analysis Area 3-77
Figure 3-16. Raptor Nest Sites and Prairie Dog Colonies Within the West Antelope II Wildlife Two-Mile Perimeter Area 3-99

TABLE OF CONTENTS (Continued)

Figure 3-17. Wildlife Features and Survey Routes Within the West Antelope II Wildlife Two-Mile Perimeter Area 3-100
Figure 3-18. Average Male Sage-grouse Lek Attendance Within the Northeast Wyoming Local Working Group Area (1967-2005)..... 3-109
Figure 3-19. Average Male Sage-grouse Lek Attendance Statewide, Within the Northeast Wyoming Local Sage-Grouse Working Group Area, and Within the Thunder Basin National Grasslands (1996-2005) 3-109
Figure 3-20. Surface Ownership Within the West Antelope II LBA Tract. 3-122
Figure 3-21. Oil and Gas Ownership on the West Antelope II LBA Tract 3-124
Figure 3-22. Relationship Between A-Scale Decibel Readings and Sounds of Daily Life..... 3-146
Figure 3-23. Transportation Facilities Within and Adjacent to the West Antelope II LBA Tract 3-149
Figure 3-24. Oil and Gas Pipelines Within and Adjacent to the West Antelope II LBA Tract 3-150
Figure 4-1. Wyoming Study Area for PRB Coal Review Studies Evaluating Current and Projected Levels of Development 4-3
Figure 4-2. Tons of Federal Coal Leased Versus Tons of Coal Mined Since 1990 4-5
Figure 4-3. Projected Total Coal Production from Campbell and Converse Counties Under the Lower and Upper Coal Production Scenarios 4-9
Figure 4-4. Wyoming Task 3 Study Area for PRB Coal Review Studies Evaluating Projected Environmental Consequences..... 4-28
Figure 4-5. Extrapolated Extent of Cumulative Drawdown Within the Wyodak Coal Aquifer in the South Gillette Subregion 4-46
Figure 4-6. Projected Campbell County Population and Employment to 2020..... 4-88
Figure 4-7. Projected Housing Demand in the PRB Study Area Under the Lower Coal Production Scenario..... 4-91
Figure 4-8. Projected School Enrollment Trends to 2020 Under the Lower Coal Production Scenario 4-93

TABLE OF CONTENTS (Continued)

VOLUME 2

LIST OF APPENDICES

Appendix A. Federal and State Agencies and Permitting Requirements

Appendix B. Unsuitability Criteria for the West Antelope II LBA Tract

Appendix C. Coal Lease-by-Application Flow Chart

Appendix D. BLM Special Coal Lease Stipulations and Form 3400-12 Coal Lease

Appendix E. CBNG Wells Capable of Production

Appendix F. Supplemental Air Quality Information

Appendix G. Non-Mine Groundwater and Surface Water Rights

Appendix H. USDA-FS Region 2 Sensitive Species and Management Indicator Species and BLM Sensitive Species Evaluation for the West Antelope II Coal Lease Application EIS

Appendix I. Biological Assessment

Appendix J. Comment Letters on the Final EIS and Responses

Abbreviations and Acronyms Used in this Report

AAQS	Ambient Air Quality Standards
ac	acre(s)
ACC	Antelope Coal Company
ac-ft	acre-foot, acre-feet
ac-ft/yr	acre-foot per year, acre-feet per year
AM	Antelope Mine
AML	Abandoned Mine Land
ANC	Acidification Neutralization Capacity
ANFO	Ammonium Nitrate Fuel Oil
APD	Applications for Permit to Drill
APLIC	Avian Power Line Interaction Committee
AQRV	Air Quality Related Values
ARCO	Atlantic Richfield Company
AREV	Advanced Revelation (SEO water rights database and program)
AUM	Animal Unit Month
AVF	Alluvial Valley Floor
BACM	Best Available Control Measures
BACT	Best Available Control Technology
bcf	billion cubic feet
BLM	Bureau of Land Management
BNSF	Burlington Northern Santa Fe
BNSF&UP	Burlington Northern Santa Fe and Union Pacific
BOE	Barrels of Oil Equivalent
B.P.	Before Present
Btu	British thermal units
Btu/lb	British thermal units per pound
CAA	Clean Air Act
CAAA	Clean Air Act Amendment
CAGR	Compounded Annual Growth Rate
CANDO	Converse Area New Development Organization
CBNG	Coal Bed Natural Gas
CCEDC	Campbell County Economic Development Corporation
CCSD	Campbell County School District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHIA	Cumulative Hydrologic Impact Assessment
CO	carbon monoxide
CO_2	carbon dioxide
COE	U.S. Army Corps of Engineers
CREG	Consensus Revenue Estimating Group
CWA	Clean Water Act
dBA	A-weighted decibels
DEIS	Draft Environmental Impact Statement
DM&E	Dakota, Minnesota & Eastern Railroad Corporation
DOI	Department of the Interior
dv	deciview, a measure of view impairment
EC	elemental carbon particles (re: air quality)
EIA	Energy Information Administration
EIS	Environmental Impact Statement

Abbreviations and Acronyms Used in this Report

ENCOAL	Encoal Corporation
EOR	Enhanced Oil Recovery
EPA	Environmental Protection Agency
EQC	Environmental Quality Council
ESA	Endangered Species Act
EVG	Erathem-Vanir Geological, PLLC
F	fahrenheit
FCLAA	Federal Coal Leasing Act Amendments of 1976
FDM	Fugitive Dust Model
FEA	Final Environmental Assessment
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FLPMA	Federal Land Policy Management Act of 1976
FMR	Federal Mineral Royalties
FR	Federal Register
ft	feet, foot
ft/day	feet per day
ft^2/day	square feet per day
ft^3	cubic feet
g	gram
GAO	General Accounting Office
GAGMO	Gillette Area Ground Water Monitoring Organization
GIS	Geographic Information System
gpd	gallons per day
gpm	gallons per minute
GSP	Gross State Product
HAP	Hazardous Air Pollutant
IBLA	Interior Board of Land Appeals
IMPROVE	Interagency Monitoring of Protected Visual Environments
ISCLT3	Industrial Source Complex - Long Term
JCR	Job Completion Report
km	kilometers
kV	kilovolts
LAC	Limits Of Acceptable Change (re: air quality)
LBA	Lease By Application
Leq	equivalent continuous noise level
LOM	Life Of Mine
LRMP	Land and Resource Management Plan
LRPL	Least Restrictive Proposed Limit
MBHFI	Migratory Birds Of High Federal Interest
µeq/L	microequivalents per liter
$\mu g/m^3$	micrograms per cubic meter
MDEQ	Montana Department of Environmental Quality
mg/L	milligrams per liter
MIS	Management indicator species
MLA	Mineral Leasing Act of 1920
mm	million
mmbcy	million bank cubic yards
mmbo	million barrels of oil
mmcfpd	million cubic feet of gas per day
mmgpy	million gallons per year

Abbreviations and Acronyms Used in this Report

mmt	million tons
mmtpy	million tons per year
mph	miles per hour
MRPL	Most Restrictive Proposed Limit
MSA	Metropolitan Statistical Area
MSHA	Mine Safety and Health Administration
MW	megawatts
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NADP	National Atmospheric Deposition Program
NARO	North Antelope/Rochelle
NEAP	Natural Events Action Plan
NEPA	National Environmental Policy Act of 1969
NIOSH	National Institute of Occupational Safety and Health
NO	nitrogen oxide
NOAA	National Oceanic and Atmospheric Administration
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPS	National Park Service
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NSPS	National Source Performance Standards
NWI	National Wetlands Inventory
NWLSWG	Northeast Wyoming Local Sage-Grouse Working Group
NWS	National Weather Service
O_3	photochemical oxidants
ORV	Off Road Vehicle
OSHA	Occupational Safety and Health Administration
OSM	Office of Surface Mining Reclamation & Enforcement
PECs	Passive Enclosure Control systems
PFYC	Probable Fossil Yield Classification
P.M.	Prime Meridian
$PM_{2.5}$	particulates finer than 2.5 microns in effective diameter
PM_{10}	particulates finer than 10 microns in effective diameter
PMT	Post-Mining Topography
POD	Plans Of Development
ppm	parts per million
PRB	Powder River Basin
PRES	Powder River Eagle Studies
PRRCT	Powder River Regional Coal Team
PSD	Prevention of Significant Deterioration
PTE	Potential to Emit
R2P2	Resource Recovery and Protection Plan
RACM	Reactionary Control Measures
RH	Relative Humidity
RMP	Resource Management Plan
ROD	Record Of Decision
ROW	Right-Of-Way
RV	Recreational Vehicle
SAR	Sodium Absorption Ratio
SARA	Superfund Amendment & Reauthorization Act of 1986

Abbreviations and Acronyms Used in this Report

scf/ton	standard cubic feet per ton
SEIS	Supplemental Environmental Impact Statement
SEO	State Engineer's Office
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SMCRA	Surface Mining Control and Reclamation Act of 1977
SO_2	sulfur dioxide
STB	Surface Transportation Board
T&E	Threatened and Endangered
TBCC	Thunder Basin Coal Company, LLC
TBNG	Thunder Basin National Grassland
TDS	total dissolved solids
TPY	tons per year
TSS	total suspended solids
TSP	total suspended particulates
UP	Union Pacific
U.S.	United States
USC, U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDA-FS	U.S. Department of Agriculture - Forest Service
USDI	U.S. Department of the Interior
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
UW	Upper Wyodak coal seam
VOCs	Volatile Organic Compounds
VRM	Visual Resource Management
WA	Wilderness Area
WAAQS	Wyoming Ambient Air Quality Standards
WAQSR	Wyoming Air Quality Standards and Regulations
WARMS	Wyoming Air Resources Monitoring System
WDEQ	Wyoming Department of Environmental Quality
WDEQ/AQD	Wyoming Department of Environmental Quality/Air Quality Division
WDEQ/ISD	Wyoming Department of Environmental Quality/Industrial Siting Division
WDEQ/LQD	Wyoming Department of Environmental Quality/Land Quality Division
WFA	Western Fuels Association
WGFD	Wyoming Game and Fish Department
WMA	Wyoming Mining Association
WOGCC	Wyoming Oil and Gas Conservation Commission
WRCC	Western Regional Climate Center
WSFC	Wyoming School Facilities Commission
WSGS	Wyoming State Geological Survey
WSO-RMG	Wyoming State Office Reservoir Management Group
WYDOT	Wyoming Department of Transportation
yrs	years

EXECUTIVE SUMMARY

On April 6, 2005, ACC[1] filed an application with the BLM for a maintenance tract of federal coal adjacent to ACC's Antelope Mine in Campbell and Converse Counties, Wyoming (Figures ES-1 and ES-2). The application, which was assigned case file number WYW163340, is referred to as the West Antelope II LBA coal lease application. As currently applied for, the West Antelope II LBA tract includes approximately 4,109 acres and ACC estimates that it includes 429.7 million tons of in-place federal coal. The lands applied for in this application are located approximately 20 miles southeast of the town of Wright, Wyoming.

This lease application was reviewed by the Division of Mineral and Lands at the BLM Wyoming State Office, who determined that the application and the lands involved met the requirements of the regulations governing coal leasing on application at 43 CFR 3425.1. The PRRCT reviewed this lease application at a public meeting held on April 27, 2005 in Gillette, Wyoming. The PRRCT recommended that the BLM process the West Antelope II lease application.

In order to process an LBA, the BLM must evaluate the quantity, quality, maximum economic recovery, and fair market value of the federal coal and fulfill the requirements of the NEPA by evaluating the environmental consequences of leasing the federal coal.

To evaluate the environmental impacts of leasing and mining the coal, the BLM must prepare an EA or an EIS to evaluate the site-specific and cumulative environmental and socioeconomic impacts of leasing and developing the federal coal in the application area. The BLM made a decision to prepare an EIS for this lease application. BLM does not authorize mining by issuing a lease for federal coal, but the impacts of mining the coal are considered in this EIS because it is a logical consequence of issuing a maintenance lease to an existing mine.

The EPA published a notice announcing the availability of the Draft EIS in the *Federal Register* on February 8, 2008. BLM published a Notice of Availability/Notice of Public Hearing in the *Federal Register* on March 17, 2008. The 60-day comment period on the Draft EIS ended on April 08, 2008. A public hearing was held on March 24, 2008, in Douglas, Wyoming. Four individuals presented statements during the hearing and fourteen written comments were received on the Draft EIS. A summary of the statements that were presented at the formal public hearing and the written comments, with agency responses, are included as Appendix J of this Final EIS.

The BLM and EPA will each publish a notice of availability of the FEIS in the Federal Register. After a 20-day availability period, the BLM will make a decision to hold or not to hold a competitive sealed-bid lease sale for the tract.

[1] Refer to page xvi for a list of abbreviations and acronyms used in this document.

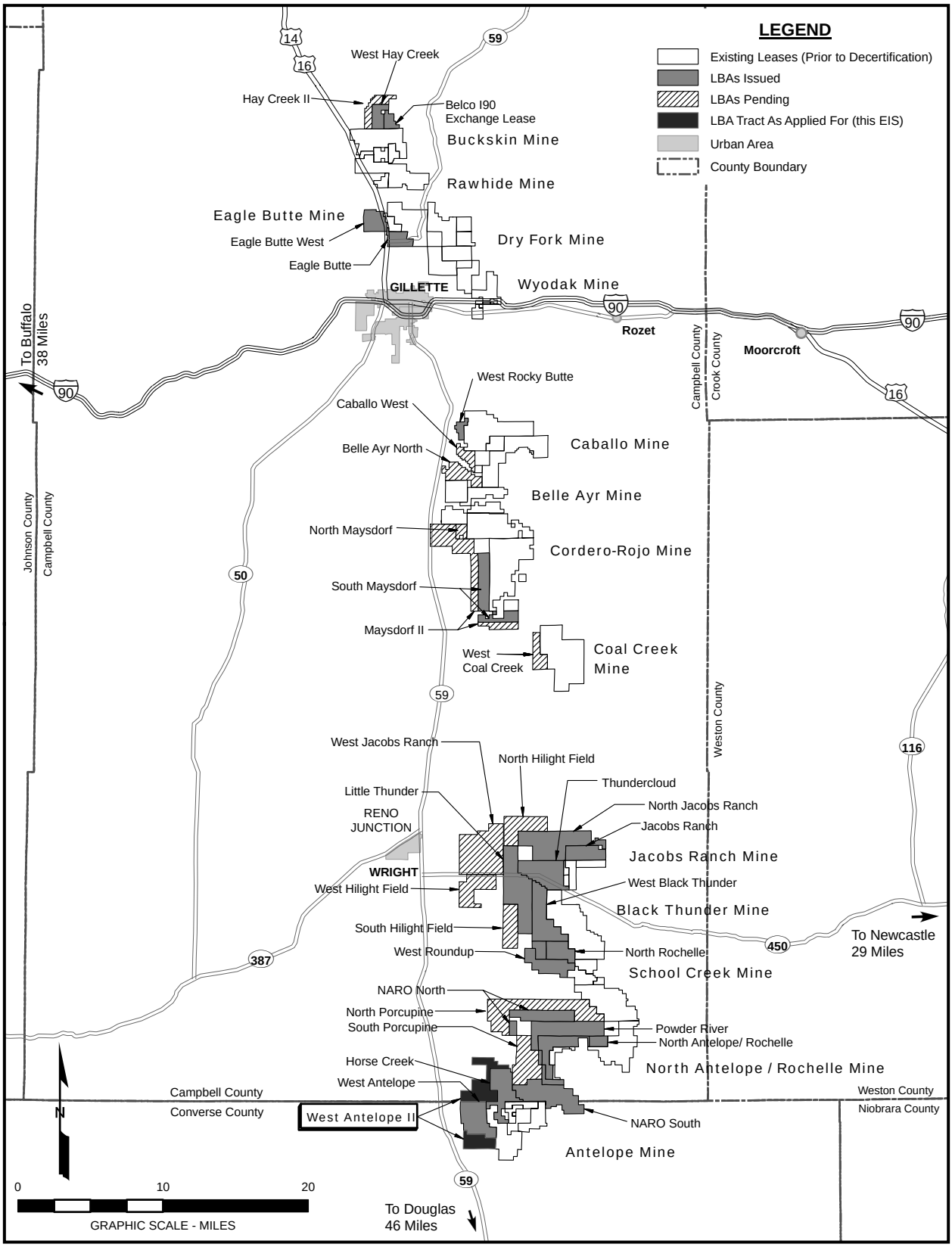


Figure ES-1. General Location Map with Federal Coal Leases and LBA Tracts.

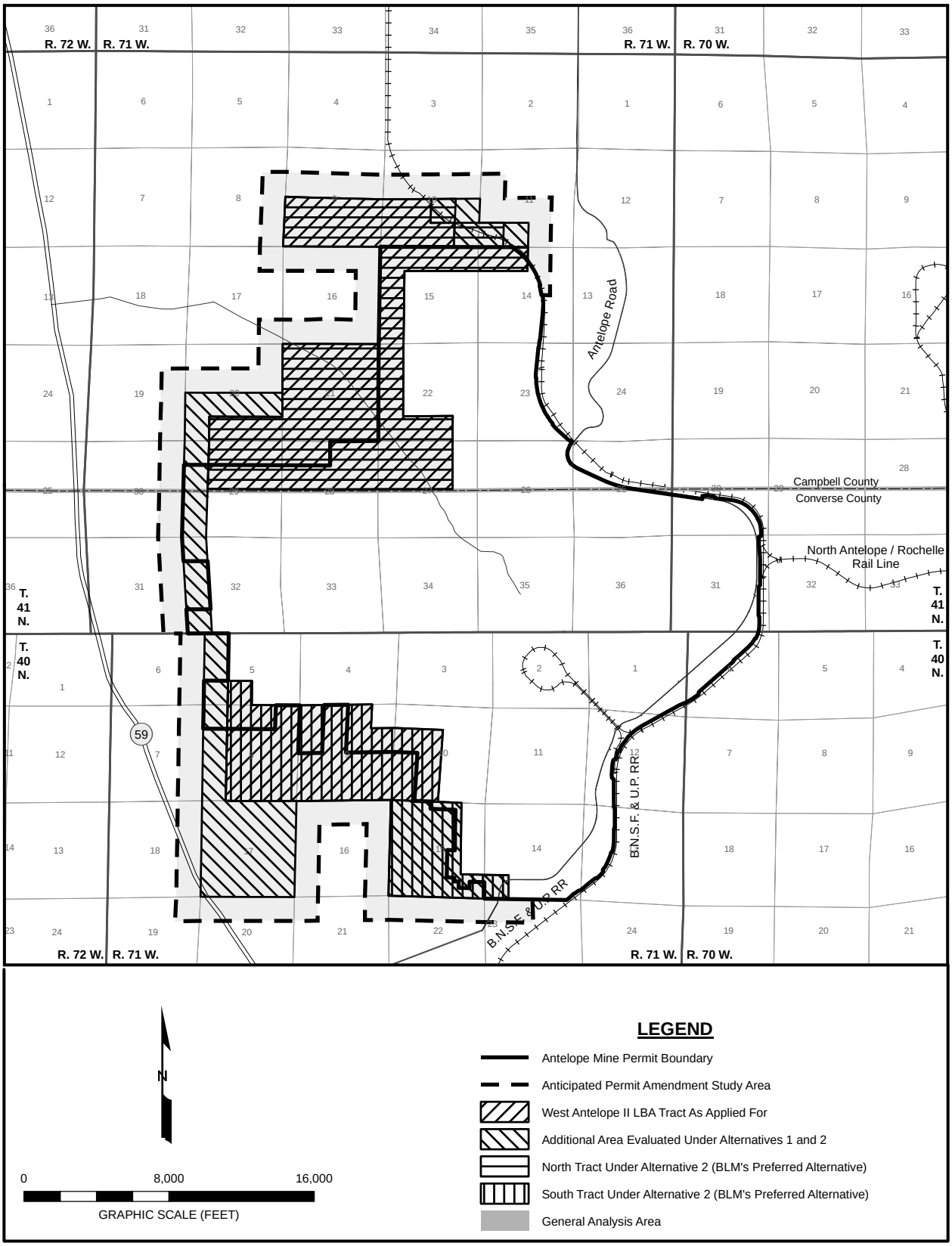


Figure ES-2. General Analysis Area.

The LBA sale process is, by law and regulation, an open, public, competitive sealed-bid process. Bidding at a potential sale would be open to any qualified bidder. If a lease sale is held for this LBA tract, the applicant (ACC) may not be the successful high bidder. If a lease sale is held, a federal coal lease would be issued to the highest bidder at the sale if a federal sale panel determines that the high bid at that sale meets or exceeds the fair market value of the coal as determined by BLM's economic evaluation, and if the U.S. Department of Justice determines that there are no antitrust violations if a lease is issued to the high bidder at the sale.

Cooperating agencies in the preparation of this EIS include USDA-FS, OSM, WDEQ/AQD, WDEQ/LQD, and the Converse County Board of Commissioners. Other agencies, including OSM, will also use this analysis to make decisions related to leasing and mining the federal coal in this tract.

A decision to lease the federal coal lands in this application would be in conformance with the BLM Resource Management Plan for the Buffalo and Casper Field Offices and with the TBNG Land and Resource Management Plan. The West Antelope II LBA tract is contiguous with the Antelope Mine. The analysis in this EIS assumes that ACC would be the successful bidder on the West Antelope II LBA tract if a sale were held, and that it would be mined as a maintenance tract for the Antelope Mine.

A Proposed Action and three alternatives to that action are analyzed in detail in this EIS.

- **Proposed Action** - The Proposed Action is to hold a competitive coal lease sale and issue a maintenance lease to the successful bidder for the West Antelope II LBA tract as applied for (Figure ES-2). Under the Proposed Action, ACC currently estimates that average annual production would be between 36 and 42 million tons per year and the life of the existing mine would be extended by 9 to 11 years. The Antelope Mine presently has a workforce of 430 employees, and as many as 25 to 40 additional workers may be needed at times during the life-of-mine.

- **Alternative 1** - Under Alternative 1, BLM would reconfigure the West Antelope II LBA Tract, hold a competitive coal lease sale for the lands included in the reconfigured tract, and issue a lease to the successful bidder.

  BLM identified a study area for the West Antelope II LBA Tract in order to evaluate the potential that an alternate configuration of the tract would provide for more efficient recovery of the federal coal, increase competitive interest in the West Antelope II LBA Tract, and/or reduce the potential that some of the remaining unleased federal coal in this area would be bypassed in the future. The BLM study area, shown in Figure ES-2, includes the tract as applied for and unleased federal coal adjacent

to the northeastern, western, and southern edges of the tract as applied for. The study area includes lands on the TBNG, which is administered by USDA-FS. In accordance with the Leasing on Application regulation at 43 CFR 3425.1-9, BLM could increase or decrease the size of the tract as applied for under Alternative 1. If all of these lands are added to the tract, this alternative would add about 100 million tons of unleased federal coal to the West Antelope II LBA tract as applied for. Under this alternative, production and average employment would be similar to the Proposed Action.

- **Alternative 2** - This alternative considers dividing the tract as applied for into two tracts (Figure ES-2) and offering one or both of those tracts for sale. A separate, competitive sealed-bid sale would be held for each tract that is offered for sale. This alternative also includes the 2,200.6 study area acres identified under Alternative 1 that BLM is considering adding to the tract. Production and employment would be similar to the Proposed Action. Alternative 2, dividing the tract as applied for or as reconfigured by BLM into two tracts and offering one or both for sale as separate competitive bids for each tract, is the BLM's Preferred Alternative.

  BLM's preferred tract configuration is to add approximately 125 acres to the northeast corner of the northern tract as applied for and approximately 554 acres to the southwest corner of the southern tract as applied for (Figure ES-3). This tract configuration would add about 26 million tons of unleased federal coal to the West Antelope II LBA tract as applied for.

- **Alternative 3** - Under this alternative, the LBA tract would not be leased, but the existing leases at the adjacent Antelope Mine would be developed according to the existing approved mining plans. Under the No Action Alternative, the Antelope Mine would mine its remaining leased coal reserves in approximately 11 years at an average annual production rate of 36 million tons per year and average employment would be approximately 430 persons. Rejection of the lease application would not preclude an application to lease the tract in the future.

Surface ownership within the West Antelope II LBA tract as applied for under the Proposed Action and the lands added under Alternatives 1 and 2 consists primarily of private lands. A small tract of federal land is administered by USDA-FS.

Tables ES-1 and ES-2 summarize coal production, surface disturbance, mine life, and revenues for the Proposed Action and Alternatives 1, 2, and 3 for the West Antelope II LBA tract for a base-case production rate of 36 mmtpy and for the currently permitted production rate of 42 mmtpy. The environmental impacts of mining the LBA tract would be similar under the Proposed Action and Alternatives 1 and 2.

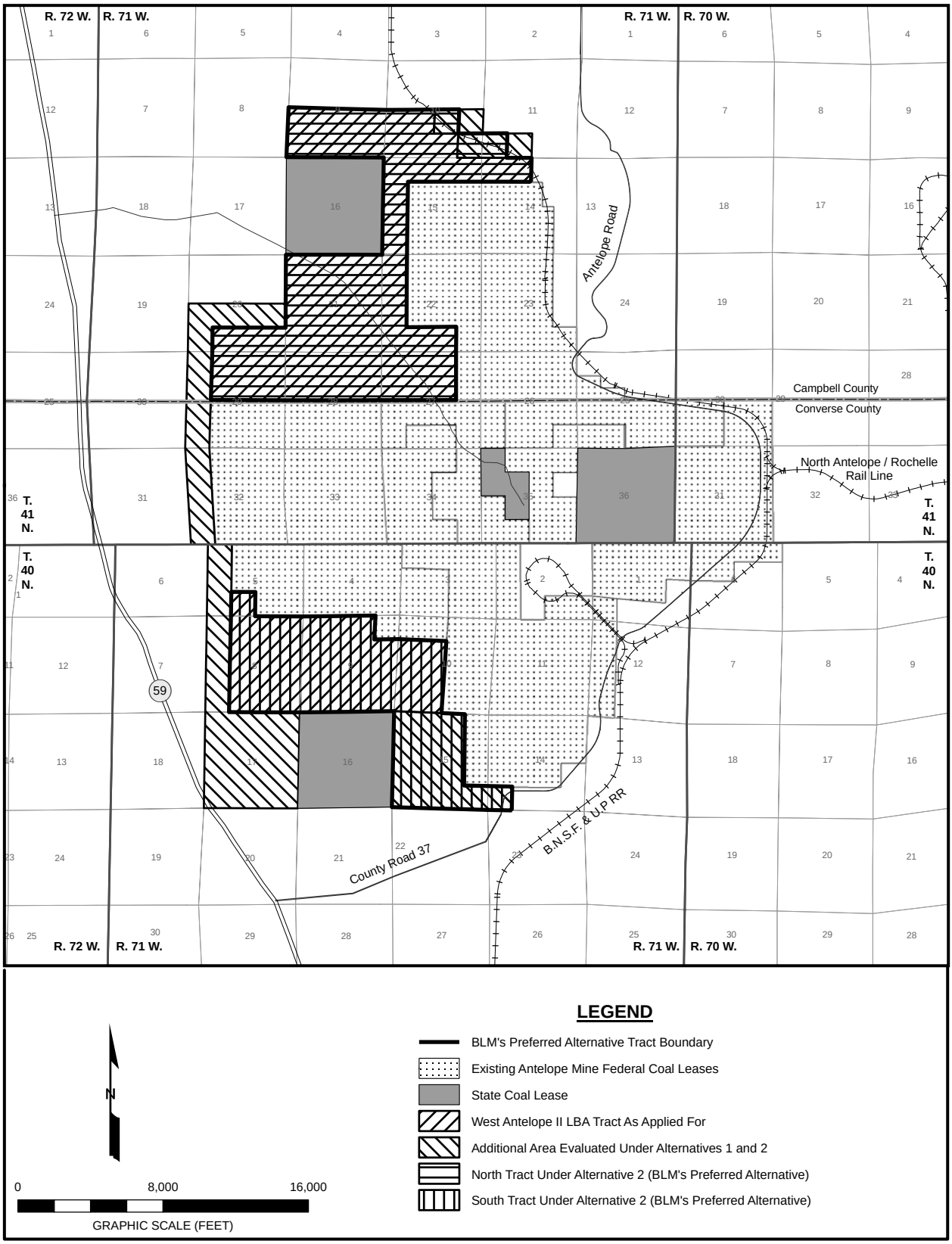


Figure ES-3. West Antelope II LBA Preferred Alternative Tract Configuration.

Table ES-1. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for West Antelope II LBA Tract and Antelope Mine - Assuming Average Annual Post-2006 Coal Production is 36 mmt.

Item	Alternative 3-No Action Alternative (Existing Antelope Mine)	Added by Proposed Action (tract as applied for}	Added by Alternative 1	Added by Alternative 2: North Tract Preferred Alternative	Added by Alternative 2: South Tract Preferred Alternative
In-Place Coal (as of 1/1/07)	428.6 mmt	429.7 mmt	530.0 mmt	379.1 mmt	76.8 mmt
Mineable Coal (as of 1/1/07)[1]	428.6 mmt	408.4 mmt	490.0 mmt	349.6 mmt	60.3 mmt
Recoverable Coal (as of 1/1/07)[2]	394.3 mmt	377.8 mmt	453.9 mmt	324.8 mmt	55.1 mmt
Coal Mined Through 2006	318.9 mmt	—	—	—	—
Lease Area[3]	11,635.5 ac	4,108.60 ac	6,309.18 ac	2,878.56 ac	1,908.60 ac
Total Area To Be Disturbed[4]	12,104.8 ac	4,314.0 ac	6,624.6 ac	3,022.5 ac	2,004.0 ac
Permit Area[4]	14,280.1 ac	4,490.2 ac	7,405.3 ac	3,168.6 ac	2,188.3 ac
Average Annual Post-2006 Coal Production	36 mmt	0 mmt	0 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2006)	11 yr	11 yr	13 yr	9 yr	2 yr
Average Number of Employees	430	up to 25	up to 25	up to 25	
Total Projected State and Local Revenues (post-2006)[5,6]	$657.3 million	$ 686.4 - $ 813.0 million	$824.7 - $976.8 million	$ 590.1 - $ 699.0 million	$ 100.1 - $ 118.6 million
Total Projected Federal Revenues (post-2006)[7]	$473.7 million	$ 510.6 - $ 637.1 million	$613.4 - $765.5 million	$ 439.0 - $ 547.8 million	$ 74.5 - $ 92.9 million

1 Mineable coal figure excludes all coal that would not be mined beneath BNSF & UP railroad ROW and public road ROWs.

2 Recoverable coal figure assumes 91.3 percent recovery (south tract) or 92.9 percent recovery (north tract) of mineable coal and excludes all mining losses that occur during normal mining operations.

3 Includes federal and state coal leases

4 The disturbed area exceeds the leased area because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

5 Revenues to the State of Wyoming and local governments include severance tax, property and production taxes, sales and use taxes, and Wyoming's share of federal royalty payments, bonus bids, and AML fees. State revenues are based on an assumed price of $9.01 per ton of 'recoverable coal', federal royalty of 12.5 percent of the value less 50.5 percent federal share, plus $0.315 per ton for AML fees x an assumed 25 percent state share, plus bonus payments of between $0.30 and $0.97 per ton of LBA leased coal per ton (based on 8 PRB LBA coal sales from 2004 through early-2008) x tonnage of recoverable coal x 50 percent state share, plus $0.07 per ton estimated sales and use taxes, plus $0.33 per ton estimate for ad valorem taxes, plus $0.631 per ton in severance taxes. Only the sales and use taxes paid directly by the mine are considered, i.e., those generated by vendors and suppliers and by consumer expenditure supported directly and indirectly by the mine are not included.

6 Revenues for Alternative 3 do not include the $43.9 million in scheduled coal lease bonus bids to be paid on the West Antelope LBA in FY07 through FY09.

7 Federal revenues are based on an assumed price of $9.01 per ton, federal royalty of 12.5 percent x 50.5 percent share, plus $0.315 per ton for AML fees x an assumed 75 percent federal share, plus black lung tax of $0.00261 per ton, plus bonus payments of between $0.30 and $0.97 per ton of LBA leased coal of (based on 8 PRB LBA coal salesfrom 2004 through early-2008) x tonnage of recoverable coal minus x 50 percent federal share.

Table ES-2. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for West Antelope II LBA Tract and Antelope Mine - Assuming Average Annual Post-2006 Coal Production is 42 mmt.

Item	Alternative 3-No Action Alternative (Existing Antelope Mine)	Added by Proposed Action (tract as applied for)	Added by Alternative 1	Added by Alternative 2: North Tract Preferred Alternative	Added by Alternative 2: South Tract Preferred Alternative
In-Place Coal (as of 1/1/07)	428.6 mmt	429.7 mmt	530.0 mmt	379.1 mmt	76.8 mmt
Mineable Coal (as of 1/1/07)[1]	428.6 mmt	408.4 mmt	490.0 mmt	349.6 mmt	60.3 mmt
Recoverable Coal (as of 1/1/07)[2]	394.3 mmt	377.8 mmt	453.9 mmt	324.8 mmt	55.1 mmt
Coal Mined Through 2006	318.9 mmt	—	—	—	—
Lease Area[3]	11,635.5 ac	4,108.60 ac	6,309.18 ac	2,878.56 ac	1,908.60 ac
Total Area To Be Disturbed[4]	12,104.8 ac	4,314.0 ac	6,624.6 ac	3,022.5 ac	2,004.0 ac
Permit Area[4]	14,280.1 ac	4,490.2 ac	7,405.3 ac	3,168.6 ac	2,188.3 ac
Average Annual Post-2006 Coal Production	36 mmt	6 mmt	6 mmt	6 mmt	0 mmt
Remaining Life of Mine (post-2006)	11 yr	9 yr	11 yr	8 yr	1 yr
Average Number of Employees	430	up to 40	up to 40	up to 40	
Total Projected State and Local Revenues (post-2006)[5,6]	$657.3 million	$ 686.4 - $ 813.0 million	$824.7 - $976.8 million	$ 590.1 - $ 699.0 million	$ 100.1 - $ 118.6 million
Total Projected Federal Revenues (post-2006)[7]	$473.7 million	$ 510.6 - $ 637.1 million	$613.4 - $765.5 million	$ 439.0 - $ 547.8 million	$ 74.5 - $ 92.9 million

1 Mineable coal figure excludes all coal that would not be mined beneath BNSF & UP railroad ROW and public road ROWs.

2 Recoverable coal figure assumes 91.3 percent recovery (south tract) or 92.9 percent recovery (north tract) of mineable coal and excludes all mining losses that occur during normal mining operations.

3 Includes federal and state coal leases

4 The disturbed area exceeds the leased area because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

5 Revenues to the State of Wyoming and local governments include severance tax, property and production taxes, sales and use taxes, and Wyoming's share of federal royalty payments, bonus bids, and AML fees. State revenues are based on an assumed price of $9.01 per ton of 'recoverable coal', federal royalty of 12.5 percent of the value less 50.5 percent federal share, plus $0.315 per ton for AML fees x an assumed 25 percent state share, plus bonus payments of between $0.30 and $0.97 per ton of LBA leased coal per ton (based on 8 PRB LBA coal sales from 2004 through early-2008) x tonnage of recoverable coal x 50 percent state share, plus $0.07 per ton estimated sales and use taxes, plus $0.33 per ton estimate for ad valorem taxes, plus $0.631 per ton in severance taxes. Only the sales and use taxes paid directly by the mine are considered, i.e., those generated by vendors and suppliers and by consumer expenditure supported directly and indirectly by the mine are not included.

6 Revenues for Alternative 3 do not include the $43.9 million in scheduled coal lease bonus bids to be paid on the West Antelope LBA in FY07 through FY09.

7 Federal revenues are based on an assumed price of $9.01 per ton, federal royalty of 12.5 percent x 50.5 percent share, plus $0.315 per ton for AML fees x an assumed 75 percent federal share, plus black lung tax of $0.00261 per ton, plus bonus payments of between $0.30 and $0.97 per ton of LBA leased coal of (based on 8 PRB LBA coal sales from 2004 through early-2008) x tonnage of recoverable coal minus x 50 percent federal share.

Other alternatives that were considered but not analyzed in detail include holding a competitive coal lease sale and issuing a lease to the successful bidder (not the applicant) for the purpose of developing a new stand-alone mine, and delaying the sale of the West Antelope II LBA tract as applied for to increase the benefit to the public afforded by higher coal prices and/or to allow more complete recovery of the potential CBNG resources in the tract prior to mining.

Critical elements of the human environment (BLM 1988) that could potentially be affected by the Proposed Action or Alternatives 1 and 2 include air quality, cultural resources, Native American religious concerns, T&E species, hazardous or solid wastes, water quality, wetlands/riparian zones, invasive non-native species, and environmental justice. Five other critical elements (areas of critical environmental concern, prime or unique farmlands, wild and scenic rivers, floodplains, and wilderness) are not present in the general analysis area and are not addressed further. In addition to the critical elements that are potentially present in the general analysis area, this EIS discusses the status and potential effects of mining the LBA tract on topography and physiography, geology and mineral resources, soils, water quantity, alluvial valley floors, vegetation, wildlife, land use and recreation, paleontological resources, visual resources, noise, transportation resources, and socioeconomics.

The project area is located in the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. The West Antelope II LBA tract is located in the eastern part of the PRB, in an area consisting primarily of a dissected rolling upland plain with low relief, broken by steeply cut washes. Elevations range from about 4,500 ft to 5,100 ft above sea level and slopes range from flat to around 34 percent and average about five percent. There are four mineable coal seams at the Antelope Mine and within the West Antelope II LBA tract. Locally, these seams are referred to as the Anderson, Lower Anderson, Canyon/Upper Canyon, and Lower Canyon. These seams are part of what is more widely known as the Wyodak-Anderson coal zone of the Tongue River Member of the Fort Union Formation. Mining would remove an average of 280 ft of overburden and 60 ft of coal on about 4,109 acres under the Proposed Action. Mining would remove an average of 260 ft of overburden and 50 ft of coal on up to 6,309 acres under Alternatives 1 and 2.

The existing topography on the LBA tract would be substantially changed during mining. A highwall with a vertical height equal to overburden plus coal thickness would exist in the active pits. Following reclamation, the average surface elevation would be lower due to removal of the coal. The reclaimed land surface would approximate premining contours and the basic drainage network would be retained; however, the reclaimed surface would contain fewer and gentler topographic features. This could contribute to reduced habitat diversity and wildlife carrying capacity on the LBA tract. These topographic changes would not conflict with regional land use, and the postmining topography would adequately support anticipated postmining land use.

The geology from the base of the coal to the land surface would be subject to considerable permanent change on the LBA tract under the Proposed Action or Alternatives 1 and 2. After removal of the coal, the replaced overburden would be a relatively homogeneous mixture compared to the premining layered overburden. Development of other minerals potentially present on the West Antelope II LBA tract could not occur during mining, but could occur after mining.

There are currently no producing conventional oil and gas wells on the West Antelope II LBA tract under the Proposed Action or Alternatives 1 and 2. Conventional oil and gas wells near the tract, if disturbed by mining, would have to be plugged and abandoned during mining but could be recompleted after mining if the remaining reserves justify the expense of the recompletion.

Forty CBNG wells have been completed in the Wyodak-Anderson coal zone in the sections that include the West Antelope II LBA tract under the Proposed Action and Action Alternatives. Thirty of these wells are capable of producing. CBNG resources that are not recovered prior to mining would be vented to the atmosphere and irretrievably lost when the coal is removed. BLM's policy is to optimize recovery of both resources, ensure the public receives a reasonable return, and encourage agreements between lessees or use BLM authority to minimize loss of publicly owned resources.

No significant or unique paleontological resources have been recorded in the general analysis area.

Moderately adverse short-term impacts to air quality would be extended onto the West Antelope II LBA tract during the time it is mined if a lease is issued. Modeling for the current Antelope Mine permit predicted no exceedances of the annual PM_{10} WAAQS at a 42 mmtpy production rate. One exceedance of the PM_{10} WAAQS was recorded at one of the monitoring stations at the Antelope Mine, however, that exceedance was attributed by WDEQ/AQD to maintenance/construction operations on the adjacent railroad line and not to mining operations at the Antelope Mine. NO_x modeling was also conducted in support of the most recent permit application, and impacts from the worst-case years fall well below the NAAQS. There have been no reported events of public exposure to NO_2 from blasting activities at the Antelope Mine through 2005. Figure ES-4 shows the maximum modeled PM_{10} and NO_x concentrations at the Antelope Mine for 2012. There have been no exceedances of the 24-hour or annual ambient air standards resulting from mining operations at the Antelope Mine through 2005 and none are expected from mining the LBA tract.

Public exposure to emissions from surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the areas of mining operations. Occupants of dwellings in the area could also be affected. Roads, highways, occupied dwellings, businesses, and school bus stops in the vicinity of the Antelope Mine and the study area for the West Antelope II LBA tract are shown in Figure ES-5.

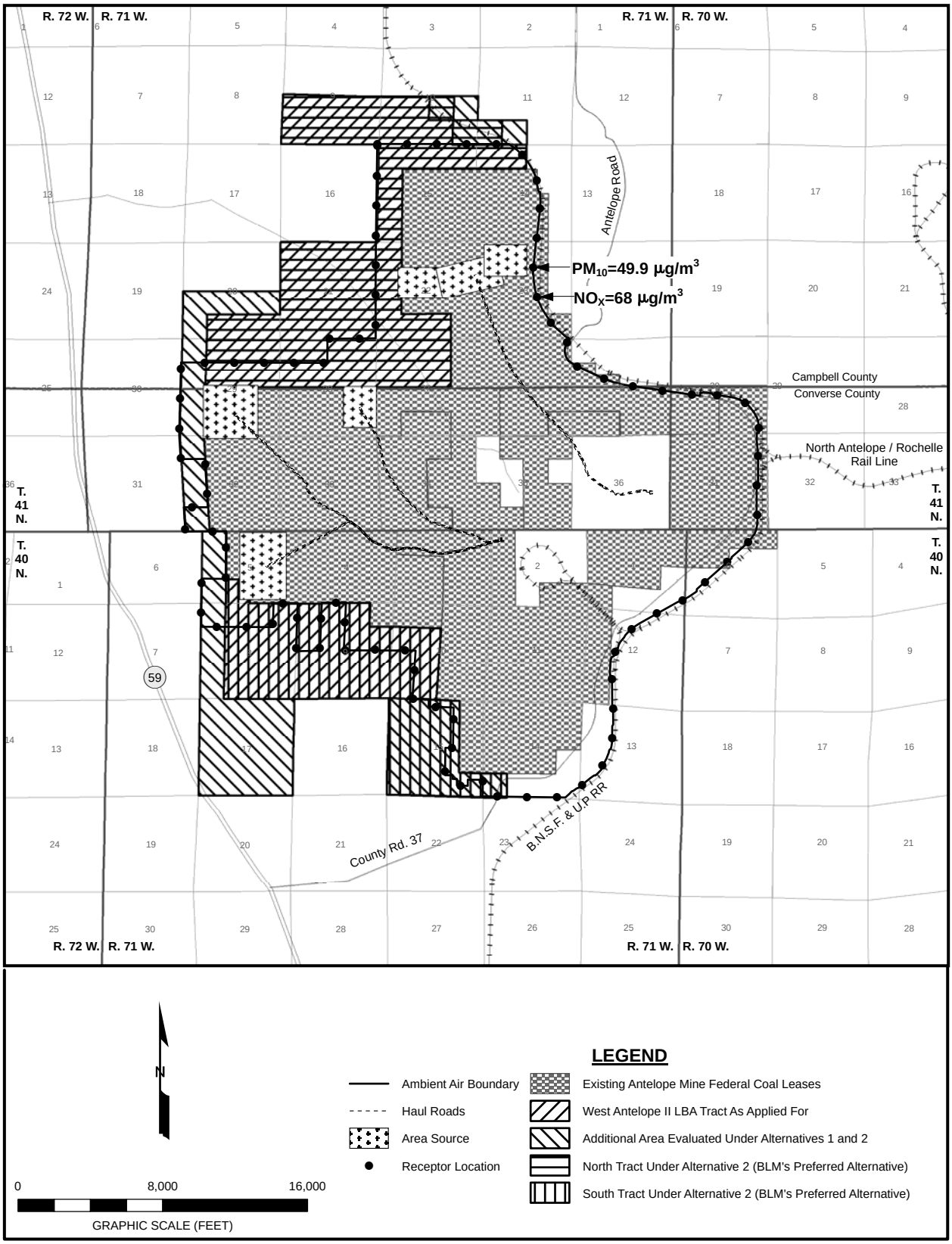


Figure ES-4. Maximum Modeled PM_{10} and NO_X Concentrations at the Antelope Mine Ambient Air Boundary for the Year 2012.

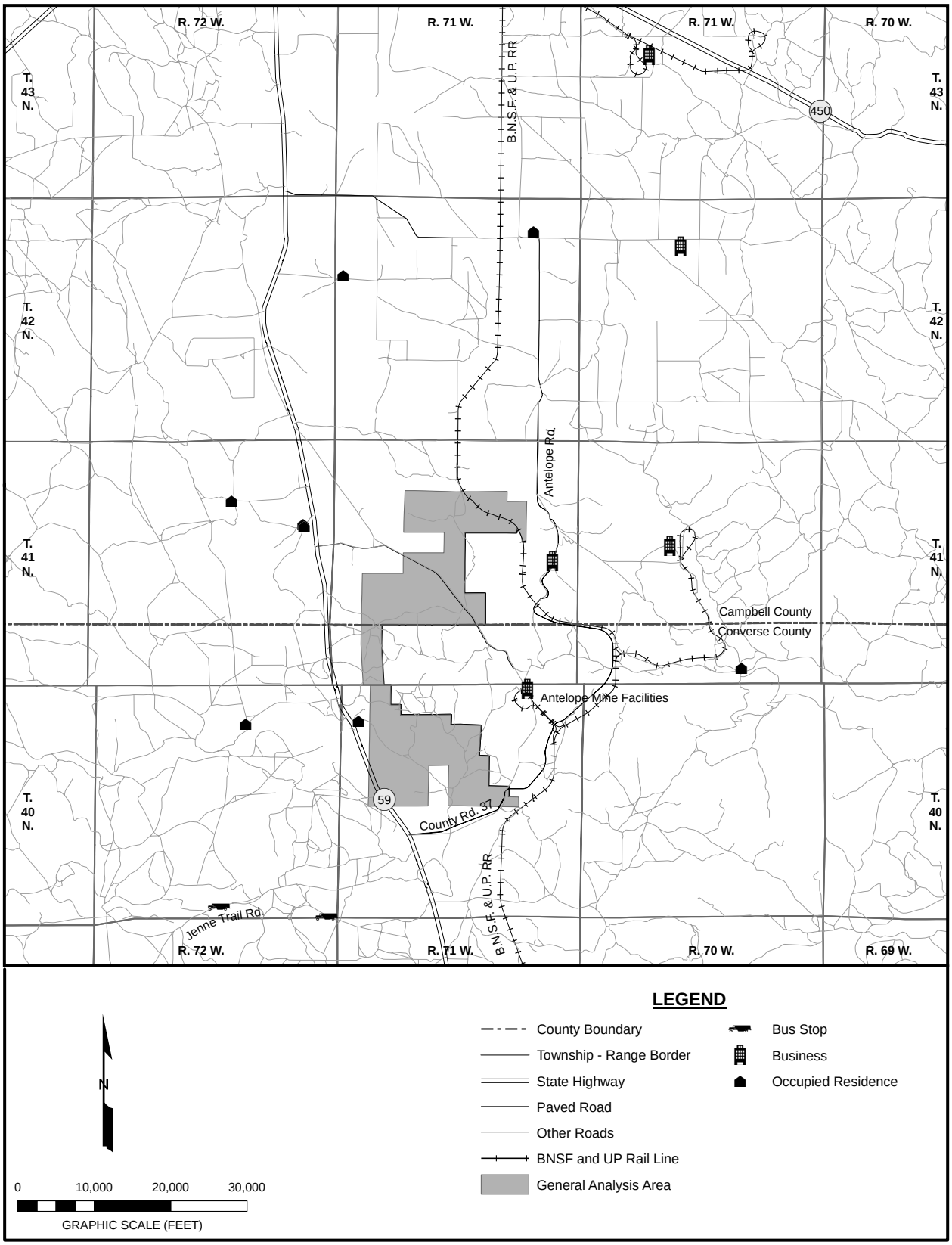


Figure ES-5. Roads, Highways, Occupied Dwellings, Businesses and School Bus Stops in the Vicinity of the Antelope Mine and the West Antelope II General Analysis Area.

Mining would disturb the coal aquifer and the aquifers in the overburden above the coal within the West Antelope II LBA tract. The coal aquifer and any water-bearing strata in the overburden would be removed and replaced with unconsolidated backfill. The area of drawdown in the areally-continuous coal aquifer related to mining operations at the Antelope Mine would be expected to increase roughly in proportion to the increase in area affected by mining. Figure ES-6 shows the predicted extent of drawdown in the Anderson-Canyon coal seam over the life of the mine if the Antelope Mine acquires the West Antelope II LBA tract. The area of drawdown in the discontinuous overburden aquifers would be smaller. The data available indicate that, after reclamation, the hydraulic properties of the backfill would be comparable to the properties of the premining overburden and coal aquifers. TDS levels in groundwater from the backfill could initially be expected to be higher than in the premining overburden and coal aquifers, but would be expected to meet Wyoming Class III standards for use as livestock water.

Mining would not directly disturb aquifers below the coal. ACC has two water supply wells completed in aquifers below the coal and these wells would be used to supply water for a longer period of time if the West Antelope II LBA tract is leased. Antelope Mine probably would not require additional sub-coal wells to mine the LBA tract.

Antelope Creek and its tributaries, most notably Horse Creek and Spring Creek, drain the existing Antelope Mine permit area and the West Antelope II LBA tract. Except for two crossings, Antelope Creek flows undisturbed from west to east across Antelope Mine's current permit area. Horse Creek is currently disturbed by mining in the Horse Creek Amendment Area of the Antelope Mine. Spring Creek has recently been diverted to accommodate the mine's upcoming mining activities, and two other draws within the permit area are also slated for mine-related disturbance. Changes in runoff characteristics and sediment discharges would occur during mining of the LBA tract as a result of the destruction and reconstruction of drainage channels and the use of sediment control structures to manage discharges of surface water. In accordance with SMCRA and Wyoming State Statutes, the major channels would be restored after surface mining operations are completed on the West Antelope II LBA tract. Surface water flow, quality, and sediment discharge would approximate premining conditions.

The West Antelope II LBA tract has not yet been formally evaluated for the presence of AVFs. However, there are stream-laid deposits in portions of Horse Creek and Spring Creek within the general analysis area that are potential AVFs. A site-specific study will be part of the mine permitting process if a lease sale is held and the LBA tract is proposed for mining. Declarations of the presence or absence of AVFs, their significance to agriculture, and the appropriate perimeters will then be made by the WDEQ/LQD. It is reasonable to assume that if the WDEQ/LQD determines AVFs are present within the LBA tract that is leased, mining would be permitted because all of the proposed lease area consists entirely of undeveloped rangeland.

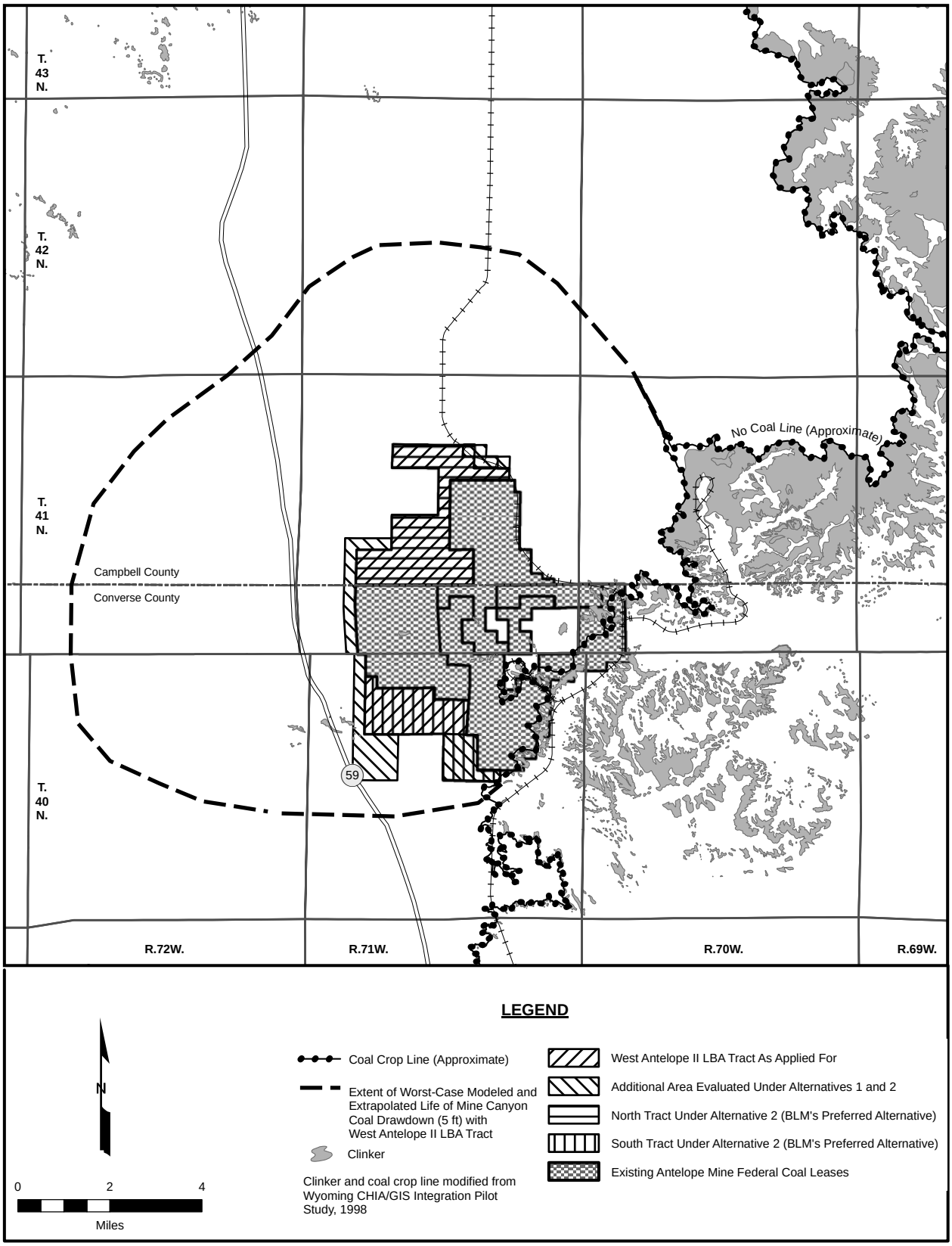


Figure ES-6. Life of Mine Drawdown Map, Resulting from Currently Approved Mining with Addition of the West Antelope II LBA Tract.

Wetland inventories have been completed on the West Antelope II general analysis area. Approximately 42.9 acres of wetlands and other waters of the U.S. have been identified. The majority of the wetlands are associated with the Antelope Creek, Horse Creek, and Spring Creek stream channels. The majority of the channel other waters of the U.S. are associated with the ephemeral stream channels present on the area. Existing wetlands located in the LBA tract would be destroyed by mining operations. Jurisdictional wetlands that are disturbed by mining must be replaced during the reclamation process.

Consequences to soil resources from mining the LBA tract would include changes in the physical, biological, and chemical properties. Following reclamation, the soils would be unlike premining soils in texture, structure, color, accumulation of clays, organic matter, microbial populations, and chemical composition. The replaced topsoil would be more uniform in type, thickness, and texture. It would be adequate in quantity and quality to support planned postmining land uses (i.e., wildlife habitat and rangeland).

The predominant vegetation types, in terms of total acres of occurrence in the vegetation analysis area are the blue grama upland (41.65 percent) and blue grama roughland (20.36 percent), which occur primarily on the level uplands and adjacent breaks. Mining would progressively remove this native vegetation. Reclamation and revegetation of mined areas would occur contemporaneously with mining on adjacent lands. Reestablished vegetation would be dominated by species mandated in the reclamation seed mixtures, which are approved by the WDEQ/LQD. The majority of these species would be native to the LBA tract. Initially, the reclaimed land would be dominated by grassland vegetation, which would be less diverse than the premining vegetation. Estimates for the time it would take to restore sagebrush to premining density levels range from 20 to 100 years. An indirect long-term impact associated with this vegetative change would potentially be a decrease in available habitat for shrub dependent species. However, a diverse, productive, and permanent vegetative cover would be established on the LBA tract following reclamation and prior to release of the final reclamation bond. The decrease in plant diversity would not seriously affect the potential productivity of the reclaimed areas, and the proposed postmining land uses (wildlife habitat and rangeland) should be achieved even with the changes in vegetation composition and diversity. The reclamation plans for the LBA tract would also include steps to control invasion by weedy (invasive, nonnative) plant species.

Direct impacts of surface coal mining on wildlife occur during mining and are short term. They include road kills by mine-related traffic, direct losses of less mobile wildlife species, restrictions on wildlife movement created by fences, spoil piles and pits, displacement of wildlife from existing habitat in areas of active mining (including abandonment of nests or nesting and breeding habitat for birds), increased competition between animals in areas adjacent to mining operations, and increased noise, dust, and human presence. Habitat for aquatic species would also be lost during mining operations. Indirect impacts

are longer term and include alterations in topography and vegetative cover following reclamation which may decrease wildlife carrying capacity and habitat diversity. The West Antelope II LBA tract does not include any unique or crucial big game habitat, and habitat disturbance would be incremental, with reclamation progressing as new disturbance occurs. The West Antelope II general analysis area is not located within or near sage-grouse core breeding areas identified by the Wyoming Statewide Sage-Grouse Implementation Team. More than 25 years of annual monitoring have documented that sage-grouse do not inhabit the West Antelope II general analysis area, and habitat for this species within the general analysis area is of minimal quantity and marginal quality. In the long term, following reclamation, wildlife carrying capacity and habitat diversity may be reduced due to flatter topography, less diverse vegetative cover, and reduction in sagebrush density.

T&E plant and animal species that could be present on the tract include the Ute ladies'-tresses orchid and black-footed ferret. Areas of suitable habitat for the Ute ladies'-tresses orchid within the West Antelope II LBA tract and adjacent study area were surveyed in August 2006, in July and August 2007, and in August 2008 and no individuals were located. The black-footed ferret is a nocturnally active mammal that depends almost entirely upon the prairie dog for its survival. The West Antelope II EIS study area and its perimeter harbor some small prairie dog colonies, but black-footed ferrets have never been documented at the mine or in the surrounding region during surveys conducted over the last 20 plus years by a variety of private, state, and federal entities. The lack of black-footed ferret observations or scat in the EIS study area leads to the conclusion that ferrets are not present in the area.

Active mining would preclude other land uses. Recreational and grazing use of the LBA tract would be severely limited during mining. Oil and gas development would be curtailed and CBNG that is not recovered prior to mining would be vented and irretrievably lost as the coal is removed. Access to approximately 240 acres of USDA-FS-administered federal surface included in the West Antelope II LBA tract under Alternatives 1 and 2 would be limited if that land is leased and mined. Approximately 100 of those acres are within the current Antelope Mine permit area and access to the public is currently limited on those lands as a result. Within 10 years after initiation of each reclamation phase, rangeland and wildlife use would return to near premining levels. The cumulative impacts of energy development (coal mining, oil and gas) in the PRB will continue to contribute to a reduction in hunting opportunities for some animals (pronghorn, mule deer, and sage-grouse).

The West Antelope II general analysis area has been entirely surveyed for cultural resources at the Class III level. Of the eighty-two cultural sites that have been documented within the West Antelope II general analysis area, 63 were evaluated as not eligible for nomination to the National Register of Historic Places (NRHP). Eight sites were evaluated as eligible for nomination to the NRHP. The remaining 11 sites will require additional evaluation and/or Native American consultation. Approximately 1,140 acres within the general

analysis area were surveyed for cultural resources at the Class III level in October 2008. Agency archaeologists are reviewing the results of that inventory, and site evaluations and assessment of potential effects and mitigation needs will be detailed in the Conditions of Approval accompanying the Record of Decision. Of the seven cultural sites documented by the recorder within the 1,140 acres, four were recommended as eligible for the NRHP. Until consultation with SHPO has occurred and agreement regarding NRHP eligibility has been reached, all cultural sites within the West Antelope II general analysis area would be protected from disturbance.

No sites of Native American religious or cultural importance have been identified on the LBA tract. If such sites or localities are identified at a later date, appropriate action must be taken to address concerns related to those sites.

Mining activities on the West Antelope II LBA tract would be visible from Wyoming Highway 59 and several county roads. Mining would affect landscapes classified by BLM as VRM Class IV, and the landscape character would not be significantly changed following reclamation. No unique visual resources have been identified on or near the LBA tract.

There are occupied dwellings and businesses in the vicinity of the West Antelope II LBA tract (Figure ES-5). The nearest occupied residence (the Don Jacobs residence) is approximately 2,800 feet west of the westernmost extent of the tract. If the tract is leased and mined, mining operations could be approximately 2,000 feet closer to this residence than the current lease would allow. Wildlife in the immediate vicinity of mining may be adversely affected; however, anecdotal observations at surface coal mines in the area indicate that some wildlife may adapt to increased noise associated with coal mining activity. After mining and reclamation are completed, noise would return to premining levels.

Leasing the West Antelope II LBA tract would extend the length of time that coal is shipped from the permitted Antelope Mine, which would extend the length of time that coal transportation facilities would be required under the Proposed Action or Alternatives 1 or 2. State Highway 59 crosses the southwestern corner of the south block of the tract under Alternatives 1 and 2. County Road 37 crosses the southeastern corner of the south block of the tract under Alternatives 1 and 2. Lands within 100 feet of the outside line of the ROW of a public road are considered unsuitable for mining; however, they could be included in the West Antelope II LBA tract to allow recovery of economically mineable coal outside of the ROW and buffer zone. Active pipelines and utility/power transmission lines would have to be relocated in accordance with previous agreements, or agreements would have to be negotiated for their removal or relocation.

Royalty and bonus payments for the coal in the LBA tract would be collected by the federal government and split with the state. Assuming an average coal

price of $9.01 per ton recovered and a potential range of bonus payments of $0.30 to $0.97 per ton, the potential additional federal revenues would range from approximately $511 to $766 million, depending on the alternative selected and the bonus price at the time the coal is leased. Potential revenue to the state would range from approximately $686 to $977 million. Mine life, and thus employment, would be extended by up to 13 years at Antelope Mine.

With regard to Environmental Justice issues, economic and demographic data indicate that neither minority populations nor people living at or below the poverty level make up "meaningfully greater increment" of the total population in Gillette, Wright, Campbell County, Douglas or Converse County than they do in the state as a whole. Also, the Native American population is smaller than in the state as a whole and there are no known Native American sacred sites on or near the study area for the West Antelope II LBA tract.

Under the No Action Alternative, the coal lease application would be rejected and the area contained in the application would not be offered for lease at this time. The tract could be nominated for lease again in the future. Under the No Action Alternative, the impacts described in the preceding paragraphs to topography and physiology, geology and minerals, soils, air quality, water resources, AVFs, wetlands, vegetation, wildlife, T&E species, land use and recreation, cultural resources, Native American concerns, paleontological resources, visual resources, noise, transportation, and socioeconomics would occur on the existing Antelope Mine coal leases, but these impacts would not be extended onto the West Antelope II LBA tract. Portions of the LBA tract adjacent to the existing mine would be disturbed to recover the coal in the existing leases.

If impacts are identified during the leasing process that are not mitigated by existing required mitigation measures, BLM can include additional mitigation measures, in the form of stipulations on the new lease, within the limits of its regulatory authority. BLM has not identified additional special stipulations that should be added to the BLM lease or areas where additional or increased monitoring measures are recommended.

Cumulative impacts result from the incremental impacts of an action added to other past, present, and reasonably foreseeable future actions, regardless of who is responsible for such actions. Cumulative impacts can result from individually minor, but collectively significant, actions occurring over time.

Since decertification of the Powder River Federal Coal Region in 1990, 19 coal leases containing more than five billion tons of federal coal have been issued following competitive sealed-bid sales. Four exchanges of federal coal in the Wyoming portion of the Powder River Federal Coal Region have also been completed. Additional coal lease applications, including the West Antelope II application, are currently pending. The pending LBA applications contain approximately 4.5 billion tons of coal.

Currently, BLM is completing a regional technical study, called the PRB Coal Review, to help evaluate the cumulative impacts of coal and other mineral development in the PRB. The study evaluates current conditions as of a baseline year (2003) and projects development levels and potential associated cumulative impacts related to coal and coal-related development, oil and gas and oil- and gas-related development, and other development through 2020. Due to variables associated with future coal production, two projected coal production scenarios (representing an upper and a lower production level) were developed. The projected development levels are based on projected demand and coal market forecasts and include production at the Antelope Mine during the baseline year and projected production for the mine for 2010, 2015, and 2020.

The Wyoming portion of the PRB is the primary focus of the PRB Coal Review, but the Montana portion of the PRB is included in some studies. A series of reports has been prepared (some reports in the series are in preparation) to present the results of the PRB Coal Review studies. The results of the PRB Coal Review studies that have been completed are summarized in Section 4.0 of this EIS.

Cumulative impacts vary by resource, with potential impacts to air quality, groundwater quantity, wildlife habitat, and socioeconomics generally being the greatest concerns.

The PRB Coal Review air quality study documents the modeled air quality impact of existing operations during 2002 and of projected development activities in 2010. The model was used to evaluate impacts of existing and projected source emissions on several source groups, including near-field receptors in Wyoming and Montana, receptors in nearby federally designated "Class I" areas, and receptors at "Class II" sensitive areas. The EPA guideline CALPUFF model system was used for the modeling analysis.

The existing regional air quality conditions are generally very good, but the modeling showed some substantial impacts at some receptors for 2002 and 2010. Table ES-3 presents the maximum modeled impacts on ambient air quality at the near-field receptors in Wyoming and Montana for 2002 and for the 2010 upper and lower coal development scenarios. Table ES-4 lists the projected modeled visibility impacts for 2002 for all analyzed Class I and sensitive Class II areas. For the upper and lower coal production scenarios, it shows the number of additional days that the projected impacts were greater than 1.0 dv (10 percent in extinction) for each site in 2010.

The PRB Coal Review groundwater and surface water studies are in progress, but a number of modeling analyses have previously been conducted to help predict the impacts of surface coal mining on groundwater resources in the

Table ES-3. Projected Maximum Potential Near-field Impacts (μg/m³).

Pollutant	Averaging Time	Base Year (2002) Impacts	2010 Lower Coal Production Scenario Impacts	2010 Upper Coal Production Scenario Impacts	NAAQS	Wyoming AAQS	Montana AAQS	PSD Class II Increments
Wyoming Near-field								
NO_2	Annual	37.3	42.4	49.0	100	100	--[1]	25
SO_2	Annual	3.9	4.8	5.6	80	60	--[1]	20
	24-hour	14.5	33.5	34.8	365	260	--[1]	91
	3-hour	37.9	148.0	154.2	1,300	1300	--[1]	512
PM_{10}	Annual	42.7	49.0	**56.6**	--[2]	50	--[1]	17
	24-hour	**335.5**	**378.8**	**439.9**	150	150	--[1]	30
Montana Near-field								
NO_2	Annual	8.85	11.3	11.8	100	--[1]	100	25
	1-hour	365.8	415.9	519.5	--	--[1]	564	--
SO_2	Annual	1.3	2.3	2.7	80	--[1]	80	20
	24-hour	18.9	19.5	20.4	365	--[1]	365	91
	3-hour	74.7	76.4	79.8	1,300	--[1]	1,300	512
	1-hour	240.7	246.4	257.3	--	--[1]	1,300	--
PM_{10}	Annual	19.6	22.5	27.7	--[2]	--[1]	50	17
	24-hour	**175.8**	**200.0**	**247.7**	150	--[1]	150	30

1 No standard or increment.

2 On September 21, 2006, the EPA announced final revisions to the NAAQS for particulate matter, which were published in the Federal Register on October 17, 2006 and took effect December 18, 2006. The revision not only strengthened the 24-hour $PM_{2.5}$ standard from 65 to 35 ug/m³, but also revoked the annual PM_{10} standard of 50 μg/m³. Wyoming will enter into rulemaking to revise the Wyoming Ambient Air Quality Standards. Until that time, however, Wyoming will retain the 50 ug/m³ annual PM_{10} standard. See additional discussion in Chapter 3, Section 3.4.2.1.

Bold values indicate projected exceedances of AAQS.

Source: PRB Coal Review Task 3A Report (BLM 2006a)

Table ES-4. Modeled Change in Visibility Impacts at Class I and Sensitive Class II Areas.

Location	2002 No. of Days >10%	2010 Lower Coal Production Scenario Change in No. of Days > 10%	2010 Upper Coal Production Scenario Change in No. of Days > 10%
Federally and Tribally Designated Class I Areas			
Badlands National Park [1]	238	19	26
Bob Marshall WA	12	2	4
Bridger WA	47	4	7
Fitzpatrick WA	42	3	5
Fort Peck Indian Reservation	69	8	9
Gates of the Mountain WA	14	6	7
Grand Teton National Park	26	2	5
North Absaorka WA	47	6	6
North Cheyenne Indian Reservation	305	5	10
Red Rock Lakes	16	3	5
Scapegoat WA	14	4	4
Teton WA	40	4	5
Theodore Roosevelt National Park	98	15	22
UL Bend WA	49	4	5
Washakie WA	53	2	3
Wind Cave National Park	261	11	15
Yellowstone National Park	42	7	8
Sensitive Class II Areas			
Absaorka Beartooth WA	53	3	5
Agate Fossil Beds National Monument	199	26	30
Big Horn Canyon National Rec. Area	108	7	8
Black Elk WA	263	16	22
Cloud Peak WA	137	8	8
Crow Indian Reservation	284	10	15
Devils Tower National Monument	279	15	21
Fort Belknap Indian Reservation	46	3	4
Fort Laramie National Historic Site	153	27	30
Jedediah Smith WA	23	1	2
Jewel Cave National Monument	267	14	18
Lee Metcalf WA	25	2	4
Mount Naomi WA	8	6	8
Mount Rushmore National Monument	248	19	25
Popo Agie WA	47	7	8
Soldier Creek WA	223	23	29
Wellsville Mountain WA	6	5	7
Wind River Indian Reservation	66	12	15

[1] The U.S. Congress designated the Wilderness Area portion of Badlands National Park as a mandatory Federal PSD Class I area. The remainder of Badlands National Park is a PSD Class II area.

Source: PRB Coal Review Task 3A Report (BLM 2006a)

PRB. In addition, each mine must monitor groundwater levels in the coal and underlying and overlying aquifers and assess the probable hydrologic consequences of mining as part of the mine permitting process. The monitoring programs track the extent of groundwater drawdown propagation to the west and the extent of recharge and quality of the water in the backfill areas of the mines. The monitoring data indicate that recharge is occurring in the backfill and that water from the backfill will generally be acceptable for premining use, which is primarily livestock watering. Modeling and monitoring indicate that the groundwater drawdown impacts of coal mining and CBNG development are overlapping.

The PRB Coal Review studies include an evaluation of the impacts to wildlife and aquatic species as of 2003 and an evaluation of the projected levels of disturbance in the PRB in 2010, 2015, and 2020, based on the projected development levels in those years. Impacts to wildlife and fisheries can be classified as short-term and long-term. Short-term impacts are related to habitat disturbance during project development and operation. Long-term impacts result from changes in habitat after reclamation is completed. Habitat fragmentation can result from activities such as roads, well pads, mines, pipelines, and electrical power lines, as well as increased noise, elevated human presence, dispersal of noxious and invasive weed species, and dust from unpaved road traffic.

The PRB Coal Review used the Regional Economic Models Inc. (REMI) Policy Insight regional economic model to project cumulative employment and population levels and associated impacts in the PRB for the upper and lower coal production scenarios in 2010, 2015, and 2020. Table ES-5 presents the recent and projected population levels for the counties included in the PRB Coal Review socioeconomic analysis.

Table ES-5. Recent and Projected PRB Population.

YEAR	Campbell County	Converse County	Crook County	Johnson County	Sheridan County	Weston County	Six County PRB Total
				Census			
2000	33,698	12,104	5,895	7,108	26,606	6,642	92,053
2003	36,381	12,326	5,971	7,530	27,116	6,665	95,989
2006	38,934	12,866	6,255	8,014	27,673	6,762	100,504
				Lower Coal Production Scenario			
2010	45,925	13,103	6,542	8,389	28,459	7,108	109,526
2015	48,905	13,671	6,759	8,867	30,016	7,174	115,392
2020	50,995	14,193	6,989	9,326	31,467	7,208	120,178
				Upper Coal Production Scenario			
2010	47,662	13,160	6,570	8,424	28,579	7,137	111,532
2015	51,558	13,763	6,802	8,924	30,214	7,219	118,480
2020	54,943	14,313	7,045	9,403	31,733	7,266	124,703

Source: U.S. Census Bureau (2006b - historical data) and PRB Coal Review Task 3C Report (BLM 2005e)

This EIS presents the BLM's analysis of environmental impacts under authority of the NEPA and associated rules and guidelines. The BLM will use this analysis to make a leasing decision. The decision to lease these lands is a necessary requisite for mining, but is not in itself the enabling action that will allow mining. The most detailed analysis prior to mine development would occur after the lease is issued, when the lessee files an application for a surface mining permit and mining plan approval, supported by extensive proposed mining and reclamation plans, to the WDEQ/LQD.

1.0 INTRODUCTION

This EIS[1] analyzes the environmental impacts of leasing a tract of federal coal reserves adjacent to the Antelope Mine, an operating surface coal mine in the south-central PRB of Wyoming. The Antelope Mine is operated by ACC, a directly held subsidiary of Rio Tinto Energy. ACC filed an application to lease the federal coal included in a maintenance coal tract under the regulations at 43 CFR 3425, Leasing On Application. The Division of Minerals and Lands at the BLM Wyoming State Office reviewed the application and determined that the lease application meets the regulatory requirements for an LBA. The tract is referred to as the West Antelope II LBA tract. Figure 1-1 shows the West Antelope II LBA tract as applied for by ACC, other currently pending LBA tracts, and the existing federal leases, including previously leased LBA tracts, in the Wyoming PRB.

1.1 Background

On April 6, 2005, ACC filed an application with the BLM for federal coal reserves in a tract located west of and immediately adjacent to the Antelope Coal Mine in Campbell and Converse Counties, Wyoming, approximately 20 miles southeast of Wright, Wyoming and 55 Miles north of Douglas, Wyoming (Figure 1-1). The tract, which is referred to as the West Antelope II LBA tract, was assigned case file number WYW163340. The federal coal reserves were applied for as a maintenance tract for the Antelope Mine. The Antelope Mine is operated by ACC, a directly held subsidiary of Rio Tinto Energy America (formerly Kennecott Energy and Coal Company).

The West Antelope II LBA tract is located within the Powder River Federal Coal Region, which was decertified in January, 1990. Although the Powder River Federal Coal Region is decertified, the PRRCT, a federal/state advisory board established to develop recommendations concerning management of federal coal in the region, has continued to meet regularly and review all federal lease applications in the region. The PRRCT reviewed this maintenance coal lease application at a public meeting held on April 27, 2005 in Gillette, Wyoming. The PRRCT recommended that the BLM process the West Antelope II lease application.

In order to process an LBA, the BLM must evaluate the quantity, quality, maximum economic recovery, and fair market value of the federal coal and fulfill the requirements of NEPA by evaluating the environmental impacts of leasing the federal coal. BLM does not authorize mining by issuing a lease for federal coal, but the impacts of mining the coal are considered in this EIS because it is a logical consequence of issuing a maintenance lease to an existing mine. This EIS has been prepared to evaluate the site-specific and cumulative environmental impacts of leasing and developing the federal coal included in the application area. BLM will use the analysis in this EIS to decide whether to hold a competitive,

[1] Refer to page xvi for a list of abbreviations and acronyms used in this document.

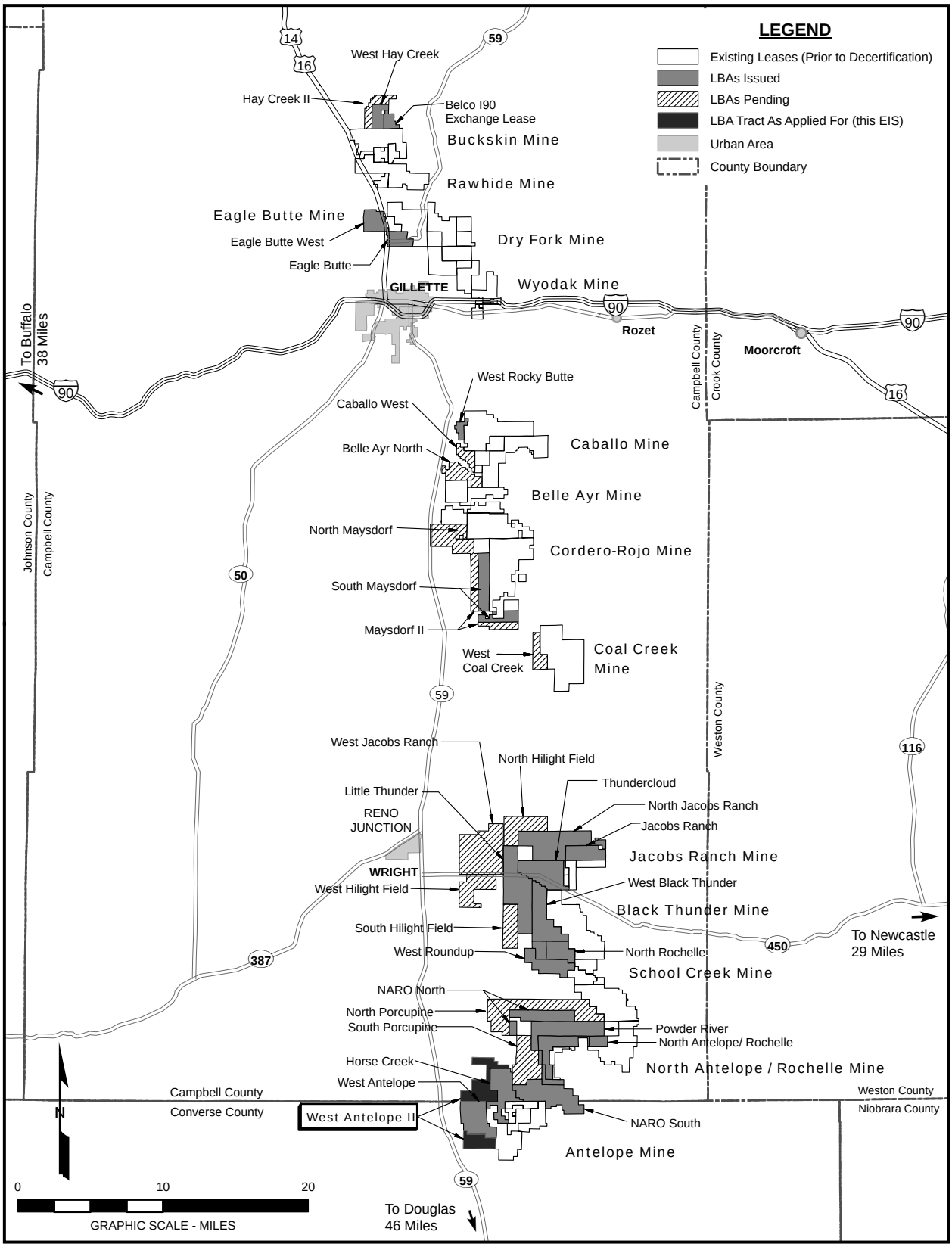


Figure 1-1. General Location Map with Federal Coal Leases and LBA Tracts.

sealed-bid lease sale for the tract as applied for, hold a competitive, sealed-bid lease sale for a modified tract, or reject the lease application and not offer the tract for sale at this time. A Record of Decision will be issued and, if the decision is to offer the tract for lease, then a sale will be held. If a sale is held, the bidding at the sale would be open to any qualified bidder; it would not be limited to the applicant.

If the lease sale is held, a lease would be issued to the highest bidder at the sale if a federal sale panel determines that the high bid meets or exceeds the fair market value of the coal as determined by BLM's economic evaluation and if the U.S. Department of Justice determines that there would be no antitrust violations if a lease is issued to the high bidder.

In return for receiving a lease, a lessee must pay the federal government a bonus equal to the amount it bids at the time the lease sale is held (the bonus can be paid in five yearly installments), make annual rental payments to the federal government, and make royalty payments to the federal government when the coal is mined. Federal bonus, rental, and royalty payments are equally divided with the state in which the lease is located.

Other agencies may use this analysis to make decisions related to leasing and mining the federal coal in this tract. OSM, USDA-FS, WDEQ/AQD, WDEQ/LQD, and the Converse County Board of Commissioners are cooperating agencies on this EIS. OSM has primary responsibility to administer federal programs that regulate surface coal mining operations and will use this EIS to make decisions related to the approval of the MLA mining plan if the tract is leased. USDA-FS must consent to leasing the federal coal before BLM can make a decision to hold a federal coal lease sale if any of the lands in the TBNG, which they administer, are included in the tract that is leased. WDEQ has entered into a cooperative agreement with the Secretary of the Interior to regulate surface coal mining operations on federal and non-federal lands within the State of Wyoming. The responsibilities of the Converse County Board of Commissioners include, but are not limited to, management and oversight of county roads and facilities and zoning rules in the county.

Since decertification of the Powder River Federal Coal Region, 19 federal coal leases have been sold at competitive sealed-bid sales and four exchanges of federal coal in the Wyoming portion of the Powder River Federal Coal Region have been completed (Table 1-1). This is the fourth application for a maintenance coal tract submitted by the ACC since decertification (Table 1-1 and Figure 1-1).

Table 1-2 summarizes the lease applications that are currently pending.

The West Antelope II LBA tract as applied for and the existing federal coal leases in the adjacent Antelope Mine are shown in Figure 1-2. As applied for, the West Antelope II LBA tract consists of two separate blocks of federal coal and includes

Table 1-1. Leases Issued and Exchanges Completed Since Decertification, Powder River Basin, Wyoming.

Leases Issued			
LBA Name (Lease Number) **Applicant Mine** **Current Lessee** **Effective Date**	**Acres Leased[1]**	**Mineable Tons of Coal[1]**	**Successful Bid**
Jacobs Ranch LBA (WYW117924) Jacobs Ranch Mine Jacobs Ranch Coal Co. 10/1/1992	1,708.620	147,423,560	$20,114,930.00
West Black Thunder LBA (WYW118907) Black Thunder Mine Thunder Basin Coal Co. 10/1/1992	3,492.495	429,048,216	$71,909,282.69
North Antelope/Rochelle LBA (WYW119554) North Antelope & Rochelle Mines Powder River Coal Co. 10/1/1992	3,064.040	403,500,000	$86,987,765.00
West Rocky Butte LBA (WYW122586) No Existing Mine[2] Caballo Coal Co. 1/1/1993	463.205	56,700,000	$16,500,000.00
Eagle Butte LBA (WYW124783) Eagle Butte Mine Foundation Wyoming Land Co. 8/1/1995	1,059.180	166,400,000	$18,470,400.00
Antelope LBA (WYW128322) Antelope Mine Antelope Coal Co. 2/1/1997	617.200	60,364,000	$9,054,600.00
North Rochelle LBA (WYW127221) North Rochelle Mine Ark Land Co. 1/1/1998	1,481.930	157,610,000	$30,576,340.00
Powder River LBA (WYW136142) North Antelope Rochelle Mine Powder River Coal Co. 9/1/1998	4,224.225	532,000,000	$109,596,500.00
Thundercloud LBA (WYW136458) Jacobs Ranch Mine Thunder Basin Coal Co., LLC 1/1/1999	3,545.503	412,000,000	$158,000,008.50
Horse Creek LBA (WYW141435) Antelope Mine Antelope Coal Co. 12/1/2000	2,818.695	275,577,000	$91,220,120.70
North Jacobs Ranch LBA (WYW146744) Jacobs Ranch Mine Jacobs Ranch Coal Co. 5/1/2002	4,982.240	537,542,000	$379,504,652.00

Table 1-1. Leases Issued and Exchanges Completed Since Decertification, Powder River Basin, Wyoming (Continued).

LBA Name (Lease Number) Applicant Mine Current Lessee Effective Date	Acres Leased[1]	Mineable Tons of Coal[1]	Successful Bid
NARO South LBA (WYW154001) North Antelope Rochelle Mine BTU Western Resources, Inc. 9/1/2004	2,956.725	297,469,000	$274,117,684.00
West Hay Creek LBA (WYW151634) Buckskin Mine Kiewit Mining Properties, Inc. 1/1/2005	921.158	142,698,000	$42,809,400.00
Little Thunder LBA (WYW150318) Black Thunder Mine Ark Land LT Co. 3/1/2005	5,083.500	718,719,000	$610,999,949.80
West Antelope LBA (WYW151643) Antelope Mine Antelope Coal Co. 3/1/2005	2,809.130	194,961,000	$146,311,000.00
NARO North LBA (WYW150210) North Antelope Rochelle Mine BTU Western Resources, Inc. 3/1/2005	2,369.380	324,627,000	$299,143,785.00
West Roundup LBA (WYW151134) North Rochelle Mine West Roundup Resources, Inc 5/1/2005	2,812.51	327,186,000	$317,697,610.00
Eagle Butte West LBA (WYW155132) Eagle Butte Mine Foundation Wyoming Land Co. 5/1/2008	1,427.77	255,000,000	$180,540,000.00
South Maysdorf LBA (WYW174407) Cordero Rojo Mine Cordero Mining Co. 8/1/2008	2,900.240	288,082,000	$250,800,000.00
TOTALS	**48,737.746**	**5,726,906,776**	**$3,114,354,027.69**

Exchanges Completed

Exchange Name Case File Number Exchange Proponent Exchange Type Effective Date	Acres Exchanged	Mineable Tons of Coal	Federal Coal Exchanged for:
EOG (Belco) I-90 Lease Exchange WYW150152 EOG Resources (formerly Belco)[3] I-90 Lease Exchanged for New Lease 4/1/2000	599.170	106,000,000	Lease rights to Belco I-90 Lease (WYW0322794).

Table 1-1. Leases Issued and Exchanges Completed Since Decertification, Powder River Basin, Wyoming (Continued).

Exchange Name **Case File Number** **Exchange Proponent** **Exchange Type** **Effective Date**	**Acres Exchanged**	**Mineable Tons of Coal**	**Federal Coal Exchanged for:**
Pittsburg & Midway Coal Exchange WYW148816 Pittsburg and Midway Coal Mining Co. Private Land Exchanged for Federal Coal 1/27/2005	2,045.530	84,200,000	6,065.77 acres of land and some minerals in Lincoln, Carbon, and Sheridan Counties, Wyoming.
Gold Mine Draw Lease Exchange WYW0321779, WYW154001 Powder River Coal Co.	623.000	47,700,000	Lease rights to 921.60 acres of leased federal coal underlying an AVF.
AVF Lease Exchanged for New Lease 6/25/2006			
TOTALS	**3,267.700**	**237,900,000**	

[1] Information from Sale Notice.
[2] The West Rocky Butte LBA was originally leased to Northwestern Resources Co.
[3] The EOG Resources Belco Exchange lease is now owned by the Buckskin Mine.

Table 1-2. Pending LBAs and Exchanges, Powder River Basin, Wyoming.

Pending LBAs

LBA Name Lease Number Applicant Mine	Application Date	Acres as Applied for	Estimated as Applied for Coal (mmt)	Status
North Maysdorf WYW154432 Cordero Rojo Mine	9/20/2001 Revised on 11/8/2004	445.89	54.66[1]	Sales 10/18/2007 and 3/19/08 Bids Rejected
Belle Ayr North WYW161248 Belle Ayr Mine	7/06/2004	1,578.7	200.00[2]	DEIS available 10/17/2008
West Antelope II WYW163340 Antelope Mine	4/06/2005	4,108.60	429.70[3]	DEIS available 2/8/08FEIS in Preparation
North Hilight Field WYW164812 Black Thunder Mine	10/07/2005 Revised 10/16/2007	2,613.50	588.20[2] (North and South)	Scoping period ended 9/3/2007 DEIS in Preparation
South Hilight Field WYW174596 Black Thunder Mine	10/07/2005 Revised 10/16/2007	1,976.69	See above	Scoping period ended 9/3/2007 DEIS in Preparation
West Hilight Field WYW172388 Black Thunder Mine	1/17/2006	2,370.52	428.00[2]	Scoping period ended 9/3/2007 DEIS in Preparation
West Coal Creek WYW172585 Coal Creek Mine	2/10/2006	1,151.26	57.00[2]	DEIS available 10/17/2008
Caballo West WYW172657 Caballo Mine	3/15/2006	777.49	87.52[1]	DEIS available 10/17/2008
West Jacobs Ranch WYW172685 Jacobs Ranch Mine	3/24/2006	5,944.37	956.00[3]	Scoping period ended 9/3/2007 DEIS in Preparation
Hay Creek II WYW172684 Buckskin Mine	3/24/2006 Revised 5/19/2008	1,088.73	140.00[1]	Scoping period ended 3/29/2008DEIS in preparation
Maysdorf II WYW173360 Cordero Rojo Mine	9/1/2006	4,653.80	483.00[3]	DEIS available 10/17/2008
North Porcupine WYW173408 N. Antelope/Rochelle Mine	9/29/2006 Modified 10/12/2007	8,981.74 (North and South)	1,097.00 (North and South)	Scoping period ended 9/3/2007 DEIS in Preparation
South Porcupine WYW176095 N. Antelope/Rochelle Mine	9/29/2006 Modified 10/12/2007	See above	See above	Scoping period ended 9/3/2007 DEIS in preparation
TOTALS		**35,691.29**	**4,521.08**	

1 Estimated tons of mineable coal as reported in the lease application.
2 Estimated tons of recoverable coal as reported by the applicant.
3 Estimated tons of in-place coal as reported in the lease application.

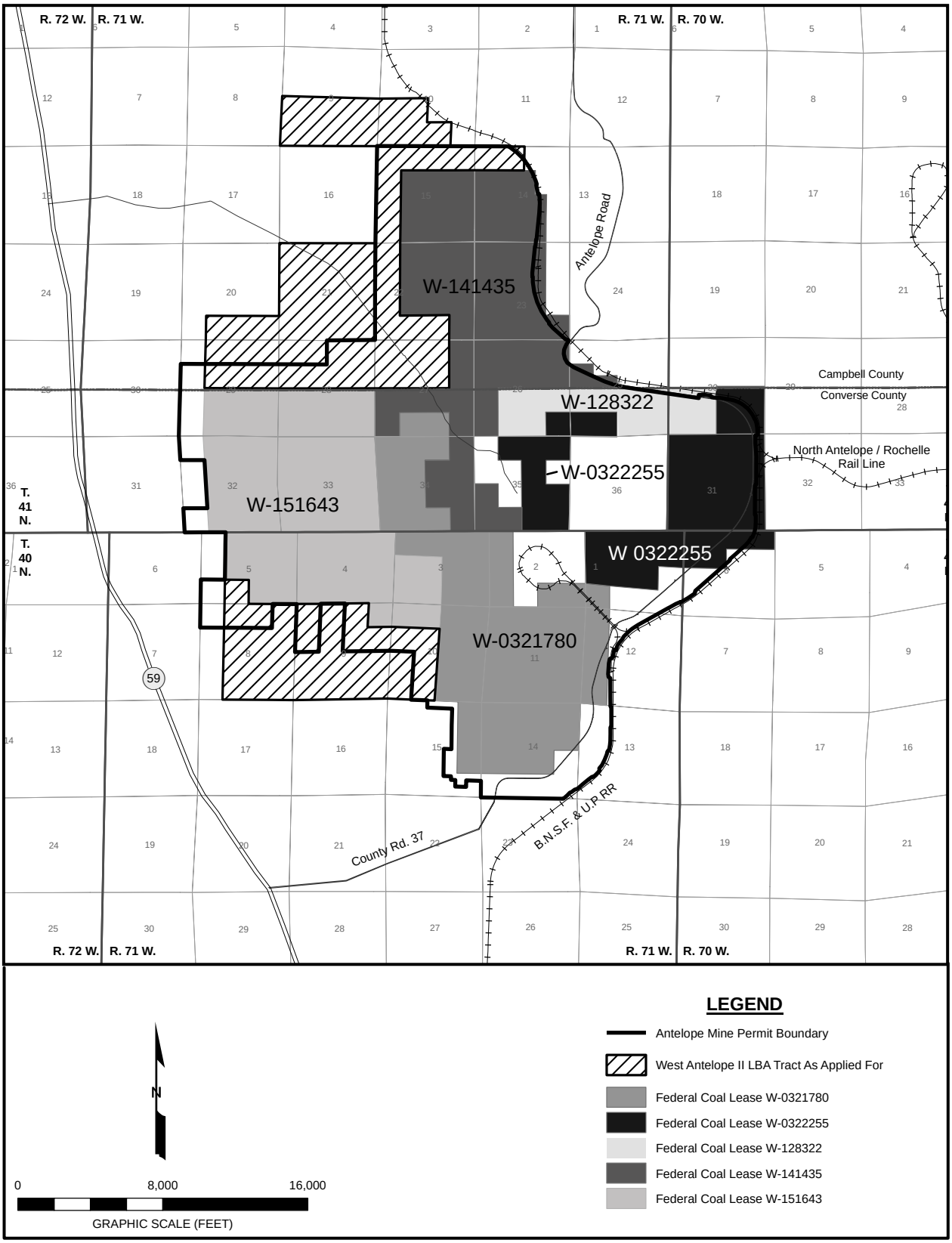


Figure 1-2. Federal Coal Leases and West Antelope II LBA Tract as Applied for.

approximately 4,108.6 acres with an estimated 429.7 million tons of in-place coal reserves. ACC estimates that approximately 377.8 million tons of in-place coal reserves would be recovered from the West Antelope II LBA tract as applied for. As of January 2007, ACC estimates the in-place reserves on the existing Antelope Mine to be 428.6 million tons, of which 394.3 million tons are recoverable.

Antelope Mine's currently approved (by WDEQ/AQD) air quality permit allows mining of up to 42 million tons of coal per year. The Antelope Mine produced approximately 33.9 million tons of coal in 2006, 30.0 million tons of coal in 2005, 29.7 million tons of coal in 2004, 29.5 million tons of coal in 2003, 26.8 million tons of coal in 2002, and 24.6 million tons of coal in 2001 (Antelope Mine 2000, 2001, 2002, 2003, 2004, 2005, and 2006).

As discussed above, the West Antelope II LBA tract as applied for consists of two separate blocks, both of which are contiguous with the Antelope Mine (Figure 1-1). Portions of both blocks lie within current ACC mine permit boundaries (Figure 1-2). The area applied for is substantially similar to the adjacent mine for which detailed site-specific environmental data have been collected and for which environmental analyses have previously been prepared to secure the existing leases and necessary mining permits.

The surface of the West Antelope II LBA tract is owned by ACC, Barbara H. Dilts Living Trust et. al., Jerry J. and Barbara Dilts Family Ltd. Partnership and Bridle Bit Ranch Co., and Patricia L. Isenberger Litton. Current land uses of the tract include grazing by domestic animals and wildlife and gas production.

The mining method would be a combination of truck and shovel and dragline, which are the mining methods currently in use at this mine. The coal would be used primarily for electric power generation.

After mining, the land would be reclaimed to a rangeland function suitable for use by livestock and wildlife as is the current practice at the Antelope Mine. Industrial postmining land uses, which include but are not limited to oil and gas wells, pipelines, roads, and utility easements, also will be reestablished as required.

1.2 Purpose and Need for Action

BLM administers the federal coal leasing program under the Mineral Leasing Act of 1920. A federal coal lease grants the lessee the exclusive right to obtain a mining permit for, and to mine coal on, the leased tract subject to the terms of the lease, the mining permit, and applicable state and federal laws. Before a new lease can be mined, the lessee must obtain approval of a detailed permit to conduct mining operations.

This EIS is being prepared in response to an application BLM received from an existing mine, the Antelope Mine, to lease a tract of federal coal in the Wyoming PRB. In response to this coal lease application, the BLM must decide whether to

hold a competitive, sealed-bid lease sale for the tract as applied for, hold a competitive sealed-bid lease sale for a modified tract, or reject the current lease application and not offer the tract for sale at this time.

ACC has applied for the coal reserves in the West Antelope II LBA tract in order to extend the life of the Antelope Mine. If production continues at the current (2007) average annual coal production rate of about 36 mmtpy, the applicant estimates that the post-2006 recoverable reserves at the Antelope Mine would be depleted within approximately 11 years. If Antelope Mine acquires a lease for the West Antelope II LBA tract as applied for and maintains a similar production rate, the applicant estimates that mine life would be extended by an additional 11 years. If production increases to the permitted level of 42 mmtpy and ACC acquires the West Antelope II LBA tract, mining the LBA tract would extend production at the mine by an additional nine years.

If the LBA tract is leased to the applicant as a maintenance tract, the permit to conduct mining operations for the adjacent Antelope Mine would have to be amended to include the new lease area before it could be disturbed. This process takes several years to complete. ACC is applying for federal coal reserves now so that they can negotiate new contracts and then complete the permitting process in time to meet anticipated new contract requirements.

As discussed above, the purpose of ACC's application is to allow the Antelope Mine access to a continuing supply of low sulfur compliance coal, which it can continue to sell to power plants for the purpose of electric power generation. According to the Energy Information Administration, coal is currently responsible for about 50 percent of the total generation in the electric power sector (DOE 2006a, 2007a). Continued leasing of PRB coal enables coal-fired power plants to meet CAA requirements without constructing new plants, revamping existing plants, or switching to existing alternative fuels. This helps provide a stable supply of power to meet increasing demand without a potentially significant increase in power costs for individuals and businesses.

A primary goal of the National Energy Policy is to add energy supplies from diverse sources, including domestic oil, gas, and coal, as well as hydropower and nuclear power. BLM recognizes that the continued extraction of coal is essential to meet the nation's future energy needs. As a result, private development of federal coal reserves is integral to the BLM coal leasing program under the authority of the MLA, as well as FLPMA and FCLAA. The coal leasing program, managed by BLM, encourages the development of domestic coal reserves and reduction of the U.S. dependence on foreign sources of energy. As a result of the leasing and subsequent mining and sale of federal coal resources in the PRB, the public receives lease bonus payments, lease royalty payments, and a reliable supply of low sulfur coal for power generation.

This EIS analyzes the environmental impacts of issuing a federal coal lease and mining the federal coal in the West Antelope II maintenance coal lease application

as required by NEPA and associated rules and guidelines. A decision to hold a competitive sale and issue a lease for the lands in this application is a prerequisite for mining but it is not the enabling action that would allow mining to begin. The BLM does not authorize mining operations by issuing a lease. After a lease has been issued but prior to mine development, the lessee must file a permit application package with the WDEQ/LQD and OSM for a surface mining permit and approval of the MLA mining plan. An analysis of a detailed site-specific mining and reclamation plan occurs at that time. Authorities and responsibilities of the BLM and other concerned regulatory agencies are described in the following sections.

1.3 Regulatory Authority and Responsibility

The West Antelope II maintenance coal lease application was submitted and will be processed and evaluated under the following federal authorities:

- MLA, as amended;
- Multiple-Use Sustained Yield Act of 1960;
- NEPA;
- FCLAA;
- FLPMA; and
- SMCRA.

The BLM is the lead agency responsible for leasing federal coal lands under the MLA as amended by FCLAA and is also responsible for preparation of this EIS to evaluate the potential environmental impacts of issuing a coal lease.

OSM is a cooperating agency on this EIS. After a federal coal lease is issued, SMCRA gives OSM primary responsibility to administer programs that regulate surface coal mining operations and the surface effects of underground coal mining operations. WDEQ is also a cooperating agency on this EIS. Pursuant to Section 503 of SMCRA, the WDEQ developed, and in November 1980 the Secretary of the Interior approved, a permanent program authorizing WDEQ to regulate surface coal mining operations and surface effects of underground mining on nonfederal lands within the State of Wyoming. In January 1987, pursuant to Section 523(c) of SMCRA, WDEQ entered into a cooperative agreement with the Secretary of the Interior authorizing WDEQ to regulate surface coal mining operations and surface effects of underground mining on federal lands within the state.

Pursuant to the cooperative agreement, a federal coal lease holder in Wyoming must submit a permit application package to OSM and WDEQ/LQD for any proposed coal mining and reclamation operations on federal lands in the state. WDEQ/LQD reviews the permit application package to insure the permit application complies with the permitting requirements and the coal mining operation will meet the performance standards of the approved Wyoming program. OSM, BLM, and other federal agencies review the permit application package to insure it complies with the terms of the coal lease, the MLA, NEPA, and other

federal laws and their attendant regulations. If the permit application package does comply, WDEQ issues the applicant a permit to conduct coal mining operations. OSM recommends approval, approval with conditions, or disapproval of the MLA mining plan to the Assistant Secretary of the Interior, Land and Minerals Management. Before the MLA mining plan can be approved, the BLM must concur with this recommendation.

If a proposed LBA tract is leased to an existing mine, the lessee is required to revise its coal mining permit prior to mining the coal, following the processes outlined above. As a part of that process, a detailed new plan would be developed showing how the newly-leased lands would be mined and reclaimed. The area of mining disturbance would be larger than the newly-leased area to allow for activities such as overstripping, matching reclaimed topography to undisturbed topography, constructing flood control and sediment control facilities, and related activities. Specific impacts that would occur during the mining and reclamation of the LBA tract would be addressed in the mining and reclamation plan, and specific mitigation measures for anticipated impacts would be described in detail at that time.

WDEQ enforces the performance standards and permit requirements for reclamation during a mine's operation and has primary authority in environmental emergencies. OSM retains oversight responsibility for this enforcement. Where federal surface or coal resources are involved, BLM has authority in emergency situations if WDEQ or OSM cannot act before environmental harm and damage occurs. In preparing this EIS, BLM also has a responsibility to consult with and obtain the comments and assistance of other state and federal agencies that have jurisdiction by law or special expertise with respect to potential environmental impacts.

Appendix A presents other federal and state permitting requirements that must be satisfied to mine this LBA tract.

1.4 Relationship to BLM Policies, Plans, and Programs

In addition to the federal acts listed under Section 1.3, guidance and regulations for managing and administering public lands, including the federal coal lands in the ACC application, are set forth in 40 CFR 1500 (Protection of Environment), 43 CFR 1601 (Planning, Programming, Budgeting), and 43 CFR 3400 (Coal Management).

Specific guidance for processing applications is provided by BLM Manual 3420, Competitive Coal Leasing (BLM 1989) and the 1991 *Powder River Regional Coal Team Operational Guidelines For Coal Lease-By-Applications* (BLM 1991). The *National Environmental Policy Act Handbook* (BLM 1988) has been followed in developing this EIS.

1.5 Conformance with Existing Land Use Plans

FCLAA requires that lands considered for leasing be included in a comprehensive land use plan and that leasing decisions be compatible with that plan. The BLM *Approved Resource Management Plan for Public Lands Administered by the Bureau of Land Management Buffalo Field Office* (BLM 2001a), an update of the *Buffalo Resource Area Resource Management Plan* (BLM 1985a), governs and addresses the leasing of federal coal in Campbell County. The *Record of Decision and Approved Casper Resource Management Plan* (BLM 2007), an update of the *Platte River Resource Management Plan* (BLM 1985b), addresses the leasing of federal coal in Converse County. The *Land and Resource Management Plan for the Thunder Basin National Grassland, Medicine Bow-Routt National Forest, Rocky Mountain Region* (USDA-FS 2001) offers guidance for all resource management activities on the TBNG.

The major land use planning decision that BLM must make concerning the federal coal resources is a determination of which federal coal lands are acceptable for further consideration for leasing. There are four screening procedures that BLM uses to identify these coal lands. These screening procedures require BLM to:

- estimate development potential of the coal lands;
- apply the unsuitability criteria listed in the regulations at 43 CFR 3461;
- make multiple land use decisions that eliminate federal coal deposits from consideration for leasing to protect other resource values; and
- consult with surface owners who meet the criteria defined in the regulations at 43 CFR 3400.0-5 (gg) (1) and (2).

Only those federal coal lands that pass these screens are given further consideration for leasing. BLM has applied these coal screens to federal coal lands in the PRB several times, starting in the early 1980s. Most recently, in 1993, BLM began the process of reapplying these screens to federal coal lands in Campbell, Converse, and Sheridan Counties. This analysis, which includes the portion of Converse County where the Antelope Mine is located, was adopted in the 2001 BLM Buffalo RMP update (BLM 2001a) and the results were included as Appendix D of the update, which can be viewed in the 2001 documents section on the Wyoming BLM website at: http://www.blm.gov/wy/st/en/info/NEPA/documents.html. The coal screen was completed for use not only in updating the 1985 Buffalo RMP but also the TBNG planning documents. Appendix D of the 2001 RMP update was prepared in cooperation with the USDA-FS, Douglas Ranger District for lands within the TBNG. No revisions of the coal-screening determinations completed for the Buffalo Field Office RMP update are included in the approved Casper Field Office RMP and associated EIS (BLM 2007).

Under the first coal screening procedure, a coal tract must be located within an area that has been determined to have coal development potential in order to be acceptable for further consideration for leasing (43 CFR 3420.1-4(e)(1)). The West

Antelope II coal lease application is within the area identified as having coal development potential by the BLM in the coal screening analyses published in 2001 BLM Buffalo RMP update (BLM 2001a).

The second coal screening procedure requires the application of the coal mining unsuitability criteria listed in the federal coal management regulations at 43 CFR 3461. The coal mining unsuitability criteria were applied to high to moderate coal development potential lands in the Wyoming PRB, including the West Antelope II LBA tract and surrounding lands, during the coal screening conducted for the 2001 BLM Buffalo RMP update. Appendix B of this EIS summarizes the unsuitability criteria, describes the general findings for the 2001 BLM Buffalo RMP update, and presents a validation of these findings for the West Antelope II LBA tract.

The BNSF & UP railroad line crosses portions of the northern block of federal coal included in the West Antelope II LBA tract (Figure 1-2). As indicated in Appendix B, the lands in the West Antelope II LBA tract that are within the BNSF & UP railroad ROW and associated 100 foot buffer zone have been found to be unsuitable for mining under Unsuitability Criterion Number 2. Although lands within the railroad ROW have been determined to be unsuitable for mining, they are included in the LBA tract to allow recovery of all the mineable coal outside of the ROW and associated buffer zone and to comply with the coal leasing regulations, which do not allow leasing in less than 10-acre aliquot parts. A stipulation stating that no mining activity may be conducted in the portion of the lease within the BNSF & UP railroad ROW will be attached if a lease is issued for this tract. The exclusion of the coal underlying the railroad ROW from mining activity by lease stipulation honors the finding of unsuitability for mining under Unsuitability Criterion Number 2 for the BNSF & UP railroad ROW.

Unsuitability Criterion Number 3 states that lands within 100 ft of the outside line of the ROW of a public road shall be considered unsuitable for surface coal mining, with certain exceptions. No public roads cross the West Antelope II LBA tract as applied for (Figure 1-2). However, as discussed in Chapter 2, BLM evaluates alternate tract configurations as alternatives to the Proposed Action for NEPA purposes. In evaluating the West Antelope II application, BLM has identified a study area for the tract which includes the tract as applied for and adjacent unleased federal coal. As shown in Figure 2-1, portions of Converse County Road 37 and Wyoming State Highway 59 cross the southern end of the BLM study area for the West Antelope II LBA tract. The 2001 BLM Buffalo RMP update and the 2001 TBNG Land and Resource Management Plan (USDA-FS 2001) deferred a decision on the unsuitability of the Wyoming State Highway 59 and Converse County Road 37 ROWs and associated buffer zones until a leasing action occurred. As indicated in Appendix B, BLM has determined that the portions of the West Antelope II LBA tract which include Wyoming State Highway 59 and Campbell County Road 37, their ROWs, and a 100-ft buffer zone on either side of the ROWs must be considered unsuitable for mining under Unsuitability Criterion Number 3 at this time.

One of the exceptions to Unsuitability Criterion 3 allows surface coal mining in the ROW and buffer zone for a public road if the regulatory authority (or the appropriate public road authority designated by the regulatory authority) allows the public road to be relocated or closed after providing public notice and opportunity for a public hearing; and finding in writing that the interests of the affected public and landowners will be protected [30 CFR 761.11(d) and 43 CFR 3461.5(c)(iii)]. At this time, there are no proposals to relocate either Wyoming State Highway 59 or Converse County Road 37, and the exception does not apply.

Although the lands within the Wyoming State Highway 59 and Converse County Road 37 ROWs and associated buffer zones have been determined to be unsuitable for mining, they are included in the BLM study area for the West Antelope II LBA tract. If the portions of the tract that include the Wyoming State Highway 59 ROW and/or Converse County Road 37 are leased, including these lands in the tract would allow recovery of all the mineable coal adjacent to and outside of the highway buffer zones and would comply with the coal leasing regulations, which do not allow leasing in less than 10-acre aliquot parts. If a permit to relocate one or both of the roads is approved at some time in the future, including these lands in the tract would allow recovery of the coal underlying the public road ROWs and associated buffer zones. A stipulation stating that no mining activity may be conducted within the Wyoming State Highway 59 and Converse County Road 37 ROWs and associated 100-foot buffer zones unless a permit to move them is approved will be attached if a lease is issued for this tract. The exclusion of the coal underlying the public road ROWs and associated buffer zones from mining activity by lease stipulation honors the finding of unsuitability for mining under Unsuitability Criterion Number 3 for Wyoming State Highway 59 and Converse County Road 37.

There were no findings of unsuitability for the other criteria listed in the regulations; however, as indicated in Appendix B, several criteria will be further evaluated during the leasing process.

The third coal screening procedure, a multiple land use conflict analysis, must be completed to identify and "eliminate additional coal deposits from further consideration for leasing to protect resource values of a locally important or unique nature not included in the unsuitability criteria", in accordance with 43 CFR 3420.1-4(e)(3). The 2001 BLM Buffalo RMP update (BLM 2001a) addresses two types of multiple land use conflicts: municipal/residential conflicts and multiple mineral development (coal versus oil and gas) conflicts.

The West Antelope II LBA tract does not lie within or in proximity to an identified buffer zone surrounding an existing community. Therefore, no federal coal lands within the West Antelope II LBA tract have been eliminated from further consideration for leasing due to municipal/residential conflicts.

The 2001 BLM Buffalo RMP update includes two decisions related to multiple mineral development conflicts in Campbell, Converse and Sheridan Counties.

With respect to oil and gas leasing in coal mining areas, the RMP update determines that oil and gas tracts that would interfere with coal mining operations would not be offered for lease but that, where possible, oil and gas leases will be issued with specific conditions to prevent a development conflict with coal mining operations. With respect to coal leasing in oil and gas fields, the 2001 BLM Buffalo RMP update (BLM 2001a) states that coal leasing in producing oil and gas fields would be deferred unless or until coal development would not interfere with the economic recovery of the oil and gas resources, as determined on a case by case basis.

Both conventional and CBNG wells have been drilled within or around the West Antelope II LBA tract. BLM's evaluation of the potential for conflict with the development of oil and gas resources within the LBA tract is included in the Mineral Resources discussion in Section 3.3 of this EIS. BLM's policy and guidance on conflicts between surface coal mine and CBNG development is to optimize the recovery of both resources and ensure that the public receives a reasonable return, as explained in BLM Instruction Memorandum No. 2006-153 (BLM 2006d).

The fourth coal screening procedure requires consultation with surface owners who meet the criteria defined in the regulations at 43 CFR 3400.0-5 (gg) (1) and (2). Chapter 7 includes a definition of the term "qualified surface owner", based on these regulations. Surface owner consultation was conducted as part of the coal screening analysis published in the 2001 BLM Buffalo RMP update. Private surface owners in the Gillette coal development potential area (including Campbell County and northern Converse County) were provided the opportunity to express their preference for or against surface mining of federal coal under their private surface estate during that screening. At that time, no attempt was made to distinguish qualified surface owners and Appendix D of the 2001 BLM Buffalo RMP update states that "no area should be dropped from further consideration for leasing as a result of responses received from surface owners". Therefore, no federal coal lands within the West Antelope II LBA tract have been eliminated from further consideration for leasing due to qualified surface owner conflicts at this time. The current surface ownership of the LBA tract is discussed in Section 1.1 of this chapter and in Section 3.11. BLM will review the current surface ownership in the tract that is considered for leasing prior to holding a lease sale for the tract. Surface owner consultation must be completed with any private surface owners who are determined to be qualified prior to holding a lease sale for the tract.

In summary, the lands in the ACC coal lease application have been subjected to the four coal planning screens and determined acceptable for further consideration for leasing. Thus, a decision to lease the federal coal lands in this application would be in conformance with the current BLM Buffalo RMP, the BLM Casper RMP, and the TBNG RMP.

1.6 Consultation and Coordination

Initial Involvement

BLM received the West Antelope II coal lease application on April 6, 2005. The application was initially reviewed by the Division of Minerals and Lands at the BLM Wyoming State Office. The BLM ruled that the application and lands involved met the requirements of regulations governing coal leasing on application (43 CFR 3425).

The BLM Wyoming State Director notified the Governor of Wyoming that ACC had filed a lease application with BLM for the West Antelope II LBA tract on April 13, 2005.

The PRRCT reviewed this lease application at a public meeting held on April 27, 2005, in Gillette, Wyoming. ACC presented information about their existing mine and the pending lease application to the PRRCT at that meeting. The PRRCT recommended that the BLM continue to process this application. The major steps in processing an LBA are shown in Appendix C.

The BLM published a Notice of Intent to Prepare an Environmental Impact Statement and Notice of Public Meeting in the *Federal Register* on October 17, 2006. The publication served as public notice that the West Antelope II coal lease application had been received, announced the time and location of a public scoping meeting, and requested public comment on the application. Letters requesting public comment and announcing the time and location of the public scoping meeting were mailed to all parties on the distribution list.

The BLM published a notice of public scoping meeting in the Gillette News-Record and in the Douglas Budget newspapers. The public scoping meeting was held on November 1, 2006 in Douglas, Wyoming. At the public meeting, the applicant orally presented information about their mine and their need for the coal.

Chapter 5 provides a list of other federal, state, and local governmental agencies that were consulted in preparation of this EIS and the distribution list for this EIS.

Issues and Concerns

Issues and concerns that have been expressed by the public and government agencies relating to the potential impacts of leasing the West Antelope II LBA tract, specifically, and to previous coal lease applications in general include:

- potential conflicts between coal mining and existing and proposed conventional oil and coalbed natural gas development;
- potential cumulative impacts of coal leasing decisions combined with other existing and proposed development in the Wyoming Powder River Basin;
- validity and currency of resource data;

- potential impacts to cultural and paleontological resources;
- potential impacts to Greater sage-grouse and other wildlife;
- potential impacts to listed threatened and endangered species and other species of concern;
- potential impacts to wetland resources;
- potential impacts related to coal loss during transport;
- potential air quality impacts including cumulative impacts to visibility;
- potential surface and groundwater quality and quantity impacts;
- potential impacts of and possible mitigation for nitrogen oxide emissions resulting from blasting of coal and overburden;
- potential human health impacts;
- the need to include reasonably foreseeable actions such as the construction and operation of the DM&E railroad and power plants in the cumulative analysis;
- the need to address coal combustion residues and other by-products from coal-fired power plants;
- the need to address increasing PRB coal production in the cumulative analysis;
- the need to address site-specific greenhouse gas emissions; and
- climate change.

Draft EIS

Parties on the distribution list were sent copies of the Draft EIS, and copies were made available for review at the BLM offices in Casper and Cheyenne, Wyoming.

A notice announcing the availability of the Draft EIS was published in the *Federal Register* by the EPA on February 8, 2008. A 60-day comment period on the Draft EIS commenced with publication of the EPA's notice of availability and ended on April 8, 2008. The BLM published a Notice of Availability/Notice of Public Hearing in the *Federal Register* on March 17, 2008. The BLM's *Federal Register* notice announced the date and time of a public hearing, which was held on March 24, 2008, at 7:00 p.m. at the Best Western Douglas Inn in Douglas, Wyoming. The purpose of the public hearing was to solicit public comments on the Draft EIS and on the fair market value, the maximum economic recovery, and the proposed competitive sale of federal coal from the LBA tract. Four individuals presented statements at the formal public hearing. A complete transcript of the hearing is available at the BLM Casper Field Office for public review. Fourteen comment letters were received by the BLM on the Draft EIS during the 60-day comment period. A summary of the statements that were presented at the formal public hearing and the 14 comment letters that were received on the Draft EIS during the 60-day comment period are published as part of the Final EIS in Appendix J.

Final EIS and Future Involvement

BLM received fourteen written comments on the Draft EIS. These comments are included, with agency responses, as Appendix J of this Final EIS. Availability of

the Final EIS will be published in the *Federal Register* by the BLM and the EPA. After a 30-day availability period, BLM will make a decision to hold or not to hold a competitive lease sale for the federal coal in the West Antelope II LBA tract. The USDA-FS must consent to leasing the federal coal underlying lands that they administer before BLM can make a decision to hold a federal coal lease sale. If any lands administered by the Forest Service are included in the tract that BLM considers for leasing, the USDA-FS will issue a separate ROD consenting to leasing those lands. The decision to consent to leasing the USDA-FS land can be appealed within 45 days from the date the USDA-FS ROD is issued.

A public ROD for the tract will be mailed to parties on the mailing list and others who commented on this EIS during the NEPA process. The public and/or the applicant can appeal the BLM decision to hold or not to hold a competitive sale and issue a lease for the tract. The BLM decision must be appealed within 30 days from the date the Notice of Availability for the Record of Decision is published in the *Federal Register.* The decision can be implemented at that time if no appeal is received. If a competitive lease sale is held, the lease sale will follow the procedures set forth in 43 CFR 3422, 43 CFR 3425, and BLM Handbook H-3420-1 (Competitive Coal Leasing) (BLM 1989).

Department of Justice Consultation

After a competitive coal lease sale, but prior to issuance of a lease, the BLM must solicit the opinion of the Department of Justice on whether the planned lease issuance creates a situation inconsistent with federal antitrust laws. The Department of Justice is allowed 30 days to make this determination. If the Department of Justice has not responded in writing within the 30 days, the BLM can proceed with issuance of the lease.

2.0 PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action and alternatives to this action. The Proposed Action is to hold a competitive lease sale and issue a lease for the federal coal lands included in the West Antelope II LBA[1] Tract as applied for by ACC.

Under the Proposed Action, the tract would be offered for lease as applied for at one competitive lease sale with sealed bids, subject to standard and special lease stipulations developed for the PRB and that tract. The boundaries of the tract would be consistent with the tract configuration proposed by the applicant. As applied for, the West Antelope II LBA tract consists of two non-contiguous blocks of federal coal. The Proposed Action assumes that the applicant would be the successful bidder on the tract, and that the tract would be mined as a maintenance lease for an existing mine.

NEPA requires the consideration and evaluation of other reasonable ways to meet proposal objectives while minimizing or avoiding environmental impacts. Thus, NEPA requires the evaluation of a No Action Alternative and a practical range of other "reasonable" alternatives that may avoid or minimize project impacts. Reasonable alternatives are defined by NEPA as those that are technically, economically, and environmentally practical and feasible. Reasonable alternatives are formulated to address issues and concerns raised by the public and agencies during scoping. These alternatives should represent another means of satisfying the stated purpose and need for the federal action.

Five alternatives to the Proposed Action are considered in this analysis:

1) Reconfigure the tract and hold one competitive coal sale.
2) Divide the tract as applied for or as reconfigured by BLM into two tracts and offer one or both for sale as separate competitive bids for each tract.
3) Reject the application (No Action.)
4) Assume that the applicant is not the successful bidder on the tract (as applied for or under Alternatives 1 or 2) and the coal is developed as a new mine.
5) Delay the sale of tract (as applied for or under Alternatives 1 or 2).

Alternatives 4 and 5 were considered but not analyzed in detail. The Proposed Action and all alternatives are discussed in greater detail in sections 2.1 through 2.6.

The BLM Competitive Coal Leasing Handbook (BLM 1989) requires the BLM to evaluate modifying the configuration of federal coal tracts based on providing for maximum economic recovery of the coal resource, maintaining or increasing

[1] Refer to page xvi for a list of abbreviations and acronyms used in this document.

the potential for competition, and avoiding future bypass or captive tract situations. For NEPA purposes, BLM evaluates alternate tract configurations as alternatives to the Proposed Action. In evaluating this lease application, BLM has identified a study area for the tract which includes the tract as applied for and adjacent unleased federal coal, shown in Figure 2-1.

The leasing on application regulations at 43 CFR 3425.1-9 state that: "The authorized officer may add or delete lands from an area covered by an application for any reason he/she determines to be in the public interest." Accordingly, in evaluating alternative tract configurations, BLM could increase or decrease the size of the tract as applied for.

Under Alternatives 1 and 2, the study area is evaluated for the purpose of identifying potential alternate tract configurations that would be technically, economically, or environmentally preferable to the Proposed Action. Under both alternatives, BLM is evaluating adding all or part of the additional coal included in the BLM study area to the tract as applied for and/or reducing the size of the tract as applied for. Under Alternative 1, one competitive sale would be held and a lease issued for federal coal lands included in an LBA tract as modified by the BLM. Under Alternative 2, BLM is evaluating splitting the application into two tracts (North Tract and South Tract). The lands included in the two tracts would be the lands included in the as-applied-for tract or the tract as modified by BLM. Two separate competitive sales would be held and two leases would be issued. The West Antelope II LBA tract as applied for (Proposed Action), the BLM study area (the tract as applied for and the additional area evaluated under Alternatives 1 and 2), and the two tracts formed under Alternative 2 are shown in Figure 2-1.

The No Action Alternative (Alternative 3) is to reject the West Antelope II lease application. Under the No Action Alternative, the tract would not be offered for competitive sale, and the coal contained within the tract would not be mined as proposed. Rejection of the application would not affect currently permitted mining activities on existing leases at the Antelope Mine and selection of the No Action Alternative would not preclude an application to lease the rejected tract in the future. Portions of the surface of the LBA tract would probably be disturbed due to overstripping to allow coal to be removed from the adjacent existing leases.

The alternatives considered but not analyzed in detail are:

- holding a competitive lease sale and issuing a lease for federal coal lands included in the West Antelope II LBA tract (as applied for or as modified by BLM), with the assumption that the tract would be developed as a new mine (Alternative 4); and

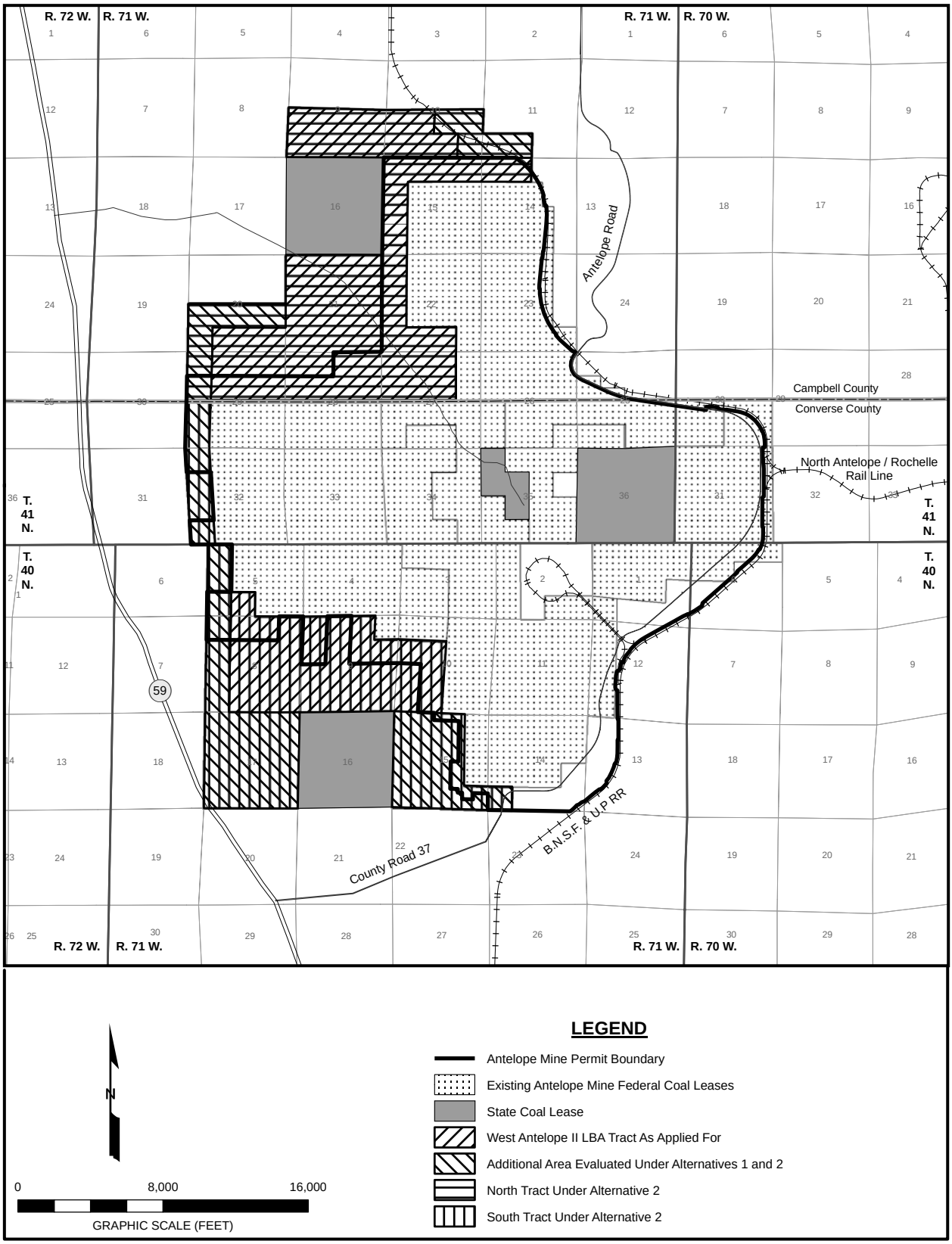


Figure 2-1. West Antelope II LBA Alternative Tract Configurations.

- delaying the sale of the West Antelope II LBA tract as applied for in order to take advantage of higher coal prices and/or to allow recovery of the potential CBNG resources in the tract prior to mining (Alternative 5). Under this alternative, it is assumed that the tract could be developed later as a maintenance tract or a new mine start, depending on how long the sale was delayed.

LBA tracts are nominated for leasing by companies with an interest in acquiring them but, as discussed in Chapter 1, the LBA process is, by law and regulation, an open, public, competitive sealed-bid process. If a tract is offered for lease, the applicant for that tract may or may not be the high bidder when the lease sale is held. The Proposed Action and Alternatives 1 and 2 considered in this EIS assume ACC would be the successful bidder if the federal coal included in the tract is offered for lease, and that the West Antelope II LBA tract would be mined as a maintenance tract for the permitted Antelope Mine.

If a decision is made to hold a competitive lease sale for a tract of federal coal and a lease is issued, the lessee must obtain a permit to conduct coal mining operations before mining can begin on the tract. As discussed in Section 1.3, this permit application would undergo detailed review by state and federal agencies as part of the approval process. The detailed permit application could potentially differ from the more general mining plan used to analyze the impacts of the Proposed Action and Alternatives 1 and 2 in this EIS, but the differences would not be expected to substantially change the impacts described here. These differences would typically be related to the details of mining and reclaiming the tract but major factors, like the approximate number of tons of coal to be mined and yards of overburden to be removed, the acres disturbed, etcetera, would not be substantially different from the plans used in this analysis.

If the tract is leased under the Proposed Action or Alternatives 1 and 2, it is assumed that an area larger than the lease area would have to be disturbed in order to recover all of the coal in that tract. The disturbances outside the coal removal area would be due to activities like overstripping, matching undisturbed topography, and construction of flood control and sediment control structures.

2.1 Proposed Action

Under the Proposed Action, the West Antelope II LBA tract, as applied for by ACC, would be offered for lease at a sealed-bid, competitive lease sale, subject to standard and special lease stipulations developed for the PRB (Appendix D). The boundaries of the tract would be consistent with the tract configuration proposed in the West Antelope II lease application (Figure 2-1). The Proposed Action assumes that ACC will be the successful bidder on the West Antelope II LBA tract if it is offered for sale.

The legal description of the proposed West Antelope II LBA tract coal lease lands as applied for by ACC under the Proposed Action is as follows:

T.41N., R.71W., 6th P.M., Campbell County, Wyoming	
Section 9: Lots 9 through 16:	330.68 acres
Section 10: Lots 11 through 15:	203.00 acres
Section 14: Lots 3 and 4:	82.64 acres
Section 15: Lots 1 through 5, 12, and 13:	289.35 acres
Section 20: Lots 14 through 16:	122.89 acres
Section 21: Lots 1 through 16:	651.74 acres
Section 22: Lots 2, 7, 8, and 14 through 16:	252.93 acres
Section 27: Lots 6 through 11:	250.51 acres
Section 28: Lots 1 through 8:	322.50 acres
Section 29: Lots 1 through 3 and 6 through 8:	247.76 acres
T.40N., R.71W., 6th P.M., Converse County, Wyoming	
Section 5: Lot 18:	40.25 acres
Section 8: Lots 1 through 3, 6 through 11, and 14 through 16:	478.14 acres
Section 9: Lots 2 through 16:	597.22 acres
Section 10: Lots 5, 6, and 11 through 14:	238.99 acres
Total:	4,108.60 acres

The land descriptions and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of April 15, 2004 and December 6, 2004. The coal estate included in the tract described above is federally owned. The ownership of the surface and oil and gas estates is discussed in Section 3.11.

As discussed in Section 1.5, the BNSF & UP railroad crosses portions of the northern block of federal coal included in the West Antelope II LBA tract (Figure 2-1), and the coal that is located within the BNSF & UP ROW and an associated 100 foot buffer zone has been determined to be unsuitable for mining under Unsuitability Criterion 2. As a result, some of the coal in the above described lands is not currently considered to be recoverable. Although these lands would not be mined, they are included in the tract to allow maximum recovery of all of the mineable coal that is adjacent to but outside of the railroad ROW and its associated buffer zone and to comply with the coal leasing regulations that do not allow leasing of less than 10-acre aliquot parts.

As applied for, the West Antelope II LBA tract consists of two separate blocks of federal coal (Figure 2-1), which includes approximately 4,108.6 acres with an estimated 429.7 million tons of in-place coal reserves. ACC estimates that 21.3 million tons of the in-place coal would not be mineable because of the BNSF & UP railroad tracks and associated ROW. Of the 408.4 million tons of mineable reserves, ACC estimates that approximately 377.8 million tons would be recoverable from the West Antelope II LBA tract as applied for. This estimate of recoverable reserves assumes that approximately seven to nine percent of the

mineable coal included within the West Antelope II LBA tract would not be recoverable under normal mining practices, based on historical recovery factors.

BLM independently evaluates the volume and average quality of the coal resources included in proposed LBA tracts as part of the fair market value determination process. BLM's estimate of the mineable federal coal reserves included in the tract may not be in agreement with the mineable coal reserve and coal quality estimates provided by the applicant. BLM's estimate of the mineable federal coal reserves included in the tract under BLM's preferred alternative (Alternative 2) will be published in the sale notice if the tract is offered for sale.

The West Antelope II LBA tract would be mined as an integral part of the Antelope Mine under the Proposed Action. The West Antelope II LBA tract would be an extension of the existing Antelope Mine, the facilities and infrastructure would be the same as those identified in the WDEQ/LQD Mine Permit 525 Term T7 approved October 29, 2003 and the BLM R2P2, which was approved November 8, 2006.

The currently approved air quality permit from the WDEQ/AQD for the Antelope Mine allows up 42 million tons of coal per year to be mined. The Antelope Mine produced:

- 23.0 million tons of coal in 2000,
- 24.6 million tons of coal in 2001,
- 26.8 million tons of coal in 2002,
- 29.5 million tons of coal in 2003,
- 29.7 million tons of coal in 2004,
- 30.0 million tons of coal in 2005, and
- 33.9 million tons of coal in 2006

(Antelope Mine 2000, 2001, 2002, 2003, 2004, 2005, and 2006).

Under the currently approved mining plan (the No Action Alternative), the Antelope Mine would mine its remaining estimated 394.3 million tons of recoverable coal reserves in eleven years at an average production rate of approximately 36 mmtpy. Under the Proposed Action, ACC estimates that the life of the mine would be extended by 11 additional years at an average annual coal production rate of approximately 36 million tons. If the production rate increases to 42 mmtpy, the maximum rate allowed by the air quality permit, the life of mine would be extended by nine additional years under the Proposed Action.

If ACC acquires the West Antelope II LBA tract as applied for, they estimate that a total of 772.1 million tons of coal would be recovered after January 1, 2007, with an estimated 377.8 million tons coming from the LBA tract. As of December 31, 2006, approximately 318.9 million tons of coal had been mined from within the current permitted area of the mine.

Prior to disturbance and in advance of mining, mine support structures such as roads, power lines, substations, and flood and sediment control measures would be built as needed.

Topsoil removal with suitable heavy equipment, such as rubber-tired scrapers, would proceed ahead of overburden removal. Whenever possible, direct haulage to a reclamation area would be done, but due to scheduling, some topsoil would be temporarily stockpiled. As required by the reclamation plan, heavy equipment again would be used to haul and distribute the stockpiled topsoil.

The Antelope Mine is one of several mines currently operating in the PRB. Mining would be conducted in five separate, semi-independent pits identified as the Horse Creek (HC) Pit, North West Mine Area North (NWMAN) Pit, South Mine Area (SMA) Pit, West Antelope South (WAS) Pit, and West Antelope North (WAN) Pit. The multi-pit concept has been and would be utilized to reduce operating costs by blending production from areas having different stripping ratios and coal quality, and also to help stabilize manpower requirements. Overburden removal has been and would continue to be conducted using trucks and shovels, draglines, and/or direct cast blasting. Other equipment used during overburden removal and backfilling would include dozers, scrapers, excavators, front-end loaders, graders, and water trucks. Most overburden and all coal have been and would continue to be drilled and blasted to facilitate efficient excavation.

The design of the Antelope Mine seeks to confine disturbance to the active mine blocks. As overburden is removed, most would be directly placed into areas where coal has already been removed.

Once the overburden has been replaced it is sampled and verified to be suitable for reclamation, then graded to approximate final contour, ripped and finally topsoiled. Material that is found to be unsuitable for reclamation (i.e., material that is not suitable for use in reestablishing vegetation or that may affect groundwater quality due to high concentrations of certain constituents, such as selenium, or adverse pH levels) would either be removed and treated, or adequately covered with suitable overburden material prior to grading and topsoiling. Elevations consistent with an approved PMT plan would be established as quickly as possible. Under certain conditions, the PMT may not be immediately achievable. This occurs when there is an excess of material that may require temporary stockpiling, when there is insufficient material available from current overburden removal operations, or when future mining could redisturb an area already mined. Once a seedbed has been formed, vegetation that is consistent with the postmining land use would be reestablished.

Coal would be produced from two coal seams. ACC refers to these seams as the Anderson, which averages 34 ft thick, and the Canyon, which averages 35 ft thick. Coal would be mined at several working faces to enable blending of the

coal to meet customer quality requirements, to comply with BLM lease requirements for maximum economic recovery of the coal resource, and to optimize coal removal efficiency with available equipment. Coal would be loaded with electric-powered shovels into off-highway haul trucks for transport to crushing facilities. Coal haul roads would be temporary structures built within the mine areas. The Antelope Mine utilizes two separate, existing coal crushing facilities; the North East Mine Area and South Mine Area pit facilities located within the ACC permit area. These facilities provide the capacity to produce the permitted production tonnage. All coal crushing operations and conveying, transferring, and storage facilities are equipped with passive emission controls, atomizer/fogger systems or bag house collection systems for dust control. There are two existing coal storage silos. While sufficient storage capacity exists, future changes in facilities may be constructed to improve operating efficiency and air quality protection. For example, a covered slot storage barn, additional silos, covered dome, or other appropriate storage structure may be built at the plant. In addition, a covered overland conveyor and near-pit crusher system may be constructed and moved as the mining operation progresses away from the plant facilities.

The Antelope Mine presently has a workforce of 430 employees. The expansion in reserves associated with the West Antelope II LBA tract under the Proposed Action would sustain current rates of production [about 36 mmtpy), and as many as 25 additional workers may be needed at times during the life-of-mine as mining progresses to different locations. Raising annual production to 42 mmtpy could increase the incremental workforce needs to as many 40 workers, or 470 total employees, at times.

2.1.1 Regulatory Compliance, Mitigation and Monitoring

SMCRA and Wyoming State Law require surface coal mines to collect extensive baseline information and implement extensive monitoring programs and mitigation measures. The currently approved permit to conduct mining operations for the Antelope Mine includes these requirements. Monitoring programs and mitigation measures that are required by regulation are considered to be part of the Proposed Action and the Action Alternatives considered in this EIS for the West Antelope II LBA tract. These data collection requirements, mitigation plans, and monitoring plans are in place for the No Action Alternative, as part of the current approved permit to conduct mining operations for the existing Antelope Mine. These data collection requirements, mitigation plans, and monitoring commitments would be extended to include mining operations on the West Antelope II LBA tract if it is leased and permitted for mining. A permit to conduct mining operations on the West Antelope II LBA tract would have to be approved before mining operations could be conducted on the tract, regardless of who acquires it. The major mitigation and monitoring measures that are required by state or federal regulation are summarized in Table 2-1. More specific information about some of these mitigation and monitoring measures and their results at the Antelope Mine are described in Chapter 3.

Table 2-1. Regulatory Compliance, Mitigation and Monitoring Measures for Surface Coal Mining Operations Required by SMCRA and State Law for all Alternatives.

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State or Federal Law[1]	Monitoring[1]
Topography & Physiography	Restoring to approximate original contour or other approved topographic configuration.	WDEQ/LQD checks as-built vs. approved topography with each annual report.
Geology & Minerals	Identifying & selectively placing or mixing chemically or physically unsuitable overburden materials to minimize adverse effects to vegetation or groundwater.	WDEQ/LQD requires monitoring in advance of mining to detect unsuitable overburden.
Soil	Salvaging soil suitable to support plant growth for use in reclamation; Protecting soil stockpiles from disturbance and erosional influences; Selectively placing at least four ft of suitable overburden on the graded backfill surface below replaced topsoil to meet guidelines for vegetation root zones.	Monitoring vegetation growth on reclaimed areas to determine need for soil amendments; Sampling regraded overburden for compliance with root zone criteria.
Air Quality	Dispersion modeling of mining plans for annual average particulate pollution impacts on ambient air; Using particulate pollution control technologies; Using work practices designed to minimize fugitive particulate emissions; Using EPA- or state-mandated BACT, including: Fabric filtration or wet scrubbing of coal storage silo and conveyor vents, Watering or using chemical dust suppression on haul roads and exposed soils, Containment of truck dumps and primary crushers, Covering of conveyors, Prompt revegetation of exposed soils, High efficiency baghouse dust collection systems or PECs, or atomizers/foggers on the crusher, conveyor transfer, storage bin and train loadout, meeting a standard of 0.01 grains per dry standard cubic foot (dscf) of exit volume, Watering of active work areas, Reclamation plan to minimize surface disturbances subject to wind erosion, Paving of access roads, Haul truck speed limits, Limited material drop heights for shovels and draglines.	On-site air quality monitoring for PM_{10} and/or TSP; Off-site ambient monitoring for PM_{10} and/or TSP; On-site compliance inspections.

[1] These requirements, mitigation plans, and monitoring plans are in place for the existing Antelope Mine in its current approved mining and reclamation plan (the No Action Alternative). If the West Antelope II LBA tract were leased, these requirements, mitigation plans, and monitoring plans would be part of a mining plan revision covering the West Antelope II LBA tract that must be approved before mining can occur on the tract under the Proposed Action or Action Alternatives.

Table 2-1. Regulatory Compliance, Mitigation and Monitoring Measures for Surface Coal Mining Operations Required by SMCRA and State Law for all Alternatives (Continued).

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State or Federal Law[1]	Monitoring[1]
Air Quality (continued)	Following voluntary and required measures to avoid exposing the public to NO_2 from blasting clouds, including: Phone notification of neighbors and workers prior to blasting, Monitoring weather and atmospheric conditions prior to decisions to blast, Timing blasts to avoid temperature inversions and to minimize inconvenience to neighbors, Closing public roads when appropriate to protect the public, Minimizing blast sizes, Posting signs on major public roads.	
Surface Water	Building and maintaining sediment control ponds or other devices during mining; Restoring approximate original drainage patterns during reclamation; Restoring stock ponds and playas during reclamation.	Monitoring storage capacity in sediment ponds; Monitoring quality of discharges; Monitoring streamflow and water quality.
Groundwater Quantity	Evaluating cumulative impacts to water quantity associated with proposed mining; Replacing existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quantity.	Monitoring wells track water levels in overburden, coal, interburden, underburden, and backfill.
Groundwater Quality	Evaluating cumulative impacts to water quality associated with proposed mining; Replacing existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quality.	Monitoring wells track water quality in overburden, coal, interburden, underburden, and backfill.
Alluvial Valley Floors	Identifying all AVFs that would be affected by mining; Determining significance to agriculture of all identified AVFs affected by mining (WDEQ); Protecting downstream AVFs during mining; Restoring essential hydrologic function of all AVFs affected by mining.	Monitoring to determine restoration of essential hydrologic functions of any declared AVF.
Wetlands	Identifying all wetlands that would be affected by mining; Identifying jurisdictional wetlands (COE); Replacing all jurisdictional wetlands that would be disturbed by mining; Replacing functional wetlands as required by surface managing agency, surface landowner, or WDEQ/LQD.	Monitoring of reclaimed wetlands using same procedures used to identify pre-mining jurisdictional wetlands.

[1] These requirements, mitigation plans, and monitoring plans are in place for the existing Antelope Mine in its current approved mining and reclamation plan (the No Action Alternative). If the West Antelope II LBA tract were leased, these requirements, mitigation plans, and monitoring plans would be part of a mining plan revision covering the West Antelope II LBA tract that must be approved before mining can occur on the tract under the Proposed Action or Action Alternatives.

Table 2-1. Regulatory Compliance, Mitigation and Monitoring Measures for Surface Coal Mining Operations Required by SMCRA and State Law for all Alternatives (Continued).

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State or Federal Law[1]	Monitoring[1]
Vegetation	Permanently revegetating reclaimed areas according to a comprehensive revegetation plan using approved permanent reclamation seed mixtures consisting predominantly of species native to the area; Reclaiming 20 percent of reclaimed area with native shrubs at a density of one per square meter; Controlling erosion on reclaimed lands prior to seeding with final seed mixture using mulching, cover crops, or other approved measures; Chemically and mechanically controlling weed infestation; Direct hauling of topsoil; Selectively planting shrubs in riparian areas; Planting sagebrush; Creating depressions and rock piles; Using special planting procedures around rock piles; Posting reclamation bond covering the cost of reclamation.	Monitoring of revegetation growth & diversity until release of final reclamation bond (minimum 10 years); Monitoring of erosion to determine need for corrective action during establishment of vegetation; Use of controlled grazing during revegetation evaluation to determine suitability for post-mining land uses.
Wildlife and Sensitive Species	Restoring pre-mining topography to the maximum extent possible; Planting a diverse mixture of grasses, forbs, and shrubs in configurations beneficial to wildlife; Designing fences to permit wildlife passage; Raptor-proofing power transmission poles; Using raptor safe power lines; Creating artificial raptor nest sites; Increasing habitat diversity by creating rock clusters and shallow depressions on reclaimed land; Cottonwood plantings along reclaimed drainages; Replacing drainages, wetlands, and AVFs disturbed by mining; Reducing vehicle speed limits to minimize mortality; Instructing employees not to harass or disturb wildlife; Following approved raptor mitigation plans; Avoiding bald eagle disturbance; Restoring bald eagle foraging areas disturbed by mining; Restoring mountain plover habitat disturbed by mining; Surveying for mountain plover; Surveying for black-tailed prairie dog.	Baseline and annual wildlife monitoring surveys; Monitoring for Migratory Bird Species of Management Concern in Wyoming.

[1] These requirements, mitigation plans, and monitoring plans are in place for the existing Antelope Mine in its current approved mining and reclamation plan (the No Action Alternative). If the West Antelope II LBA tract were leased, these requirements, mitigation plans, and monitoring plans would be part of a mining plan revision covering the West Antelope II LBA tract that must be approved before mining can occur on the tract under the Proposed Action or Action Alternatives.

Table 2-1. Regulatory Compliance, Mitigation and Monitoring Measures for Surface Coal Mining Operations Required by SMCRA and State Law for all Alternatives (Continued).

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State or Federal Law[1]	Monitoring[1]
Threatened, Endangered, Proposed, and Candidate Species	Surveying for Ute ladies'-tresses; Searching for black-footed ferrets if prairie dog colonies are on or move onto tract; Same as Wildlife Resource and Sensitive Species above.	Baseline and annual wildlife monitoring surveys.
Land Use	Suitably restoring reclaimed area for historic uses (grazing and wildlife);	Monitoring of controlled grazing prior to bond release evaluation.
Cultural Resources	Conducting Class I & III surveys to identify cultural properties on all state and federal lands and on private lands affected by federal undertakings; Consulting with SHPO to evaluate eligibility of cultural properties for the NRHP; Avoiding or recovering data from significant cultural properties identified by surveys, according to an approved plan; Notifying appropriate federal personnel if historic or prehistoric materials are uncovered during mining operations; Instructing employees of the importance of and regulatory obligations to protect cultural resources.	Monitoring of mining activities during topsoil stripping; cessation of activities and notification of authorities if unidentified sites are encountered during topsoil removal.
Native American Concerns	Notifying Native American tribes with known interest in this area of leasing action and request for help in identifying potentially significant religious or cultural sites.	No specific monitoring program.
Paleontological Resources	Notifying appropriate federal personnel if potentially significant paleontological sites are discovered during mining.	No specific monitoring program.
Visual Resources	Restoring landscape character during reclamation through return to approximate original contour and revegetation with native species.	No specific monitoring program.
Noise	Protecting employees from hearing loss.	MSHA inspections.
Transportation Facilities	Relocating existing pipelines, if necessary, in accordance with specific agreement between pipeline owner and coal lessee.	No specific monitoring program.
Socioeconomics	Paying royalty and taxes as required by federal, state, and local regulations. No mitigation measures are proposed.	Surveying and reporting to document volume of coal removed.

[1] These requirements, mitigation plans, and monitoring plans are in place for the existing Antelope Mine in its current approved mining and reclamation plan (the No Action Alternative). If the West Antelope II LBA tract were leased, these requirements, mitigation plans, and monitoring plans would be part of a mining plan revision covering the West Antelope II LBA tract that must be approved before mining can occur on the tract under the Proposed Action or Action Alternatives.

Table 2-1. Regulatory Compliance, Mitigation and Monitoring Measures for Surface Coal Mining Operations Required by SMCRA and State Law for all Alternatives (Continued).

Resource	Regulatory Compliance or Mitigation Required by Stipulations, State or Federal Law[1]	Monitoring[1]
Hazardous & Solid Waste	Disposing of solid waste and sewage within permit boundaries according to approved plans; Storing and recycling waste oil; Maintaining of files containing Material Safety Data Sheets for all chemicals, compounds, and/or substances used during course of mining; Ensuring that all production, use, storage, transport, and disposal of hazardous materials is in accordance with applicable existing or hereafter promulgated federal, state, and government requirements; Complying with emergency reporting requirements for releases of hazardous materials as established in CERCLA, as amended; Preparing and implementing spill prevention control and countermeasure plans, spill response plans, inventories of hazardous chemical categories pursuant to Section 312 of SARA, as amended; Preparing emergency response plans.	No specific monitoring other than required by these other regulations and response plans.

[1] These requirements, mitigation plans, and monitoring plans are in place for the existing Antelope Mine in its current approved mining and reclamation plan (the No Action Alternative). If the West Antelope II LBA tract were leased, these requirements, mitigation plans, and monitoring plans would be part of a mining plan revision covering the West Antelope II LBA tract that must be approved before mining can occur on the tract under the Proposed Action or Action Alternatives.

If impacts are identified during the leasing process that are not mitigated by existing required mitigation measures, BLM can require additional mitigation measures, in the form of stipulations on the new lease, within the limits of its regulatory authority. In general, the levels of mitigation and monitoring required for surface coal mining by SMCRA and Wyoming State law are more extensive than those required for other surface disturbing activities; however, concerns are periodically identified that are not monitored or mitigated under existing procedures.

2.1.2 Hazardous and Solid Waste

Under the Proposed Action and Action Alternatives, the procedures and requirements for handling of solid and hazardous wastes would be the same as the procedures and requirements for the existing mining operation. Solid waste that is produced at the existing Antelope Mine consists of floor sweepings, shop rags, lubricant containers, welding rod ends, metal shavings, worn tires, packing material, used filters, and office and food wastes. A portion of the solid wastes produced at the Antelope Mine is disposed of within the mine's permit boundary in accordance with WDEQ-approved solid waste disposal plans. Solid waste is also disposed of at the Campbell County landfill. Sewage is handled by WDEQ-permitted sewage systems present on the existing mine facilities. Maintenance and lubrication of most of the equipment takes place at existing shop facilities at the Antelope Mine. Major lubrication, oil changes, etcetera, of most equipment are performed inside the service building lubrication bays at the Antelope Mine, where used oil and grease are currently contained and deposited in storage tanks. All of the collected used oils and grease are then beneficially recycled off site or used for energy recovery. These practices would not change if the applicant acquires the LBA tract.

Antelope Mine has reviewed the EPA's *Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Re-authorization Act* (SARA) *of 1986* (as amended) and EPA's *List of Extremely Hazardous Substances* as defined in 40 CFR 355 (as amended) for hazardous substances used at the Antelope Mine. ACC maintains files containing Material Safety Data Sheets for all chemicals, compounds, and/or substances that are or would be used during the course of mining.

Antelope Mine is responsible for ensuring that all production, use, storage, transport, and disposal of hazardous and extremely hazardous materials as a result of mining are in accordance with all applicable existing or hereafter promulgated federal, state, and local government rules, regulations, and guidelines. All mining activities involving the production, use, and/or disposal of hazardous or extremely hazardous materials are and would continue to be conducted so as to minimize potential environmental impacts.

Antelope Mine must comply with emergency reporting requirements for releases of hazardous materials. Any release of hazardous or extremely hazardous substances in excess of the reportable quantity, as established in 40

CFR 117, is reported as required by CERCLA, as amended. The materials for which such notification must be given are the extremely hazardous substances listed in Section 302 of the *Emergency Planning and Community Right to Know Act* and the hazardous substances designated under Section 102 of CERCLA, as amended. If a reportable quantity of a hazardous or extremely hazardous substance is released, immediate notice must be given to the WDEQ Solid and Hazardous Waste Division, WDEQ Water Quality Division, and all other appropriate federal and state agencies.

Each mining company is expected to prepare and implement several plans and/or policies to ensure environmental protection from hazardous and extremely hazardous materials. These plans/policies include:

- Spill Prevention Control and Countermeasure Plans;
- Spill Response Plans;
- Stormwater Pollution Prevention Plans;
- Inventories of Hazardous Chemical Categories Pursuant to Section 313 of SARA, as Amended; and
- Emergency Response Plans.

All mining operations are also required to be in compliance with regulations promulgated under the Resource Conservation and Recovery Act, Federal Water Pollution Control Act (Clean Water Act), Safe Drinking Water Act, Toxic Substances Control Act, Mine Safety and Health Act, Department of Transportation, and the Federal Clean Air Act. In addition, mining operations must comply with all attendant state rules and regulations relating to hazardous material reporting, transportation, management, and disposal.

Compliance with these rules is the current practice at the Antelope Mine. Acquisition of the West Antelope II LBA tract by ACC would not change these current practices nor the type and quantity of any wastes generated and disposed of by the mine.

2.2 Alternative 1

Under Alternative 1 for the West Antelope II LBA tract, BLM would reconfigure the tract and hold one competitive coal sale for the lands included in the reconfigured tract and issue a lease to the successful bidder. The modified tract would be subject to standard and special lease stipulations developed for the PRB and for this tract if it is offered for sale. Alternative 1 for the West Antelope II LBA tract assumes that ACC would be the successful bidder on the tract if a lease sale is held and that the federal coal would be mined as a maintenance lease for the existing Antelope Mine. Assumptions concerning mining methods, facilities, hazardous materials, mitigation and monitoring requirements, etc. are the same as described for the Proposed Action.

As applied for, the West Antelope II LBA tract consists of two non-contiguous blocks of federal coal. In order to evaluate the potential that an alternate

configuration of the tract would provide for more efficient recovery of the federal coal, increase competitive interest in the West Antelope II LBA tract, and/or reduce the potential that some of the remaining unleased federal coal in this area would be bypassed in the future, BLM identified a study area. The BLM study area includes the tract as applied for and unleased federal coal adjacent to the northeastern, western, and southern edges of the tract as applied for (Figure 2-1). The study area includes lands on the TBNG, which is administered by USDA-FS. Under this alternative, BLM could add all or part of the adjacent lands to the tract or BLM could reduce the size of the tract, as discussed in Section 2.0. Under Alternative 1, the area BLM is evaluating in addition to the tract as applied for includes the following lands:

T.41N., R.71W., 6th P.M., Campbell County, Wyoming	
Section 10: Lots 9, 10, and 16:	123.42 acres
Section 11: Lots 13 and14:	85.03 acres
Section 20: Lots 9 through 13:	204.29 acres
Section 29: Lots 4 and 5:	81.71 acres
T.41N., R.71W., 6th P.M., Converse County, Wyoming	
Section 29: Lots 12 and 13:	81.09 acres
Section 32: Lots 4, 5, 12, and 13:	162.36 acres
T.40N., R.71W., 6th P.M., Converse County, Wyoming	
Section 5: Lots 8, 9, 16, and 17:	119.54 acres
Section 8: Lots 4, 5, 12, and13:	159.52 acres
Section 14: Lot 13:	39.99 acres
Section 15: Lots 2 through 7, and 10 through 16:	514.01 acres
Section 17: Lots 1 through 16:	629.62 acres
Total:	2,200.58 acres

The legal description of the Alternative 1 reconfiguration of the West Antelope II LBA tract is as follows:

T.41N., R.71W., 6th P.M., Campbell County, Wyoming	
Section 9: Lots 9 through 16:	330.68 acres
Section 10: Lots 9 through 16:	326.42 acres
Section 11: Lots 13 and14:	85.03 acres
Section 14: Lots 3 and 4:	82.64 acres
Section 15: Lots 1 through 5, 12, and 13:	289.35 acres
Section 20: Lots 9 through 16:	327.18 acres
Section 21: Lots 1 through 16:	651.74 acres
Section 22: Lots 2, 7, 8, and 14 through 16:	252.93 acres
Section 27: Lots 6 through 11:	250.51 acres
Section 28: Lots 1 through 8:	322.50 acres
Section 29: Lots 1 through 8:	329.47 acres

T.41N., R.71W., 6th P.M., Converse County, Wyoming	
Section 29: Lots 12 and 13:	81.09 acres
Section 32: Lots 4, 5, 12, and 13:	162.36 acres
T.40N., R.71W., 6th P.M., Converse County, Wyoming	
Section 5: Lots 8, 9, and 16 through 18:	159.79 acres
Section 8: Lots 1 through 16:	637.66 acres
Section 9: Lots 2 through 16:	597.22 acres
Section 10: Lots 5, 6, and 11 through 14:	238.99 acres
Section 14: Lot 13:	39.99 acres
Section 15: Lots 2 through 7, and 10 through 16:	514.01 acres
Section 17: Lots 1 through 16:	629.62 acres
Total:	6,309.18 acres

The land descriptions and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of April 15, 2004 and December 6, 2004. The coal estate in the tract described above is federally owned. The ownership of the surface and oil and gas estates is discussed in Section 3.11.

As discussed in Sections 1.5 and 2.1, under the Proposed Action, the BNSF & UP railroad crosses portions of the northern block of federal coal included in the West Antelope II LBA tract (Figure 2-1). The coal that is located within the BNSF and UP railroad ROW and associated 100 foot buffer zone has been determined to be unsuitable for mining under Coal Unsuitability Criterion 2 and would not be recoverable.

As discussed in Section 1.5 and shown in Figure 2-1, State Highway 59 crosses the southwestern corner of the BLM study area for the south block of the tract, and Converse County Road 37 crosses the southeastern corner of the BLM study area for the south block of the tract, in Sections 17 and 14, T. 40 N., R. 71 W., respectively. BLM has determined that the coal underlying these portions of State Highway 59 and Converse County Road 37, their ROWs, and a buffer zone extending 100 feet on either side of the ROWs are unsuitable for mining in accordance with Coal Unsuitability 3 and would not be recoverable.

ACC estimates that the BLM study area under Alternative 1 contains approximately 490 million tons of mineable coal and that approximately 453.9 million tons of that coal would be recoverable. ACC estimates that approximately 36 million tons of coal would not be mineable because of the railroad and public road ROWs and buffer zones. Although these lands would not be mined, they would be included in the alternative tract configuration to allow maximum recovery of all of the mineable coal that is adjacent to but outside of the ROWs and associated buffer zones and to comply with the coal leasing regulations that do not allow leasing of less than 10-acre aliquot parts. If a lease is issued for this tract, stipulations will be attached to the lease

stating that no mining activity may be conducted in the portions of the tract within the BNSF & UP railroad, State Highway 59, and Converse County Road 37 ROWs and associated buffer zones.

BLM independently evaluates the volume and average quality of the coal resources included in proposed LBA tracts as part of the fair market value determination process. BLM's estimate of the mineable federal coal reserves included in the tract may not be in agreement with the mineable coal reserve and coal quality estimates provided by the applicant. BLM's estimate of the mineable federal coal reserves included in the tract will be published in the sale notice if the tract is offered for sale.

Under Alternative 1 at an average annual coal production of 36 million tons, ACC estimates the life of the mine would be extended by 13 years. The average number of full-time employees could increase by as many as 25 additional workers (to approximately 455 employees). Raising annual production to 42 million tons could increase the incremental workforce needs to as many 40 workers, or 470 total employees, at times. The life of mine would be extended by 11 years at an average annual coal production rate of 42 million tons.

2.3 Alternative 2 (BLM's Preferred Alternative)

Under Alternative 2 for the West Antelope II LBA tract, BLM is considering dividing the tract into two tracts and offering one or both of those tracts for sale. A separate, competitive sealed bid sale would be held for each tract that is offered for sale, and each tract would be subject to standard and special lease stipulations developed for the PRB and for that tract (Appendix D). Alternative 2, dividing the tract as reconfigured by BLM into two tracts and offering both for sale as separate competitive bids, is the BLM's Preferred Alternative.

If the tracts are offered for lease, Alternative 2 for the West Antelope II LBA tract assumes that ACC would be the successful bidder and that the federal coal would be mined to extend the life of the existing Antelope Mine. Assumptions concerning mining methods, facilities, hazardous materials, mitigation and monitoring requirements, etc. are the same as described for the West Antelope II LBA tract Proposed Action.

As discussed under the Proposed Action and Alternative 1, the West Antelope II LBA tract consists of two non-contiguous blocks of federal coal. Under Alternative 2, the West Antelope II North LBA Tract would consist of the northern block of coal and the West Antelope II South LBA Tract would consist of the southern block of coal. BLM is dividing the tract because the northern tract would potentially be of competitive interest to more than one mine. The division would be consistent with public comments that the BLM received regarding the tract, and would also be administratively efficient given that the two tracts would be in different counties.

As discussed under Alternative 1, BLM has identified a study area which includes the tract as applied for and unleased federal coal adjacent to the northeastern, western, and southern edges of the tract as applied for. The West Antelope II South LBA Tract study area includes lands on the TBNG, which is administered by USDA-FS. BLM is evaluating the potential that adding some or all of these lands to the area offered for lease would provide for more efficient recovery of the federal coal, increase competitive interest in the West Antelope II North and South LBA Tracts, and/or reduce the potential that some of the remaining unleased federal coal in this area would be bypassed in the future. Under Alternative 2, the BLM could add all, part, or none of adjacent lands to one or both tracts or BLM could reduce the size of one or both tracts, as discussed in Section 2.0.

Under Alternative 2, the lands that BLM is evaluating in addition to the tract as applied for in the north tract are:

T.41N., R.71W., 6th P.M., Campbell County, Wyoming	
Section 9: Lots 9 through 16:	330.68 acres
Section 10: Lots 9 through 16:	326.42 acres
Section 11: Lots 13 and14:	85.03 acres
Section 14: Lots 3 and 4:	82.64 acres
Section 15: Lots 1 through 5, 12, and 13:	289.35 acres
Section 20: Lots 9 through 16:	327.18 acres
Section 21: Lots 1 through 16:	651.74 acres
Section 22: Lots 2, 7, 8, and 14 through 16:	252.93 acres
Section 27: Lots 6 through 11:	250.51 acres
Section 28: Lots 1 through 8:	322.50 acres
Section 29: Lots 1 through 8:	329.47 acres
Total:	3,248.45 acres

The lands that BLM is evaluating in addition to the tract as applied for in the south tract are:

T.41N., R.71W., 6th P.M., Converse County, Wyoming	
Section 29: Lots 12 and 13:	81.09 acres
Section 32: Lots 4, 5, 12, and 13:	162.36 acres

T.40N., R.71W., 6th P.M., Converse County, Wyoming	
Section 5: Lots 8, 9, and 16 through 18:	159.79 acres
Section 8: Lots 1 through 16:	637.66 acres
Section 9: Lots 2 through 16:	597.22 acres
Section 10: Lots 5, 6, and 11 through 14:	238.99 acres
Section 14: Lot 13:	39.99 acres
Section 15: Lots 2 through 7, and 10 through 16:	514.01 acres
Section 17: Lots 1 through 16:	629.62 acres
Total:	3,060.73 acres

BLM's preferred tract configuration is to add approximately 125 acres to the northeast corner of the North tract, as applied for, and approximately 554 acres to southeast corner of the South tract, as applied for (Figure 2-2). BLM's preferred alternative would be to divide the West Antelope II LBA, as originally applied for, into two separate tracts and to also add the following lands:

T.41N., R.71W., 6th P.M., Campbell County, Wyoming	
Section 10: Lots 10, and 16:	82.22 acres
Section 11: Lot 14:	42.69 acres
T.40N., R.71W., 6th P.M., Converse County, Wyoming	
Section 14: Lot 13:	39.99 acres
Section 15: Lots 2 through 7, and 10 through 16:	514.01 acres
Total:	678.91 acres

BLM's preferred alternative includes holding separate competitive lease sales on the two divided tracts. The legal description of BLM's preferred tract configuration for the West Antelope II LBA is as follows:

West Antelope II North Tract

T.41N., R.71W., 6th P.M., Campbell County, Wyoming	
Section 9: Lots 9 through 16:	330.68 acres
Section 10: Lots 10 through 16:	285.22 acres
Section 11: Lot 13:	42.34 acres
Section 14: Lots 3 and 4:	82.64 acres
Section 15: Lots 1 through 5, 12, and 13:	289.35 acres
Section 20: Lots 14 through 16:	122.89 acres
Section 21: Lots 1 through 16:	651.74 acres
Section 22: Lots 2, 7, 8, and 14 through 16:	252.93 acres
Section 27: Lots 6 through 11:	250.51 acres
Section 28: Lots 1 through 8:	322.50 acres
Section 29: Lots 1 through 3 and 6 through 8:	247.76 acres
West Antelope II North Tract Total:	2,878.56 acres

West Antelope II South Tract

T.40N., R.71W., 6th P.M., Converse County, Wyoming

Section 5: Lot 18:	40.25 acres
Section 8: Lots 1 through 3, 6 through 11, 14 through 16:	478.14 acres
Section 9: Lots 2 through 16:	597.22 acres
Section 10: Lots 5, 6, and 11 through 14:	238.99 acres
Section 14: Lot 13:	39.99 acres

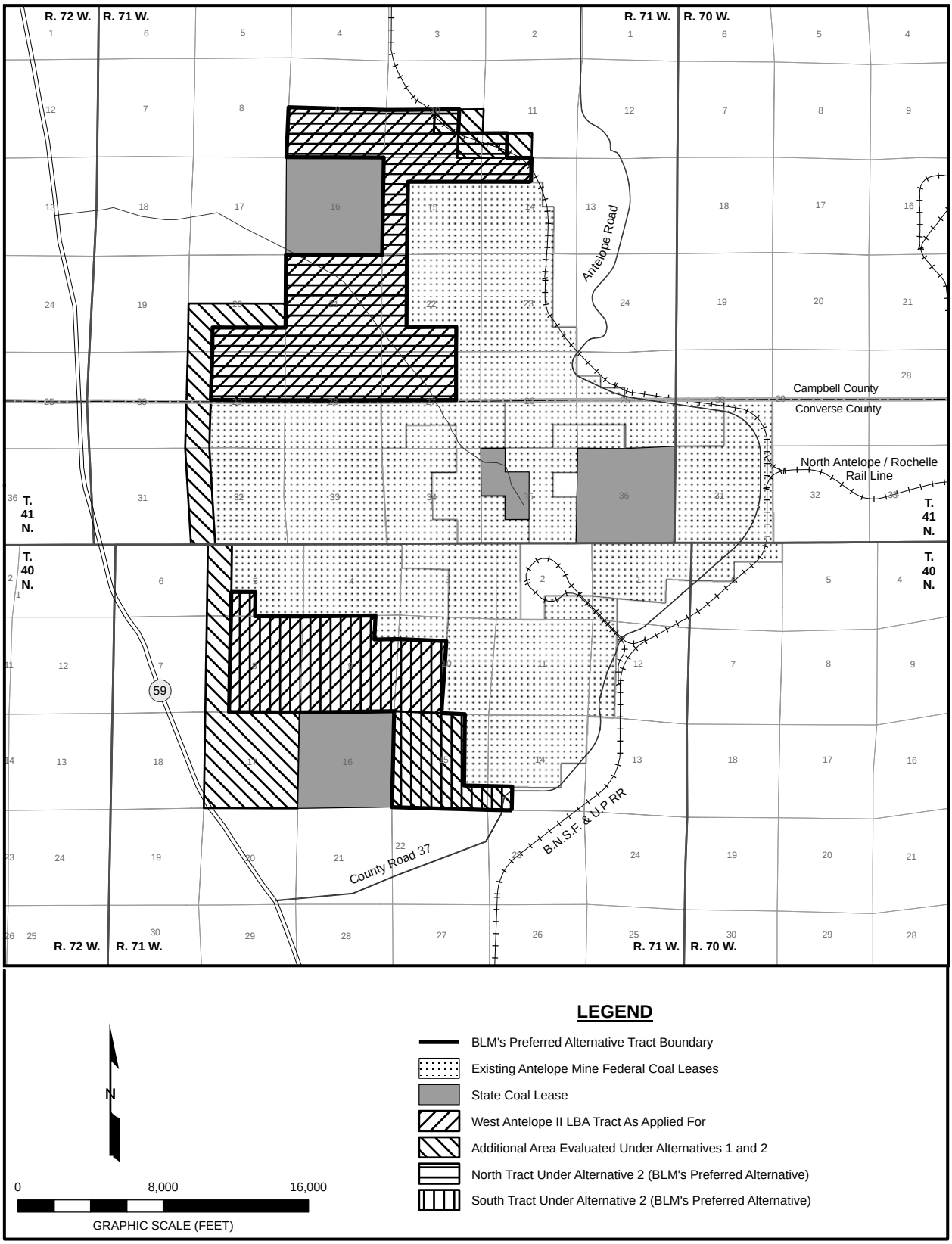


Figure 2-2. West Antelope II LBA Preferred Alternative Tract Configuration.

Section 15: Lots 2 through 7, and 10 through 16:	514.01 acres
West Antelope II South Tract Total:	1,908.60 acres
West Antelope II North and South Tracts Total:	4,787.16 acres

The land descriptions and acreage are based on the BLM Status of Public Domain Land and Mineral Titles approved Coal Plats as of April 15, 2004 and December 6, 2004. The coal estate in the tract described above is federally owned. The ownership of the surface and oil and gas estates is discussed in Section 3.11.

As discussed under the Proposed Action and Alternative 1, the BNSF and UP railroad crosses portions of the federal coal included in the West Antelope II North LBA Tract (Figure 2-2). The coal in the West Antelope II North LBA Tract that is located within the BNSF and UP railroad ROW and associated 100 foot buffer zone has been determined to be unsuitable for mining under Coal Unsuitability Criterion 2, and would not be recoverable.

As discussed under Alternative 1 and Section 1.5 and shown in Figure 2-1, State Highway 59 crosses the southwestern corner of the BLM study area for the south block of the tract, and Converse County Road 37 crosses the southeastern corner of the BLM study area for the south block of the tract, in Sections 17 and 14, T. 40 N., R. 71 W., respectively. BLM has determined that the coal underlying these portions of State Highway 59 and Converse County Road 37, their ROWs, and a buffer zone extending 100 feet on either side of the ROWs are unsuitable for mining in accordance with Coal Unsuitability 3 and would not be recoverable. The federal coal underlying State Highway 59 is not included in the tract under BLM's preferred tract configuration (Figure 2-2).

Although the coal that has been determined unsuitable for mining within the preferred tract would not be mined, the lands would be included in the alternative tract configuration to allow maximum recovery of all of the mineable coal that is adjacent to but outside of the ROWs and associated buffer zones and to comply with the coal leasing regulations that do not allow leasing of less than 10-acre aliquot parts.

ACC estimates that the West Antelope II North LBA Tract under the preferred tract configuration contains approximately 349.6 million tons of mineable coal and that approximately 324.8 million tons of that coal would be recoverable.

ACC estimates that the West Antelope II South LBA Tract under the preferred tract configuration contains approximately 60.3 million tons of mineable coal and that approximately 55.1 million tons of that coal would be recoverable.

BLM independently evaluates the volume and average quality of the coal resources included in proposed LBA tracts as part of the fair market value

determination process. BLM's estimate of the mineable federal coal reserves included in the West Antelope II North and South LBA Tracts may not be in agreement with the mineable coal reserve and coal quality estimates provided by the applicant. BLM's estimate of the mineable federal coal reserves included in the tracts will be published in the sale notice if the tracts are offered for sale.

Under Alternative 2, ACC estimates that an average annual coal production rate of 36 million tons would extend the life of the mine by approximately 11 years, and the average number of full-time employees may at times increase to as many as 455. ACC estimates that an average annual coal production rate of 42 million tons would extend the life of the mine by nine years and increase the average number of full-time employees to up to 470.

2.4 Alternative 3

Under the West Antelope II LBA tract Alternative 3, the No Action Alternative, ACC's application to lease the coal included in the West Antelope II LBA tract would be rejected, the tract would not be offered for competitive sale at this time, and the coal included in the tract would not be mined.

Rejection of the application would not affect permitted mining activities and employment on the existing leases at the Antelope Mine. The Antelope Mine currently leases approximately 10,828 acres of federal coal and 807 acres of state coal; all of which are within the existing Antelope Mine permit boundaries. A total of approximately 12,105 acres will eventually be affected in mining the current leases. If the West Antelope II LBA tract is not leased, ACC estimates that the average annual production at the Antelope Mine after January 1, 2007 will be 36 million tons, and the average full-time employment level is expected to be 430 persons. Portions of the surface of the LBA tract would probably be disturbed due to overstripping to allow coal to be removed from existing contiguous leases.

In order to compare the economic and environmental consequences of mining these lands versus not mining them, this EIS was prepared under the assumption that West Antelope II LBA tract would not be mined in the foreseeable future if the No Action Alternative is selected. However, selection of the No Action Alternative would not preclude leasing and mining of this tract in the future. If the decision is made to reject the West Antelope II lease application at this time, the tract could be leased as a maintenance lease in the future while the adjacent mine is in operation. If it is not leased while the existing adjacent mine is in operation, it may or may not be leased in the future. The tract being evaluated in this EIS does not include enough coal reserves to economically justify mining by a new operation; however, the coal reserves included in the tract could potentially be combined with unleased federal coal to the west and north to create a larger tract, which could be mined by a new operation in the future.

2.5 Alternative 4

Under this alternative, as under the Proposed Action, Alternative 1, and Alternative 2, the BLM would hold a separate, competitive, sealed-bid sale for the lands included in the West Antelope II LBA tract. Alternative 4 assumes, however, that the successful qualified bidder would be someone other than the applicant and that this bidder would plan to open a new mine to develop the coal resources included in the West Antelope II coal lease application.

A company or companies acquiring this coal for a new stand-alone mine would require considerable initial capital expenses, including the construction of new surface facilities (i.e., offices, shops, warehouses, coal processing facilities, coal loadout facilities, and rail spur), extensive baseline data collection, and development of new mining and reclamation plans. In addition, a company or companies acquiring this coal for a new start mine would have to compete for customers with established mines in a competitive market.

BLM currently estimates that a tract would potentially need to include as much as 500 to 600 million tons of coal in order to attract a buyer interested in opening a new mine in the Wyoming PRB. This is based on several assumptions. First, it is assumed that an operator would construct facilities capable of producing 30 mmtpy to take advantage of the economies of scale offered by the coal deposits in the PRB. It is also assumed that 20 to 30 years of coal reserves would be needed to justify the expense of building the facilities described above. Given these assumptions, under the Proposed Action, Alternative 1, or Alternative 2, while the total amount of coal included in the two blocks of coal may be sufficient to consider opening a new mine, that coal is divided into two blocks, and neither block includes sufficient coal resources to consider opening a new mine. Therefore, it is unlikely that a company or companies would lease the West Antelope II LBA tract in order to open a new mine.

The potential difficulty in obtaining an air quality permit is another issue that could discourage new mine starts in the PRB. A new mine would create a new source of air quality impacts. As discussed in Chapter 3, the WDEQ/AQD administers a permitting program to assist the agency in managing the state's air resources. Under this program, anyone planning to construct, modify, or use a facility capable of emitting designated pollutants into the atmosphere must obtain an air quality permit to construct. Coal mines fall into this category.

In order to obtain a construction permit, an operator may be required to demonstrate that the proposed activities will not increase air pollutant levels above annual standards established by the Wyoming Air Quality Standards and Regulations, which can be found on the internet at http://deq.state.wy.us/aqd/standards.asp. There were no exceedances of the 24-hour PM_{10} standards anywhere in the PRB through year 2000. From 2001 through 2005, there were 29 monitored exceedances of the 24-hour PM_{10} standard at seven

operating mines in the Wyoming PRB, four of which are located within the southern portion of the basin. Nineteen of these exceedances occurred in 2001 and 2002, while two, three, and five exceedances occurred in 2003, 2004, and 2005, respectively. One of the 2005 exceedances occurred at the Antelope Mine, but it was attributed to maintenance/construction operations on the adjacent railroad (WDEQ/AQD 2006a). In the first few months of 2007, there were nine exceedances at four mines. It may be difficult for an operator planning on opening a new mine to demonstrate that new operations would not result in air pollution levels that are above annual Wyoming standards.

In view of the issues discussed above, development of a new mine on the West Antelope II LBA tract is considered unlikely and this alternative is not analyzed in detail in this EIS.

The environmental impacts of developing a new mine to recover the coal resources in the West Antelope II LBA tract would be greater than under the Proposed Action, Alternative 1, Alternative 2, or Alternative 3 (the No Action Alternative) because of the need for new facilities, new rail lines, new employment, and the creation of additional sources of particulates (dust). In the event that a lease sale is held and the applicant is not the successful bidder, the successful bidder would be required to submit a detailed mining and reclamation plan for approval before any of the tract could be mined, and this NEPA analysis would be reviewed and supplemented as necessary prior to approval of that mining and reclamation plan.

2.6 Alternative 5

Under Alternative 5, the BLM would delay the sale of the West Antelope II LBA tract as applied for. The prices received for coal from the PRB have generally been increasing in recent years. If that trend continues, the bonus and royalty payments to the government might be higher if the tract is offered for sale at a later date. Also, delaying the sale of the tract would allow CBNG resources to be more completely recovered prior to mining. Under this alternative, it is assumed that the tract could be developed later as either a maintenance tract or a new start mine, depending on how long the sale was delayed.

There is no assurance at this time that delaying the sale would result in a higher coal price or a higher bonus bid. Damage to train tracks in Wyoming and other states limited coal shipments during much of 2005. These shipping constraints combined with increasing world energy demands and natural disasters in other parts of the country led to large increases in coal prices in 2005. Rail capacity increased in 2006 and prices have moderated in 2006 and 2007.

There are two major sources of revenue to state and federal governments from the leasing and mining of federal coal: 1) the competitive bonus bid paid at the time the coal is leased, and 2) federal and state royalties and taxes collected when the coal is sold.

If coal prices do increase, the fair market value of the coal resources in the LBA tract could potentially increase, which could result in an increased bonus bid if the coal is leased at a later date. However, postponing a lease sale would not necessarily lead to higher royalty or tax income to the state or federal governments. Royalty and tax payments are the larger of the two revenue sources and they increase automatically when coal prices increase because they are collected at the time the coal is sold. They cannot be collected until the coal is leased and permitted, which takes several years. If leasing is delayed, then by the time the coal is mined, the higher coal prices may or may not persist. If the higher coal prices do persist, they may enable the coal lessee to negotiate longer term contracts at higher prices, which would result in longer term, higher royalty and tax revenues. On the other hand, if an existing mine runs out of coal reserves before prices rise, it would potentially have to shut down before additional coal could be leased and permitted for mining. Under this scenario, the fair market value of the coal could actually decrease because the added expense of reopening a mine or starting a new mine would have to be factored into the fair market value.

Other considerations include the value of leaving the mineable coal for future development versus the value of making low-sulfur coal available now, in anticipation of cleaner fuel sources being developed in the future. Continued leasing of PRB coal enables coal-fired power plants to meet CAA requirements without constructing new plants, revamping existing plants, or switching to existing alternative fuels, which may significantly increase power costs for individuals and businesses. If cleaner fuel sources are developed in the future, they could be phased in with less economic impact to the public.

A range of the potential future economic benefits of delaying leasing until coal prices rise could be quantified in an economic analysis, but the benefits would have to be discounted to the present, which would make them similar to the Proposed Action and Alternatives 1 and 2.

CBNG resources are currently being recovered from oil and gas leases on the West Antelope II LBA tract and there are several mechanisms in place that can be used to allow continuing recovery of the CBNG resources prior to mining if the federal coal in the tract is leased now:

- BLM can attach a Multiple Mineral Development stipulation to the lease, which states that BLM has the authority to withhold approval of coal mining operations that would interfere with the development mineral leases issued prior to the coal lease.

- Mining of the West Antelope II LBA tract cannot occur until the coal lessee has a permit to mine the tract approved by the WDEQ/LQD and a MLA mining plan approved by the Secretary of the Interior. Before the MLA mining plan can be approved, BLM must approve the R2P2 for mining the tract. Prior to approving the R2P2, BLM can review the status of CBNG development on the tract and the mining sequence

proposed by the coal lessee. The permit approval process generally takes the coal lessee several years. This would allow time for a large portion of the CBNG resources to be recovered from the tract.

- BLM has a policy in place on CBNG-coal conflicts (BLM Instruction Memorandum No. 2006-153), which directs BLM decision makers to optimize the recovery of both resources and ensure that the public receives a reasonable return (BLM 2006d).

This alternative was not analyzed in detail because it would not produce substantially different impacts from other alternatives analyzed in detail. Rental and royalty provisions in the proposed lease provide for the U.S. to benefit if coal prices increase by the time of mining. Moreover, recovery of a large portion of the economically-recoverable CBNG resources on the tract would be anticipated after lease issuance because of the mechanisms discussed above. The environmental impacts of mining the coal later as part of an existing mine would be expected to be similar and about equal to the Proposed Action and the Action Alternatives. If a new mine start is required to mine the coal, the environmental impacts would be expected to be greater than if it were mined as an extension of an existing mine.

2.7 Summary of Alternatives and Environmental Consequences

2.7.1 Background

The decision-making process for public lands in Wyoming is conducted in compliance with NEPA, which requires all federal agencies to involve interested publics in their decision making, consider reasonable alternatives to the proposed actions, develop measures to mitigate environmental impacts, and prepare environmental documents that disclose the impacts of proposed actions and alternatives.

This final EIS analyzes in detail four different alternatives for the West Antelope II LBA tract, described in the discussion above.

2.7.2 Summary of Alternatives

The West Antelope II LBA tract under the Proposed Action and Alternatives 1 and 2 are shown on Figure 2-1. BLM's preferred tract configuration under Alternative 2 is shown on Figure 2-2. A summary comparison of projected coal production, surface disturbance, mine life, and federal and state revenues for the Proposed Action and Alternatives 1 and 2 for the West Antelope II LBA tract is presented in Table 2-2 for the 36 mmtpy production rate and in Table 2-3 for the 42 mmtpy production rate.

Table 2-4 presents a comparative summary of the direct and indirect environmental impacts of implementing each alternative as compared to the No Action Alternative. The No Action Alternative assumes completion of currently

permitted mining at the Antelope Mine for comparison to anticipated mining if the West Antelope II LBA tract is leased. Table 2-5 presents a comparative summary of cumulative environmental impacts of implementing each alternative. The environmental consequences of the Proposed Action and alternatives are analyzed in Chapters 3 and 4. These summary impact tables are derived from the following explanation of impacts and magnitude.

NEPA requires all agencies of the federal government to include, in every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on:

(i) the environmental impact of the Proposed Action,
(ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
(iii) alternatives to the Proposed Action,
(iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
(v) any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented (42 USC § 4332[C]).

Impacts can be beneficial or adverse, and they can be a primary result of an action (direct) or a secondary result (indirect). They can be permanent, long-term (persisting beyond the end of mine life and reclamation) or short-term (persisting during mining and reclamation and through the time the reclamation bond is released). Impacts also vary in terms of significance. The basis for conclusions regarding significance are the criteria set forth by the Council on Environmental Quality (40 CFR 1508.27) and the professional judgment of the specialists doing the analyses. Impact significance may range from negligible to substantial; impacts can be significant during mining but be reduced to insignificance following completion of reclamation.

Table 2-2. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for West Antelope II LBA Tract and Antelope Mine - Assuming Average Annual Post-2006 Coal Production is 36 mmt.

Item	Alternative 3-No Action Alternative (Existing Antelope Mine)	Added by Proposed Action (tract as applied for}	Added by Alternative 1	Added by Alternative 2: North Tract Preferred Alternative	Added by Alternative 2: South Tract Preferred Alternative
In-Place Coal (as of 1/1/07)	428.6 mmt	429.7 mmt	530.0 mmt	379.1 mmt	76.8 mmt
Mineable Coal (as of 1/1/07)[1]	428.6 mmt	408.4 mmt	490.0 mmt	349.6 mmt	60.3 mmt
Recoverable Coal (as of 1/1/07)[2]	394.3 mmt	377.8 mmt	453.9 mmt	324.8 mmt	55.1 mmt
Coal Mined Through 2006	318.9 mmt	—	—	—	—
Lease Area[3]	11,635.5 ac	4,108.60 ac	6,309.18 ac	2,878.56 ac	1,908.60 ac
Total Area To Be Disturbed[4]	12,104.8 ac	4,314.0 ac	6,624.6 ac	3,022.5 ac	2,004.0 ac
Permit Area[4]	14,280.1 ac	4,490.2 ac	7,405.3 ac	3,168.6 ac	2,188.3 ac
Average Annual Post-2006 Coal Production	36 mmt	0 mmt	0 mmt	0 mmt	0 mmt
Remaining Life of Mine (post-2006)	11 yr	11 yr	13 yr	9 yr	2 yr
Average Number of Employees	430	up to 25	up to 25	up to 25	
Total Projected State and Local Revenues (post-2006)[5,6]	$ 657.3 million	$ 686.4 - $ 813.0 million	$ 824.7 - $ 976.8 million	$ 590.1 - $ 699.0 million	$ 100.1 - $ 118.6 million
Total Projected Federal Revenues (post-2006)[7]	$ 473.7 million	$ 510.6 - $ 637.1 million	$ 613.4 - $ 765.5 million	$ 439.0 - $ 547.8 million	$ 74.5 - $ 92.9 million

1 Mineable coal figure excludes all coal that would not be mined beneath BNSF & UP railroad ROW and public road ROWs.

2 Recoverable coal figure assumes 91.3 percent recovery (south tract) or 92.9 percent recovery (north tract) of mineable coal and excludes all mining losses that occur during normal mining operations.

3 Includes federal and state coal leases

4 The disturbed area exceeds the leased area because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

5 Revenues to the State of Wyoming and local governments include severance tax, property and production taxes, sales and use taxes, and Wyoming's share of federal royalty payments, bonus bids, and AML fees. State revenues are based on an assumed price of $9.01 per ton of 'recoverable coal', federal royalty of 12.5 percent of the value less 50.5 percent federal share, plus $0.315 per ton for AML fees x an assumed 25 percent state share, plus bonus payments of between $0.30 and $0.97 per ton of LBA leased coal per ton (based on 8 PRB LBA coal sales from 2004 through early-2008) x tonnage of recoverable coal x 50 percent state share, plus $0.07 per ton estimated sales and use taxes, plus $0.33 per ton estimate for ad valorem taxes, plus $0.631 per ton in severance taxes. Only the sales and use taxes paid directly by the mine are considered, i.e., those generated by vendors and suppliers and by consumer expenditure supported directly and indirectly by the mine are not included.

6 Revenues for Alternative 3 do not include the $43.9 million in scheduled coal lease bonus bids to be paid on the West Antelope LBA in FY07 through FY09.

7 Federal revenues are based on an assumed price of $9.01 per ton, federal royalty of 12.5 percent x 50.5 percent share, plus $0.315 per ton for AML fees x an assumed 75 percent federal share, plus black lung tax of $0.00261 per ton, plus bonus payments of between $0.30 and $0.97 per ton of LBA leased coal of (based on 8 PRB LBA coal sales from 2004 through early-2008) x tonnage of recoverable coal minus x 50 percent federal share.

Table 2-3. Summary Comparison of Coal Production, Surface Disturbance, Mine Life, and Revenues for West Antelope II LBA Tract and Antelope Mine - Assuming Average Annual Post-2006 Coal Production is 42 mmt.

Item	Alternative 3-No Action Alternative (Existing Antelope Mine)	Added by Proposed Action (tract as applied for}	Added by Alternative 1	Added by Alternative 2: North Tract Preferred Alternative	Added by Alternative 2: South Tract Preferred Alternative
In-Place Coal (as of 1/1/07)	428.6 mmt	429.7 mmt	530.0 mmt	379.1 mmt	76.8 mmt
Mineable Coal (as of 1/1/07)[1]	428.6 mmt	408.4 mmt	490.0 mmt	349.6 mmt	60.3 mmt
Recoverable Coal (as of 1/1/07)[2]	394.3 mmt	377.8 mmt	453.9 mmt	324.8 mmt	55.1 mmt
Coal Mined Through 2006	318.9 mmt	—	—	—	—
Potential Lease Area[3]	11,635.5 ac	4,108.60 ac	6,309.18 ac	2,878.56 ac	1,908.60 ac
Total Area To Be Disturbed[4]	12,104.8 ac	4,314.0 ac	6,624.6 ac	3,022.5 ac	2,004.0 ac
Permit Area[4]	14,280.1 ac	4,490.2 ac	7,405.3 ac	3,168.6 ac	2,188.3 ac
Average Annual Post-2006 Coal Production	36 mmt	6 mmt	6 mmt	6 mmt	0 mmt
Remaining Life of Mine (post-2006)	11 yr	9 yr	11 yr	8 yr	1 yr
Average Number of Employees	430	up to 40	up to 40	up to 40	
Total Projected State and Local Revenues (post-2006)[5,6]	$ 657.3 million	$ 686.4 - $ 813.0 million	$ 824.7 - $ 976.8 million	$ 590.1 - $ 699.0 million	$ 100.1 - $ 118.6 million
Total Projected Federal Revenues (post-2006)[7]	$ 473.7 million	$ 510.6 - $ 637.1 million	$ 613.4 - $ 765.5 million	$ 439.0 - $ 547.8 million	$ 74.5 - $ 92.9 million

1 Mineable coal figure excludes all coal that would not be mined beneath BNSF & UP railroad ROW and public road ROWs.

2 Recoverable coal figure assumes 91.3 percent recovery (south tract) or 92.9 percent recovery (north tract) of mineable coal and excludes all mining losses that occur during normal mining operations.

3 Includes federal and state coal leases

4 The disturbed area exceeds the leased area because of the need for highwall reduction, topsoil removal, and other mine support activities outside the lease boundaries. The permit area is larger than the leased or disturbed area to assure that all disturbed lands are within the permit boundary and to allow an easily defined legal land description.

5 Revenues to the State of Wyoming and local governments include severance tax, property and production taxes, sales and use taxes, and Wyoming's share of federal royalty payments, bonus bids, and AML fees. State revenues are based on an assumed price of $9.01 per ton of 'recoverable coal', federal royalty of 12.5 percent of the value less 50.5 percent federal share, plus $0.315 per ton for AML fees x an assumed 25 percent state share, plus bonus payments of between $0.30 and $0.97 per ton of LBA leased coal per ton (based on 8 PRB LBA coal sales from 2004 through early-2008) x tonnage of recoverable coal x 50 percent state share, plus $0.07 per ton estimated sales and use taxes, plus $0.33 per ton estimate for ad valorem taxes, plus $0.631 per ton in severance taxes. Only the sales and use taxes paid directly by the mine are considered, i.e., those generated by vendors and suppliers and by consumer expenditure supported directly and indirectly by the mine are not included.

6 Revenues for Alternative 3 do not include the $43.9 million in scheduled coal lease bonus bids to be paid on the West Antelope LBA in FY07 through FY09.

7 Federal revenues are based on an assumed price of $9.01 per ton, federal royalty of 12.5 percent x 50.5 percent share, plus $0.315 per ton for AML fees x an assumed 75 percent federal share, plus black lung tax of $0.00261 per ton, plus bonus payments of between $0.30 and $0.97 per ton of LBA leased coal of (based on 8 PRB LBA coal sales from 2004 through early-2008) x tonnage of recoverable coal minus x 50 percent federal share.

Table 2-4. Summary Comparison of Magnitude[1] and Duration of Direct and Indirect Impacts for the Proposed Action, Alternatives 1 and 2, and the No Action Alternative for the West Antelope II LBA Tract[2].

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	***MAGNITUDE AND DURATION OF IMPACT***	
RESOURCE NAME	**ALTERNATIVE 3 - NO ACTION ALTERNATIVE**	**PROPOSED ACTION, ALTERNATIVE 1 and ALTERNATIVE 2**
TOPOGRAPHY & PHYSIOGRAPHY		
Lower surface elevation	Moderate, permanent on existing mine area	Same as No Action on expanded mine area
Permanent topographic moderation, which could result in:		
Microhabitat reduction	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Habitat diversity reduction	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Big game carrying capacity reduction	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Reduction in water runoff and peak flows	Moderate, beneficial, long term on existing mine area	Same as No Action on expanded mine area
Increased precipitation infiltration	Moderate, beneficial, long term on existing mine area	Same as No Action on expanded mine area
Reduction in erosion	Moderate, beneficial, long term on existing mine area	Same as No Action on expanded mine area
Potential enhanced vegetative productivity	Moderate, beneficial, long term on existing mine area	Same as No Action on expanded mine area
Potential acceleration of groundwater recharge	Moderate, beneficial, long term on existing mine area	Same as No Action on expanded mine area
GEOLOGY AND MINERALS		
Removal of coal	Moderate, permanent on existing mine area	Same as No Action on expanded mine area
Removal and replacement of topsoil and overburden	Moderate, permanent on existing mine area	Same as No Action on expanded mine area
Physical characteristic alterations in replaced overburden	Moderate, permanent on existing mine area	Same as No Action on expanded mine area
Loss of unrecovered CBNG though venting and/or depletion of hydrostatic pressure	Moderate to substantial, permanent on existing mine area	Same as No Action on expanded mine area
Loss of access for development of sub-coal oil and gas resources and other minerals	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Destruction of paleontological resources that are not exposed on the surface	Moderate, permanent on the existing mine area	Same as No Action on expanded mine area
AIR QUALITY		
Particulate Emissions:		
Elevated concentrations associated with average production of 36 to 42 mmtpy in compliance with ambient standards	Moderate, short term on existing mine and surrounding area	Same as No Action on expanded mine and surrounding area for 10 to 13 additional years
NO_x Emissions from Machinery:		Same as No Action on expanded mine and surrounding area for 10 to 13 additional years
Elevated concentrations associated with average production of 36 to 42 mmtpy in compliance with ambient standard	Moderate, short term on existing mine and surrounding area	

[1] Refer to Chapter 3 for a discussion on magnitude of impacts.
[2] All impacts are assumed to be adverse unless noted otherwise.

Table 2-4. Summary Comparison of Magnitude[1] and Duration of Direct and Indirect Impacts for the Proposed Action, Alternatives 2 and 3, and the No Action Alternative for the West Antelope II LBA Tract[2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	***MAGNITUDE AND DURATION OF IMPACT***	
RESOURCE NAME	**ALTERNATIVE 3 - NO ACTION ALTERNATIVE**	**PROPOSED ACTION, ALTERNATIVE 1 and ALTERNATIVE 2**
AIR QUALITY (Continued)		
NO_x Emissions from Blasting:		
Potential for public exposure	No reported events	No events projected
Visibility:		
Elevated concentrations of fine particulate matter associated with average production of 36 to 42 mmtpy	Moderate, short term on existing mine and surrounding area	Same as No Action on expanded mine and surrounding area for 10 to 13 additional years
Acidification of Lakes:		Same as No Action
SO_2 emissions derived from burning Antelope Mine coal to produce power	Moderate, short term	
WATER RESOURCES		
GROUNDWATER		
Removal of coal and overburden aquifers	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Replacement of existing coal and overburden with unconsolidated backfill material	Moderate, permanent on existing mine area	Same as No Action on expanded mine area
Depressed water levels in overburden and coal aquifers adjacent to mine	Moderate, short to long term on existing mine and surrounding area	Same as No Action on expanded mine and surrounding area
Change in hydraulic properties in backfilled areas	Negligible, long term on existing mine area	Same as No Action on expanded mine area
Increase in TDS concentrations in backfilled areas	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Use of subcoal aquifers for water supply	Negligible, short term on existing mine and surrounding area	Same as No Action on expanded mine and surrounding area
Decrease in water supply for groundwater-right holders within the five-foot drawdown area	Moderate, long term on existing mine and surrounding area	Same as No Action on expanded mine and surrounding area
SURFACE WATER		
Diversion and disruption of surface drainage systems	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Reconstruction of surface drainage systems	Permanent on existing mine areas	Same as No Action on expanded mine area
Increased runoff and erosion rates on disturbed lands due to vegetation removal	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Increased infiltration on reclaimed lands due to topographic moderation	Moderate, beneficial, long term on existing mine area	Same as No Action on expanded mine area
Increased runoff on reclaimed lands due to loss of soil structure	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Potential for adverse downstream effects as a result of sediment produced by large storms	Moderate, long term for existing approved mining operation	Same as No Action on expanded mining operation

[1] Refer to Chapter 3 for a discussion on magnitude of impacts.
[2] All impacts are assumed to be adverse unless noted otherwise.

Table 2-4. Summary Comparison of Magnitude[1] and Duration of Direct and Indirect Impacts for the Proposed Action, Alternatives 2 and 3, and the No Action Alternative for the West Antelope II LBA Tract[2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	***MAGNITUDE AND DURATION OF IMPACT***	
RESOURCE NAME	**ALTERNATIVE 3 - NO ACTION ALTERNATIVE**	**PROPOSED ACTION, ALTERNATIVE 1 and ALTERNATIVE 2**
ALLUVIAL VALLEY FLOORS		
While final determinations have not been made by WDEQ/LQD, it is believed that there are no AVFs significant to agriculture on the proposed lease tract		
Removal and restoration of AVFs determined not to be significant to agriculture	Moderate, short term on existing leases	Same as No Action on expanded mine area
Disruptions to streamflows supplying downstream AVFs	Negligible, short term on existing leases	Same as No Action on expanded mine area
WETLANDS		
Removal of jurisdictional wetlands and loss of wetland function until reclamation occurs	Moderate, short term on existing leases; jurisdictional wetlands would be replaced as required under Section 404 of the Clean Water Act	Same as No Action on expanded mine area
Removal of non-jurisdictional wetlands and loss of wetland function until reclamation occurs	Moderate, short term to long term on existing leases; non-jurisdictional wetlands would be replaced as required by the surface land owner or WDEQ/LQD	Same as No Action on expanded mine area
SOILS		
Changes in physical properties after reclamation would include:		
Increased near-surface bulk density and decreased soil infiltration rate resulting in increased potential for soil erosion	Moderate, long term on existing mine area	Same as No Action on expanded mine area
More uniformity in soil type, thickness, and texture	Moderate, beneficial, long term on existing mine area	Same as No Action on expanded mine area
Decreased runoff due to topographic modification	Moderate, beneficial, long term on existing mine area	Same as No Action on expanded mine area
Changes in biological properties in soils that are stockpiled before reclamation would include:		
Reduction in organic matter	Moderate, short to long term on existing mine area	Same as No Action on expanded mine area
Reduction in microorganism population	Moderate, short to long term on existing mine area	Same as No Action on expanded mine area
Reduction in seeds, bulbs, rhizomes, and live plant parts	Moderate, short to long term on existing mine area	Same as No Action on expanded mine area
Changes in chemical properties would include: More uniform soil nutrient distribution	Moderate, beneficial, long term on existing mine area	Same as No Action on expanded mine area

[1] Refer to Chapter 3 for a discussion on magnitude of impacts.
[2] All impacts are assumed to be adverse unless noted otherwise.

Table 2-4. Summary Comparison of Magnitude[1] and Duration of Direct and Indirect Impacts for the Proposed Action, Alternatives 2 and 3, and the No Action Alternative for the West Antelope II LBA Tract[2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	***MAGNITUDE AND DURATION OF IMPACT***	
RESOURCE NAME	**ALTERNATIVE 3 - NO ACTION ALTERNATIVE**	**PROPOSED ACTION, ALTERNATIVE 1 and ALTERNATIVE 2**
VEGETATION		
During mining:		
Progressive removal of existing vegetation	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Increased erosion	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Wildlife habitat and livestock grazing loss	Moderate, short term on existing mine area	Same as No Action on expanded mine area
After revegetation:		
Changes in vegetation patterns	Negligible, long term on existing mine area	Same as No Action on expanded mine area
Reduction in vegetation diversity	Negligible, long term on existing mine area	Same as No Action on expanded mine area
Reduction in shrub density	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Decreased big game habitat carrying capacity	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Decreased habitat for shrub dependent species	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Potential invasion of non-native plant species	Moderate, short term on existing mine area	Same as No Action on expanded mine area
WILDLIFE		
Big game displacement from active mining areas	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Increased competition on adjacent undisturbed or reclaimed lands, especially big game	Moderate, short term on adjacent area	Same as No Action on adjacent area
Restriction of wildlife movement, especially big game	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Increased mortality of small mammals	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Displacement of small and medium-sized mammals	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Surface and noise disturbance of active sage grouse leks	Moderate, short to long term on existing mine area	Same as No Action on expanded mine area
Disturbance of sage grouse nesting habitat during mining	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Loss of sage grouse nesting habitat after reclamation	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Alteration of plant and animal communities after	Negligible, short term on existing mine area	Same as No Action on expanded mine area
reclamation	Negligible, short term on existing mine area	Same as No Action on expanded mine area
Abandonment of raptor nests	Negligible, short to long term on existing mine area	Same as No Action on expanded mine area
Loss of foraging habitat for raptors	Negligible, short to long term on existing mine area	Same as No Action on expanded mine area
Loss of nesting and foraging habitat for Migratory Birds of Management Concern	Negligible, short term on existing mine area	Same as No Action on expanded mine area
Reduction in waterfowl resting and feeding habitat	Negligible, short term on existing mine area	Same as No Action on expanded mine area
Loss of habitat for aquatic species during mining	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Road kills by mine-related traffic	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Reduction in habitat carrying capacity and habitat diversity on reclaimed lands	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Potential reduction in microhabitats on reclaimed lands		

[1] Refer to Chapter 3 for a discussion on magnitude of impacts.
[2] All impacts are assumed to be adverse unless noted otherwise.

Table 2-4. Summary Comparison of Magnitude[1] and Duration of Direct and Indirect Impacts for the Proposed Action, Alternatives 2 and 3, and the No Action Alternative for the West Antelope II LBA Tract[2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	***MAGNITUDE AND DURATION OF IMPACT***	
RESOURCE NAME	**ALTERNATIVE 3 - NO ACTION ALTERNATIVE**	**PROPOSED ACTION, ALTERNATIVE 1 and ALTERNATIVE 2**
THREATENED, ENDANGERED, PROPOSED, AND CANDIDATE SPECIES (See Appendix I)		
Black-footed ferrets	As determined by previous consultation with USFWS for all species	No effect
Ute ladies'-tresses		May affect, not likely to adversely affect
LAND USE AND RECREATION		
Reduction of livestock grazing	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Loss of wildlife habitat	Moderate, long term on existing mine area	Same as No Action on expanded mine area
Loss of access for sub-coal oil and gas development	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Removal of oil and gas production facilities	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Loss of access to public land available for recreation and grazing	Moderate, short term on existing mine area	Same as No Action on expanded mine area
CULTURAL RESOURCES		
Sites that are not eligible for NRHP	Ineligible sites may be destroyed without further work	Same as No Action on expanded mine area
Sites that are eligible for NRHP	Impacts to sites that are eligible for the NHRP are not permitted; eligible sites would be avoided or mitigated through data recovery prior to mining	Same as No Action on expanded mine area
Sites that are unevaluated for eligibility	Impacts to unevaluated sites are not permitted; unevaluated sites would be evaluated prior to mining	Same as No Action on expanded mine area
NATIVE AMERICAN CONCERNS	No impact identified on existing mine area	Same as No Action on expanded mine area
VISUAL RESOURCES		
During mining:		
Alteration of landscape by mining facilities and operations	Moderate, short term on existing mine area	Same as No Action on expanded mine area
Visibility of mining operations from highway	Moderate, short term on existing mine area	
Following reclamation:	Negligible, long term on existing mine area	Same as No Action on expanded mine area
Smoother sloped terrain	Moderate, short to long term on existing mine area	Same as No Action on expanded mine area
Reduction in sagebrush density		

[1] Refer to Chapter 3 for a discussion on magnitude of impacts.
[2] All impacts are assumed to be adverse unless noted otherwise.

Table 2-4. Summary Comparison of Magnitude[1] and Duration of Direct and Indirect Impacts for the Proposed Action, Alternatives 2 and 3, and the No Action Alternative for the West Antelope II LBA Tract[2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	***MAGNITUDE AND DURATION OF IMPACT***	
RESOURCE NAME	**ALTERNATIVE 3 - NO ACTION ALTERNATIVE**	**PROPOSED ACTION, ALTERNATIVE 1 and ALTERNATIVE 2**
NOISE		
Increased noise levels	Moderate to substantial, short term on existing mine, surrounding area and occupied dwellings and businesses	Same as No Action on expanded mine area
TRANSPORTATION FACILITIES		
Use of railroads to ship coal	Moderate, for duration of existing approved mining operations	Same as No Action for additional 10 to 13 years
Employee and service contractor use of highways to and from mine sites	Moderate, for duration of existing approved mining operations	Same as No Action for additional 10 to 13 years Same as No Action on expanded mine area
Relocation of pipelines	Negligible, short to long term on existing mine area	Same as No Action on expanded mine area
Relocation of utility lines	Negligible, short to long term on existing mine area	
HAZARDOUS AND SOLID WASTE		
Waste generated by mining operations	Negligible for duration of existing approved mining operations	Same as No Action on expanded mine area
SOCIOECONOMICS		
Employment	Negligible, beneficial short term for existing approved mining operations	Up to 25 to 40 potential additional if mine life extended Same as No Action for additional 10 to 13 years
Revenues from royalties and taxes to the state and local government	Moderate, beneficial short term for existing approved mining operations	Same as No Action for additional 10 to 13 years Same as No Action for additional 10 to 13 years
Revenues from royalties and taxes to the federal government	Moderate, beneficial short term for existing approved mining operations	Same as No Action for additional 10 to 13 years
Economic development	Moderate, beneficial short term for existing approved mining operations	
Additional housing and infrastructure needs	No new impact related to existing approved mining operations	

[1] Refer to Chapter 3 for a discussion on magnitude of impacts.
[2] All impacts are assumed to be adverse unless noted otherwise.

Table 2-5. Summary Comparison of Magnitude and Duration of Cumulative Impacts[1, 2].

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	***MAGNITUDE, TYPE, AND DURATION OF IMPACT***	
RESOURCE NAME	**ALTERNATIVE 3 - NO ACTION ALTERNATIVE**	**PROPOSED ACTION, ALTERNATIVE 1 and ALTERNATIVE 2**
TOPOGRAPHY & PHYSIOGRAPHY		
Alteration of topography following reclamation of coal disturbance areas	Permanent topographic moderation following reclamation	Same as No Action
Alteration of topography to accommodate coal-related, oil and gas, and oil- and gas-related facilities	Long term to permanent limited changes in discrete, scattered areas	Same as No Action
GEOLOGY AND MINERALS		
Recovery of coal resulting in reduction in coal resources and disturbance and replacement of overburden and topsoil	Moderate, long term to permanent	Same as No Action
Surficial disturbance and reclamation on oil and gas well sites and associated facilities	Moderate, long term to permanent	Same as No Action
PALEONTOLOGY		
Coal, coal-related, oil and gas, and oil- and gas-related development disturbance of PFYC Class 5 Wasatch and Class 3 Fort Union Formations	Permanent potential adverse effects to scientifically significant fossils that are present but not visible prior to disturbance	Same as No Action
AIR QUALITY		
Impacts to Montana near-field receptors		
- 24-hour PM_{10}	A maximum modeled impact in one area above NAAQS for the baseline year and both coal production scenarios for 2010	Same as No Action
- All other parameters	Modeled impacts in compliance with NAAQS and Montana AAQS	Same as No Action
Impacts to Wyoming near-field receptors		
- 24-hour PM_{10}	Modeled impact above NAAQS at some receptors for both coal production scenarios for 2010	Same as No Action
- Annual PM_{10}	Maximum modeled impact above WAAQS at one receptor for the upper production scenario for 2010	Same as No Action
- All other parameters	Modeled impacts in compliance with NAAQS and Wyoming AAQS	Same as No Action

[1] Cumulative impact discussion in this table and in Chapter 4 is based on the PRB Coal Review analyses (BLM 2005a-f, 2006a).
[2] All impacts are assumed to be adverse unless noted otherwise.

Table 2-5. Summary Comparison of Magnitude and Duration of Cumulative Impacts[1, 2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	MAGNITUDE, TYPE, AND DURATION OF IMPACT	
RESOURCE NAME	**ALTERNATIVE 3 - NO ACTION ALTERNATIVE**	**PROPOSED ACTION, ALTERNATIVE 1 and ALTERNATIVE 2**
AIR QUALITY (Continued)		
Non-regulatory PSD Impacts at Class I and Sensitive Class II Areas		
- Class I Northern Cheyenne Indian Reservation	Modeled impacts above Class I increment levels for 24-hour PM_{10}, annual PM_{10}, 24-hour SO_2, 3-hour SO_2 for baseline year and both coal production scenarios for 2010; above Class I increment for annual NO_2 for upper coal production scenario for 2010	Same as No Action
- Class I Washakie Wilderness Area and Wind Cave National Park and Class II Crow Indian Reservation	Modeled impacts above Class I increment levels for 24-hour PM_{10} for baseline year and both coal production scenarios for 2010	Same as No Action
- All other Class I and Sensitive Class II modeled receptors	Modeled impacts within Class I increment levels for baseline year and both coal production scenarios for 2010	Same as No Action
Visibility Impacts	199 or more days with a change of 1.0 dv or greater at three Class I areas and seven sensitive Class II areas for the baseline year and both coal productions scenarios for 2010	Same as No Action
Acid deposition Impacts	All modeled impacts below the depositions threshold values for nitrogen and sulfur compounds	Same as No Action
- Florence Lake	Modeled impact above 10 percent ANC	Same as No Action
- Upper Frozen Lake	Modeled impact above 1 μeq/L	Same as No Action
- All other modeled sensitive lakes	Modeled impact below threshold values	Same as No Action
GROUNDWATER RESOURCES		
Removal of coal aquifer and replacement with backfill material	Moderate, permanent for mining areas	Same as No Action
Lowering of water levels in aquifers around the mines	Moderate, long term in area immediately west of mines	Same as No Action
Water level decline in sub-coal aquifers as a result of all development	No cumulative impacts anticipated	Same as No Action
Change in groundwater quality as a result of all development	No cumulative impacts anticipated	Same as No Action

[1] Cumulative impact discussion in this table and in Chapter 4 is based on the PRB Coal Review analyses (BLM 2005a-f, 2006a).
[2] All impacts are assumed to be adverse unless noted otherwise.

Table 2-5. Summary Comparison of Magnitude and Duration of Cumulative Impacts[1, 2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	MAGNITUDE, TYPE, AND DURATION OF IMPACT	
RESOURCE NAME	**ALTERNATIVE 3 - NO ACTION ALTERNATIVE**	**PROPOSED ACTION, ALTERNATIVE 1 and ALTERNATIVE 2**
GROUNDWATER RESOURCES (Continued)		
Overlapping drawdown in the coal aquifer caused by surface mining and CBNG development	Additive, long term in area immediately west of surface coal mines	Same as No Action
SURFACE WATER RESOURCES		
Surface disturbance of intermittent and ephemeral streams and scattered ponds and reservoirs as a result of coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short term	Same as No Action
Discharge of coal mining and CBNG produced waters into intermittent and ephemeral streams	Moderate, short term	Same as No Action
Sediment input into intermittent and ephemeral streams and scattered ponds and reservoirs as a result of coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short term	Same as No Action
ALLUVIAL VALLEY FLOORS		
Coal mining disturbance of AVFs determined to be significant to agriculture	Not permitted by regulation	Same as No Action
Coal mining disturbance of AVFs determined not to be significant to mining	AVFs disturbed by mining must be restored to essential hydrologic function No cumulative impacts anticipated	Same as No Action
SOILS		
Coal mining, coal-related, oil and gas, and oil- and gas-related disturbance and replacement of soil resources	Moderate, short term and long term impacts through accelerated wind or water erosion, declining soil quality factors through compaction, reduced microbial populations and organic matter, and potential mixing of soil zones	Same as No Action
CBNG water disposal impacts to soil resources	Potential increase in soil alkalinity depending on SAR levels in water and method of water disposal	Same as No Action

[1] Cumulative impact discussion in this table and in Chapter 4 is based on the PRB Coal Review analyses (BLM 2005a-f, 2006a).
[2] All impacts are assumed to be adverse unless noted otherwise.

Table 2-5. Summary Comparison of Magnitude and Duration of Cumulative Impacts[1, 2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	MAGNITUDE, TYPE, AND DURATION OF IMPACT	
RESOURCE NAME	**ALTERNATIVE 3 - NO ACTION ALTERNATIVE**	**PROPOSED ACTION, ALTERNATIVE 1 and ALTERNATIVE 2**
VEGETATION		
Coal mining, coal-related, oil and gas, and oil- and gas-related removal and replacement of native vegetation	Moderate, short to long term impacts due to potential differences in species composition and presence and size of woody species on reclaimed lands	Same as No Action
Coal mining, coal-related, oil and gas, and oil- and gas-related impacts to Special Status Plant Species	Potential incremental loss of alteration of potential or known habitat	Same as No Action
Coal mining, coal related, oil and gas, and oil- and gas-related dispersal of noxious and invasive species	Potential displacement of native species and changes in species composition	Same as No Action
WETLAND AND RIPARIAN VEGETATION		
CBNG-related discharge of produced water	Moderate, short to long term creation of wetlands in areas that previously supported upland vegetation	Same as No Action
WILDLIFE		
Direct and indirect coal mining, coal-related, oil and gas, and oil- and gas-related development impacts to game and non-game species, including direct mortality, habitat fragmentation, animal displacement, noise and increased human presence	Moderate, short term	Same as No Action
Coal mining, coal-related, oil and gas, and oil- and gas-related disturbance of game and nongame species habitat during project development and operation	Moderate, short term loss of all types of habitat present in disturbed areas	Same as No Action
Coal mining, coal related, oil and gas, and oil- and gas-related habitat changes after reclamation	Moderate, long term change in habitat with potential changes in associated wildlife populations	Same as No Action
FISHERIES		
Alteration or loss of habitat due to coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short to long term	Same as No Action
Changes in water quality as a result of surface disturbance or introduction of contaminants into drainages caused by coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short to long term	Same as No Action

[1] Cumulative impact discussion in this table and in Chapter 4 is based on the PRB Coal Review analyses (BLM 2005a-f, 2006a).
[2] All impacts are assumed to be adverse unless noted otherwise.

Table 2-5. Summary Comparison of Magnitude and Duration of Cumulative Impacts[1, 2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	MAGNITUDE, TYPE, AND DURATION OF IMPACT	
RESOURCE NAME	**ALTERNATIVE 3 - NO ACTION ALTERNATIVE**	**PROPOSED ACTION, ALTERNATIVE 1 and ALTERNATIVE 2**
FISHERIES (Continued)		
Changes in available habitat as a result of water withdrawals or discharges related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short term	Same as No Action
SPECIAL STATUS SPECIES		
Direct and indirect coal mining, coal-related, oil and gas, and oil- and gas-related development impacts, including direct mortality, breeding area, nest, or burrow abandonment, noise and increased human presence	Moderate, short term	Same as No Action
Coal mining, coal-related, oil and gas, and oil- and gas-related disturbance of habitat during project development and operation	Moderate, short term loss of all types of special status species habitat present in disturbed areas	Same as No Action
Coal mining, coal related, oil and gas, and oil- and gas-related habitat changes after reclamation	Moderate, long term change in habitat with potential changes in associated populations of special status species	Same as No Action
LAND USE AND RECREATION		
Loss of forage and range improvements and restriction of livestock movement due to coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short term	Same as No Action
Disturbance of developed recreation sites by coal mining, coal-related, oil and gas, and oil- and gas-related development	Negligible, short term	Same as No Action
Reduction or degradation of opportunities for dispersed recreation activities related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short term on existing mine area	Same as No Action
CULTURAL RESOURCES		
Disturbance of cultural resource sites	Moderate, permanent	Same as No Action
TRANSPORTATION AND UTILITIES		
Movement of segments of existing highways, pipelines, transmission lines, or railroads to accommodate coal mining development	Moderate, long term to permanent, disruptive effects would be minimized	Same as No Action

[1] Cumulative impact discussion in this table and in Chapter 4 is based on the PRB Coal Review analyses (BLM 2005a-f, 2006a).
[2] All impacts are assumed to be adverse unless noted otherwise.

Table 2-5. Summary Comparison of Magnitude and Duration of Cumulative Impacts[1, 2] (Continued).

DESCRIPTION OF POTENTIAL IMPACT BY RESOURCE	MAGNITUDE, TYPE, AND DURATION OF IMPACT	
RESOURCE NAME	**ALTERNATIVE 3 - NO ACTION ALTERNATIVE**	**PROPOSED ACTION, ALTERNATIVE 1 and ALTERNATIVE 2**
TRANSPORTATION AND UTILITIES		
Increased vehicular traffic on roads and highways due to coal mining, coal-related, oil and gas, and oil- and gas-related development, and associated impacts including traffic accidents, road wear, air emissions, dust, noise, and vehicle collisions with wildlife and livestock	Moderate, short term	Same as No Action
Construction and operation of additional railroad and pipeline facilities and transmission lines to transport coal, oil and gas, and electricity	Moderate, short to long term	Same as No Action
SOCIOECONOMICS		
Increases in employment related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Significant, short to long term	Same as No Action
Increases in personal income due to employment increases related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Significant, beneficial, short to long term	Same as No Action
Increase in population due to employment increases related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Significant, short to long term	Same as No Action
Expansion of housing supply due to employment increases related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Significant, short to long term	Same as No Action
Increases in school enrollment due to employment increases related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short term	Same as No Action
Need for additional local government facilities and services due to employment increases related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Moderate, short to long term	Same as No Action
Increased federal state and local revenues related to coal mining, coal-related, oil and gas, and oil- and gas-related development	Significant, beneficial, short to long term	Same as No Action

[1] Cumulative impact discussion in this table and in Chapter 4 is based on the PRB Coal Review analyses (BLM 2005a-f, 2006a).
[2] All impacts are assumed to be adverse unless noted otherwise.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources in the general analysis area for the West Antelope II LBA[1] tract (the affected environment) and analyzes the potential associated direct and indirect impacts to those resources if the tract is leased and mined under the Proposed Action or Alternatives 1 or 2 (the environmental consequences). The potential environmental consequences of the No Action Alternative (Alternative 3, rejecting the application for the tract) are also considered in this chapter.

In addition, this chapter considers regulatory compliance; mitigation; monitoring; residual impacts; the relationship between local short-term uses of man's environment and the maintenance of long-term productivity; and the irreversible and irretrievable commitments of resources that would occur with the implementation of the Proposed Action or Alternatives 1 or 2.

The West Antelope II LBA tract as applied for consists of two non-contiguous blocks of federal coal. Under the Proposed Action, the two blocks as applied for would be offered for lease at one sale. As discussed in Chapter 2, BLM has identified a study area for the tract which consists of the tract as applied for and adjacent lands that BLM is considering adding to the tract. Alternative 1 evaluates holding one sale for a tract modified by BLM. Alternative 2 evaluates splitting the application and offering one or both blocks, either as applied for or as modified by BLM, for sale. The two tracts are referred to as the North and South tracts. Under Alternatives 1 and 2, lands included in the Thunder Basin National Grassland, administered by USDA-Forest Service, would potentially be included in the lands that would be offered for lease. The proposed North and South tracts are not considered separately in the following discussions of the affected environment and the potential consequences of mining the tract on the environment.

Figure 3-1 shows the general analysis area for most environmental resources. The general analysis area for the tract includes the BLM study area for the tract (the West Antelope II LBA tract as applied for and the adjacent lands that BLM is considering adding to the tract) and the anticipated permit amendment study area for the Antelope Coal Mine. The anticipated permit amendment study area is defined as those lands adjacent to and outside of the mine's current permit area that the applicant anticipates would be contained within the amended mine permit area if they acquire the tract.

The resources that are addressed here were identified during the scoping process or interdisciplinary team review as having the potential to be affected.

[1] Refer to page xvi for a list of abbreviations and acronyms used in this document.

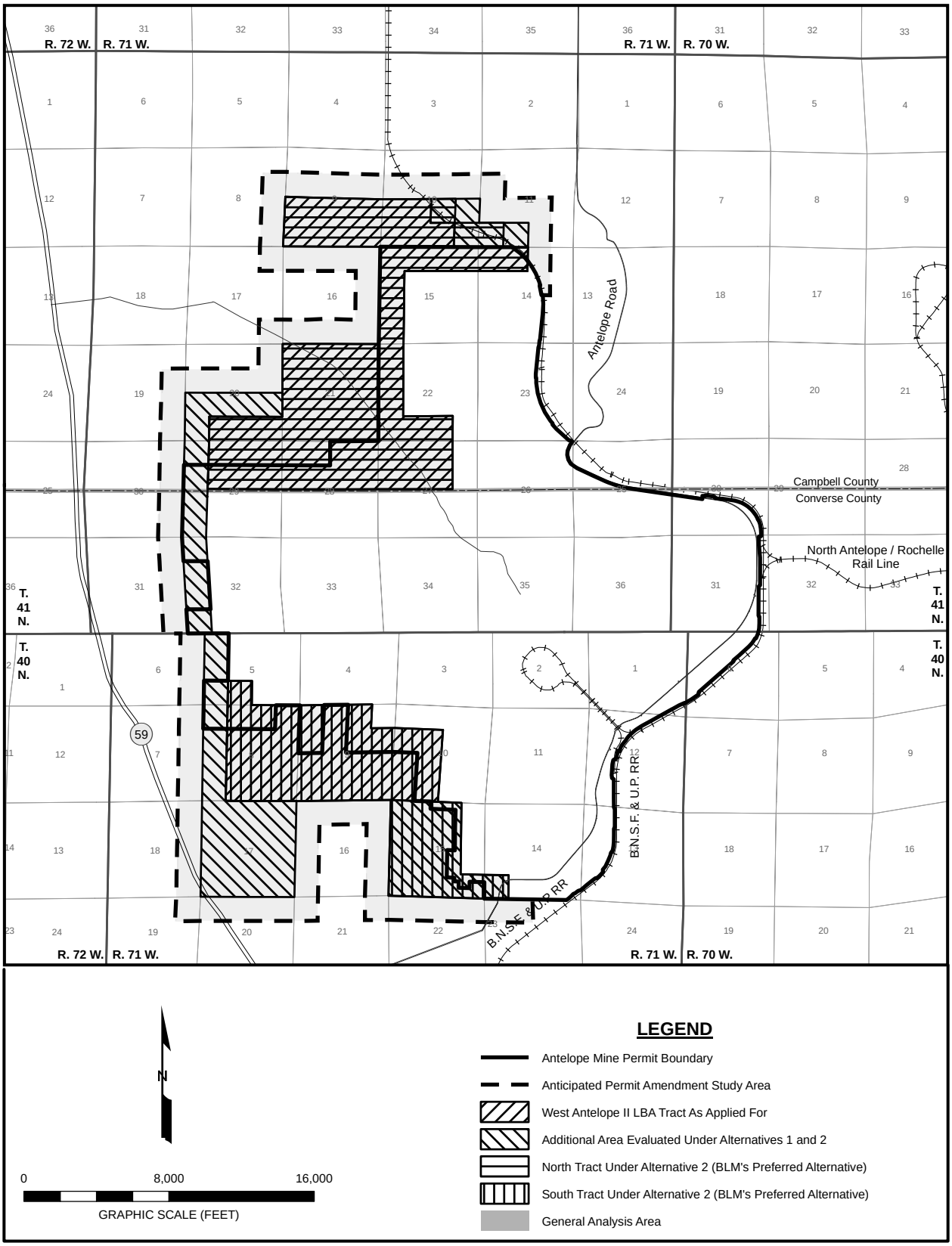


Figure 3-1. General Analysis Area.

Critical elements of the human environment (BLM 1988) that could potentially be affected by the Proposed Action or Alternatives 1 and 2 include air quality, cultural resources, Native American religious concerns, T&E species, hazardous or solid wastes, water quality, wetlands/riparian zones, invasive non-native species, and environmental justice. Five other critical elements (areas of critical environmental concern, prime or unique farmlands, wild and scenic rivers, floodplains, and wilderness) are not present in the general analysis area and are not addressed further. In addition to the critical elements that are potentially present in the general analysis area, this EIS discusses the status and potential effects of mining the LBA tract on topography and physiography, geology and mineral resources, soils, water quantity, alluvial valley floors, vegetation, wildlife, land use and recreation, paleontological resources, visual resources, noise, transportation resources, and socioeconomics.

Table 3-1 shows the acreage leased and disturbance area for the existing Antelope Mine (which represents the No Action Alternative). As indicated in Table 3-1, the Antelope Mine's coal leases currently include 11,635.5 acres and, under the approved mining and reclamation plan, the mine would disturb a total of 12,104.8 acres in order to recover that coal. According to the 2005 Annual Report for the Antelope Mine, which was submitted to WDEQ/LQD, the mine had disturbed a total of 5,581.4 acres as of September 30, 2005 (ACC 2005). Of that area of disturbance, approximately 1,522.5 acres (27 percent) were occupied by permanent or temporary facilities (stockpiles, hydrologic control structures, mine buildings, coal loading facilities, railroad loop, environmental monitoring areas, etc.), 2,266.1 acres (41 percent) were occupied by mined and unreclaimed areas or areas of active mining, and 1,792.8 acres (32 percent) were occupied by reclaimed areas.

If the West Antelope II LBA tract is leased to the applicant as a maintenance tract under the Proposed Action or Alternatives 1 or 2, the permit area for the adjacent Antelope Mine would have to be revised to include the newly leased area before the tract could be disturbed by mining activities. Table 3-1 shows how the leased area and disturbance area would change, for the tract as applied for and under Alternatives 1 and 2, if all the federal coal in the BLM study area discussed in chapter 2 is included in the tract that is offered for lease. Portions of the West Antelope II LBA tract lie inside the current mine permit area (Figure 3-1). If the tract is leased, the area that would have to be added to the existing mine permit area would be the portions of the LBA tract outside of the existing permit boundary plus an adjacent strip of land that would be used for highwall reduction after mining and such mine-related activities as construction of diversions, flood and sediment control structures, roads, and stockpiles. Portions of the LBA tract that are contiguous to the existing mine will be disturbed under the current mining plans in order to recover the coal in the existing coal leases. The environmental consequences of implementing the Proposed Action or Alternatives 1 and 2 would be similar in nature, but selection of the Proposed Action would disturb a smaller area of land surface.

Table 3-1. Comparison of Existing and Proposed Antelope Mine Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternatives 1 and 2
Additional Lease Area (Acres)	---	4,108.6	6,309.2
Total Lease Area (Acres)[1]	11,635.5	15,744.1	17,944.7
Increase in Lease Area (Percent)	---	35.3	54.2
Estimated Additional Mine Disturbance Area (Acres)[2]	---	4,314.0	6,624.6
Estimated Total Mine Disturbance Area (Acres)	12,104.8	16,418.8	18,729.4
Increase in Estimated Disturbance Area (Percent)	---	35.6	54.7
Estimated Additional Recoverable Coal (Million Tons)[3]	---	377.8	453.9
Estimated Recoverable Coal for Mine as of 1/07 (Million Tons)	394.3	772.1	848.2
Increase in Estimated Recoverable Coal as of 1/07 (Percent)	---	95.8	115.1

1 Includes federal and state coal

2 Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, highwall reduction, railroad facilities, stockpiles, etc.

3 Estimated Recoverable Coal Resources = tons of mineable coal × recovery factor (approximately 91 to 93 percent).

Surface mining and reclamation have been ongoing in the eastern PRB for over two decades. During this time, effective mining and reclamation technologies have been developed and continue to be refined. Mining and reclamation operations are regulated under SMCRA and Wyoming statutes. WDEQ technically reviews all mine permit application packages to ensure that the mining and reclamation plans comply with all state permitting requirements and that the proposed coal mining operations comply with the performance standards of the DOI-approved Wyoming program. BLM attaches special stipulations to all coal leases (Appendix D), and there are a number of federal and state permit approvals that are required in order to conduct surface mining operations (Appendix A). The regulations are designed to ensure that surface coal mining impacts are mitigated.

Impacts can range from beneficial to adverse and they can be a primary result of an action (direct) or a secondary result (indirect). They can be permanent, long-term (persisting beyond the end of mine life and reclamation), or short-term (persisting during mining and reclamation and until the time the reclamation bond is released). Impacts also vary in terms of significance. The basis for conclusions regarding significance are the criteria set forth by the Council on Environmental Quality (40 CFR 1508.27) and the professional judgment of the specialists doing the analyses. Impact significance may range from negligible to substantial; impacts can be significant during mining but be reduced to insignificance following completion of reclamation.

3.1 General Setting

The general analysis area is located in the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. Vegetation is primarily sagebrush and mixed grass prairie.

3.1.1 Climate and Meteorology

The climate in the general analysis area is typical of a semi-arid, high plains environment with relatively large seasonal and diurnal variations in temperature and seasonal variation in precipitation. The average annual precipitation at a NOAA/NWS meteorological station (Wright 12 W), located about 20 miles north-northwest of the general analysis area (see Figure 1-1), is 13.27 inches (WRCC 2007). May (2.00 inches) and June (1.99 inches) are the wettest months, whereas December (0.34 inch) and January (0.37 inch) are the driest. Snowfall averages 55.3 inches per year, with most occurring in March (8.9 inches) and April (9.7 inches). Potential evapotranspiration, at approximately 31 inches (NOAA 1969), exceeds annual precipitation. Summers are relatively short and warm, while winters are longer and cold. The annual mean temperature for the NOAA/NWS meteorological station at Wright for the period of record is 44.6 degrees F, and daily extreme temperatures have ranged from -39 degrees F to 107 degrees F. July is the warmest month, with a mean daily temperature of 69.7 degrees F, and January is the coldest month, with a mean daily temperature of 23.9 degrees F. The frost-free period is 100-120 days (Curtis 2004).

The 2000 average annual wind speed at the Antelope Mine was 10.7 mph, with winter gusts often reaching 30-40 mph. Winds are predominantly from the southwest and west and tend to be strongest in the winter and spring and calmer in the summer. Local variations in wind speed and direction are primarily due to differences in topography. Wind velocity tends to increase during the day in response to solar insolation and decrease during the night. During periods of strong wind, dust may impact air quality across the region. An average of 15 air-stagnation events occurs annually in the PRB with an average duration of two days each (BLM 1974). The wind rose diagram for the Antelope Mine is shown in Figure 3-2.

3.2 Topography and Physiography

3.2.1 Affected Environment

The general analysis area is a high plains area within the eastern portion of the PRB. The name PRB has been used to refer to both a structural basin and a drainage basin. The structural PRB is an elongated, asymmetrical syncline that is bounded in Wyoming by the Black Hills on the northeast, the Hartville Uplift on the southeast, the Big Horn Mountains on the northwest, the Casper Arch on the southwest, and the Laramie Mountains on the south. The northern terminus of the structural basin in Montana separates the PRB from the Williston Basin. The

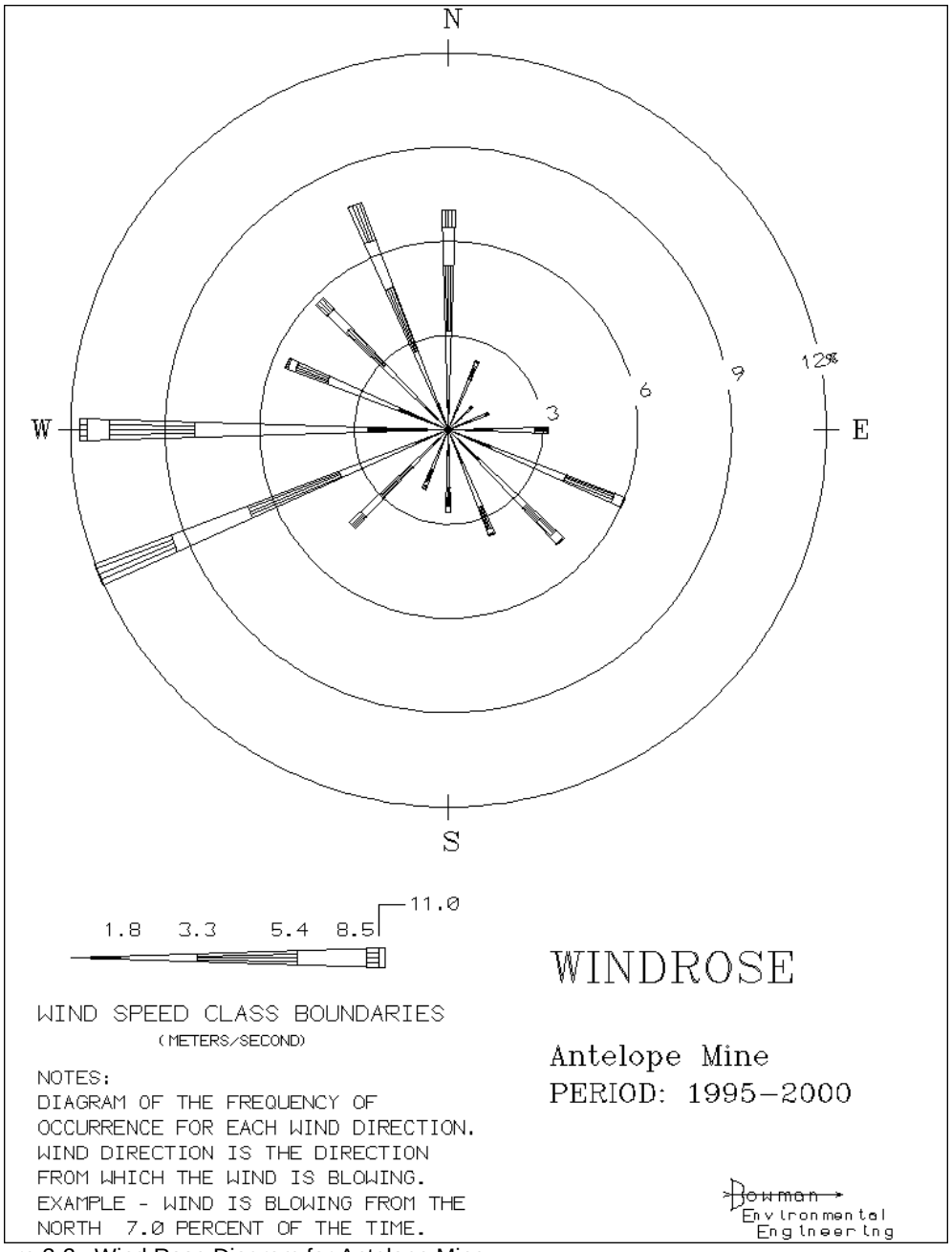


Figure 3-2. Wind Rose Diagram for Antelope Mine.

axis of the PRB trends from southeast to northwest near the western margin of the basin, and the Antelope Mine is located on the gently dipping eastern limb of the syncline. In general, geologic units dip to the west at 1 to 2 degrees toward the center of the basin on the eastern limb of the PRB. The structural PRB includes the Powder River drainage basin as well as the upstream portions of the Belle Fourche River, Cheyenne River, and Tongue River drainage basins.

Broad plains, rolling hills, and tablelands dominate the PRB landscape. Playas are common in the basin, as are buttes and plateaus capped by clinker or sandstone. In general, the topography of the basin varies from open hills with 500-1000 ft of local relief in the northern part of the PRB to plains and tablelands

with 300-500 ft of local relief in the southern PRB. Elevations in the PRB range from less than 2,500 ft to greater than 6,000 ft above sea level. The major river valleys have wide, flat floors and broad floodplains. The drainages dissecting the area are incised, typically are ephemeral or intermittent, and do not provide year-round water sources.

The general analysis area is characterized by gently rolling terrain broken by steeply cut washes. Elevations range from approximately 4,500 ft to 5,100 ft above sea level. Overall, the West Antelope II LBA tract is similar in topography to the rest of the Antelope Mine permit area where slopes range from flat to about 34 percent and average about five percent. The area is drained by Antelope Creek and its tributaries, a series of south and north trending ephemeral drainages including Horse Creek and Spring Creek.

3.2.2 Environmental Consequences

3.2.2.1 Proposed Action and Alternatives 1 and 2

Surface coal mining would permanently alter the topography of the LBA tract if it is leased and mined. Topsoil would be removed from the land and stockpiled or placed directly on recontoured areas. Overburden would be blasted and stockpiled or directly placed into the already mined pit, and coal would be removed. A highwall with a vertical height equal to overburden plus coal thickness would exist in the active pits. Spring Creek and Horse Creek channels would be diverted around the active mining area during the period of disturbance.

Typically, a direct permanent impact of coal mining and reclamation is topographic moderation. After reclamation, the restored land surfaces are generally gentler, with more uniform slopes and restored basic drainage networks. The original topography of the West Antelope II LBA tract ranges from relatively flat to gently rolling hills. Slopes range from flat to around 34 percent, as discussed above, and the average slope is about five percent. The expected postmining topography would be similar to the premining topography, but somewhat gentler and more uniform. Following reclamation, the average surface elevation on the LBA tract would be from approximately two to eight feet lower due to coal removal. The removal of the coal would be partially offset by the swelling that occurs when the overburden (and interburden, if present) is blasted and removed. Table 3-2 presents the approximate postmining surface elevation change for the LBA tract as applied for under the Proposed Action and Alternatives 1 and 2. After the coal is removed, the land surface would be restored to approximate original contour or to a configuration approved by WDEQ/LQD when the surface coal mining permit for the existing mine is amended to include the LBA tract.

Direct adverse impacts resulting from topographic moderation include a reduction in microhabitats (e.g., cutbank slopes) for some wildlife species and a reduction in habitat diversity, particularly a reduction in slope-dependent shrub communities

and associated habitat. These impacts, which would be greater in those areas characterized as rough breaks, may result in a long-term reduction in the carrying capacity for some species. A direct beneficial impact of the lower and flatter terrain would be reduced water runoff, which would allow increased infiltration and result in a minor reduction in peak flows. This may help counteract the potential for increased erosion that could occur as a result of higher near-surface bulk density of the reclaimed soils (Section 3.8.2). It may also increase vegetative productivity, and potentially accelerate recharge of groundwater.

Table 3-2. Comparison of Average Overburden and Coal Thicknesses and Approximate Postmining Surface Elevation Changes Under the No Action Alternative and the Proposed Action and Alternatives 1 and 2.

	No Action Alternative (Existing Leases)	**Proposed Action (As Applied For LBA Tract)**	**Alternatives 1 and 2**
Average Overburden Thickness (ft)[1]	122	280	260
Average Coal Thickness (ft)	86.0	60	50
Swell Factor (percent)	17	17	17
Coal Recovery Factor (percent)	92.5	92.5	92.5
Postmining Elevation Change[2]	59 ft lower	8 ft lower	2 ft lower

[1] The average overburden thickness includes the interburden where present.
[2] Reclaimed (postmining) elevation surface change calculated as:
(overburden thickness + coal thickness)-((coal thickness × (1- coal recovery factor)) + ((1 + swell factor) × overburden thickness)).

The approximate original drainage pattern would be restored and stock ponds would be replaced to provide livestock and wildlife watering sources. These topographic changes would not conflict with regional land use, and the postmining topography would be designed to adequately support anticipated land use. These impacts are occurring on the existing Antelope Mine coal leases as coal is mined and mined-out areas are reclaimed. Under the Proposed Action or Alternatives 1 and 2, the areas that would be permanently topographically changed would increase as shown in Table 3-1.

3.2.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal would not occur on the LBA tract. The impacts to topography and physiography described above and in Table 2-4 would continue as permitted on the existing adjacent Antelope Mine coal leases. Table 3-2 presents the approximate postmining surface elevation change for the existing mine. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.2.3 Regulatory Compliance, Mitigation and Monitoring

The mined-out area must be restored to approximate original contour or other topographic configuration approved by WDEQ/LQD. If the West Antelope II LBA tract is leased, the topographic configuration would be developed and approved as part of the required revision to the mining and reclamation plan for the Antelope Mine. WDEQ/LQD monitors topographic restoration by checking the as-built topography in the annual report filed by the mine to see if it conforms to the approved topography.

3.2.4 Residual Impacts

Topographic moderation is a permanent consequence of mining. The indirect impacts of topographic moderation on wildlife habitat diversity would also be considered permanent.

3.3 Geology, Mineral Resources, and Paleontology

3.3.1 General Geology and Coal Resources

3.3.1.1 Affected Environment

Stratigraphic units that would be impacted if the tract under consideration for leasing is mined include, in descending order, recent (Holocene age) alluvial and eolian deposits, the Eocene age Wasatch Formation (the overburden), and the Paleocene age Fort Union Formation (which contains the target coal beds). Figure 3-3 is a chart describing the surface and subsurface geologic units in the general analysis area and showing the stratigraphic relationships.

Surficial deposits within the general analysis area include alluvial and eolian deposits, clinker, and weathered Wasatch and Fort Union Formations. Although clinker is present in the general analysis area, the tract has no appreciable amounts of clinker. There are thin alluvial deposits along ephemeral streams. These alluvial deposits typically consist primarily of poorly to well-sorted, irregularly bedded to laminated, unconsolidated sand, silt, and clay with minor intervals of fine gravel. The valley floors of Horse Creek, Spring Creek and Antelope Creek contain appreciable amounts of alluvium both in width and depth. The alluvial deposits in Horse Creek, Spring Creek and Antelope Creek contain much more coarse-grained material (sands and gravels) than the ephemeral tributaries that drain most of the general analysis area.

Geologic Unit			Hydrologic Characteristics
RECENT ALLUVIUM HOLOCENE			Typically fine grained and poorly sorted sands interbedded with silts and clays in ephemeral drainages. Occasional, very thin, clean, interbedded sand lenses. More laterally extensive, thicker, and coarse-grained along the larger stream courses. Excessive dissolved solids generally make this aquifer unsuitable for domestic and agricultural use and marginal for livestock (Class III) use standards. Low infiltration capacity in ephemeral draws unless covered by sandy eolian blanket.
CLINKER HOLOCENE TO PLEISTOCENE			Baked and fused bedrock resulting from burning coal seams which ignite on the outcrop from lightning, manmade fires or spontaneous combustion. The reddish clinker (locally called scoria, red dog, etc.) formed by melting and partial fusing of overburden above the burning coal. The baked rock varies greatly in the degree of alteration; some is dense and glassy while some is vesicular and porous. It is commonly used as a road construction material and is an aquifer wherever saturated. Considered to be part of the Wasatch Formation.
WASATCH FORMATION EOCENE			Lenticular fine sands interbedded in predominantly very fine-grained siltstone and claystone may yield low to moderate quantities of poor to good quality water. The discontinuous nature and irregular geometry of these sand bodies result in low overall permeabilities and very slow groundwater movement in the overburden on a regional scale. Water quality in the Wasatch Formation generally does not meet Wyoming Class I (drinking water) standards due to the dissolved mineral content. Some wells do, however, produce water of considerably better quality that does meet the Class I standard.
FORT UNION FORMATION PALEOCENE	TONGUE RIVER MEMBER	W — A, C	The coal serves as a regional groundwater aquifer and exhibits highly variable aquifer properties. Permeability and porosity associated with the coal arise almost entirely from fractures. Coal water typically does not meet Class I or Class II (irrigation) use standards. In most cases, water from coal wells is suitable for livestock use. The coal water is used throughout the region as a source of stock water and occasionally for domestic use. W = Wyodak Coal; A = Anderson Coal; C = Canyon Coal
	LEBO MEMBER		The Lebo member, also referred to as the "Lebo Confining Layer" or "Lebo Shale". Has a mean thickness of 711 ft in the PRB and a thickness of about 400 ft in the vicinity of Gillette. The Lebo typically yields small quantities of poor quality groundwater. Where sand content is locally large, caused by channel or deltaic deposits, the Lebo may yield as much as 10 gpm.
	TULLOCK MEMBER		The Tullock member has a mean thickness of 785 ft in the PRB and a mean sand content of 53 percent which indicates that the unit generally functions well as a regional aquifer. Yields of 15 gpm are common but vary locally and may be as much as 40 gpm. Records from the SEO indicate that maximum yields of approximately 300 gpm have been achieved from this aquifer. Water quality in the Tullock Member often meets Class I standards. The extensive sandstone units in the Tullock Member are commonly developed regionally for domestic and industrial uses. The City of Gillette is currently using eight wells completed in this zone to meet part of its municipal water requirements.
LANCE FORMATION UPPER CRETACEOUS	UPPER LANCE		Silty, calcareous sandstones and interbedded sandy shales, claystones, and coals. Provides yields generally less than 20 gpm. Higher yields can occur where sand thicknesses are greatest. Water quality is typically fair to good. Also referred to as the "Upper Lance Confining Layer".
	FOX HILLS SANDSTONE		Marine sandstones and sandy shales. Has a mean thickness of 666 ft and a mean sand content over 50 percent in the PRB. Yields up to 200 gpm are common; however, yields can be significantly less. Water quality is good, with TDS concentrations commonly less than 1,000 mg/L. The City of Gillette is currently using five wells completed in this aquifer to meet municipal water requirements.
LEWIS FORMATION UPPER CRETACEOUS	PIERRE SHALE		This unit is comprised predominantly of marine shales with only occasional local thin sandstone lenses. Maximum yields are minor and overall the unit is not water bearing. Water obtained from this unit is poor with high concentrations of sodium and sulfate as the predominant ions in solution.

Compiled from Hodson et al. (1973) and Lewis and Hotchkiss (1981).

Figure 3-3. Stratigraphic Relationships and Hydrologic Characteristics of Upper Cretaceous, Lower Tertiary, and Recent Geologic Units, PRB, Wyoming.

The Eocene Wasatch Formation forms most of the overburden overlying the mineable coal seams in the general analysis area. It consists of interbedded lenticular sandstones, siltstones, shales, and thin discontinuous coals. There is no distinct boundary between the Wasatch Formation and the underlying Paleocene Fort Union Formation. From a practical standpoint, however, the top of the mineable coal zone is considered as the contact between the two formations. Overburden thickness averages 260 feet in the BLM study area (as indicated in Table 3-2) and ranges from around 20 ft to more than 460 ft. The overburden is relatively thin in the vicinity of the major channels within the tract and increases in thickness away from the channel bottoms.

The Fort Union Formation consists primarily of shales, mudstones, siltstones, lenticular sandstones, and coal. It is divided into three members: Tongue River (which contains the mineable coal seams), Lebo, and Tullock, in descending order (Figure 3-3).

The Tongue River Member of the Fort Union Formation consists of interbedded claystone, silty shale, carbonaceous shale, and coal, with lesser amounts of fine-grained sandstone and siltstone.

The nomenclature of the mineable coal seams in the Fort Union Formation varies from mine operator to mine operator. The U.S. Geological Survey (Flores et al. 1999) refers to the thick mineable coals in the Gillette coal field as the Wyodak-Anderson coal zone of the Tongue River Member of the Fort Union Formation. Locally these beds are referred to as Wyodak, Wyodak-Anderson, Anderson, and Canyon. There are four mineable seams in the West Antelope II LBA tract (referred to by the operator as the Anderson, Lower Anderson, Canyon/Upper Canyon, and Lower Canyon). Figure 3-4 presents geologic cross sections through the tract. The total coal thickness ranges from 15 to 86 ft. Interburden between the coal seams varies from 5 to around 115 ft. The total overburden thickness (including interburden where present) ranges from about 20 ft to approximately 550 ft.

The Fort Union coal seams are subbituminous and are generally low-sulfur, low-ash coals. Typically, the coal being mined has a higher heating value and lower sulfur content south of Gillette than north of Gillette. In the tract under consideration for leasing, the heating value of the coal seams is expected to range from 8,500 to 9,200 Btu/lb. The ash content in the coal seams is expected to vary from 3.5 to 8 percent, the sulfur content from 0.15 to 0.4 percent, and the moisture content from 23 to 28 percent.

The Lebo and Tullock Members of the Fort Union Formation underlie the Tongue River Member (Figure 3-3). They consist primarily of sandstone, siltstone, mudstone, shale, and coal. In general, the Tullock Member contains more sand than the Lebo Shale Member.

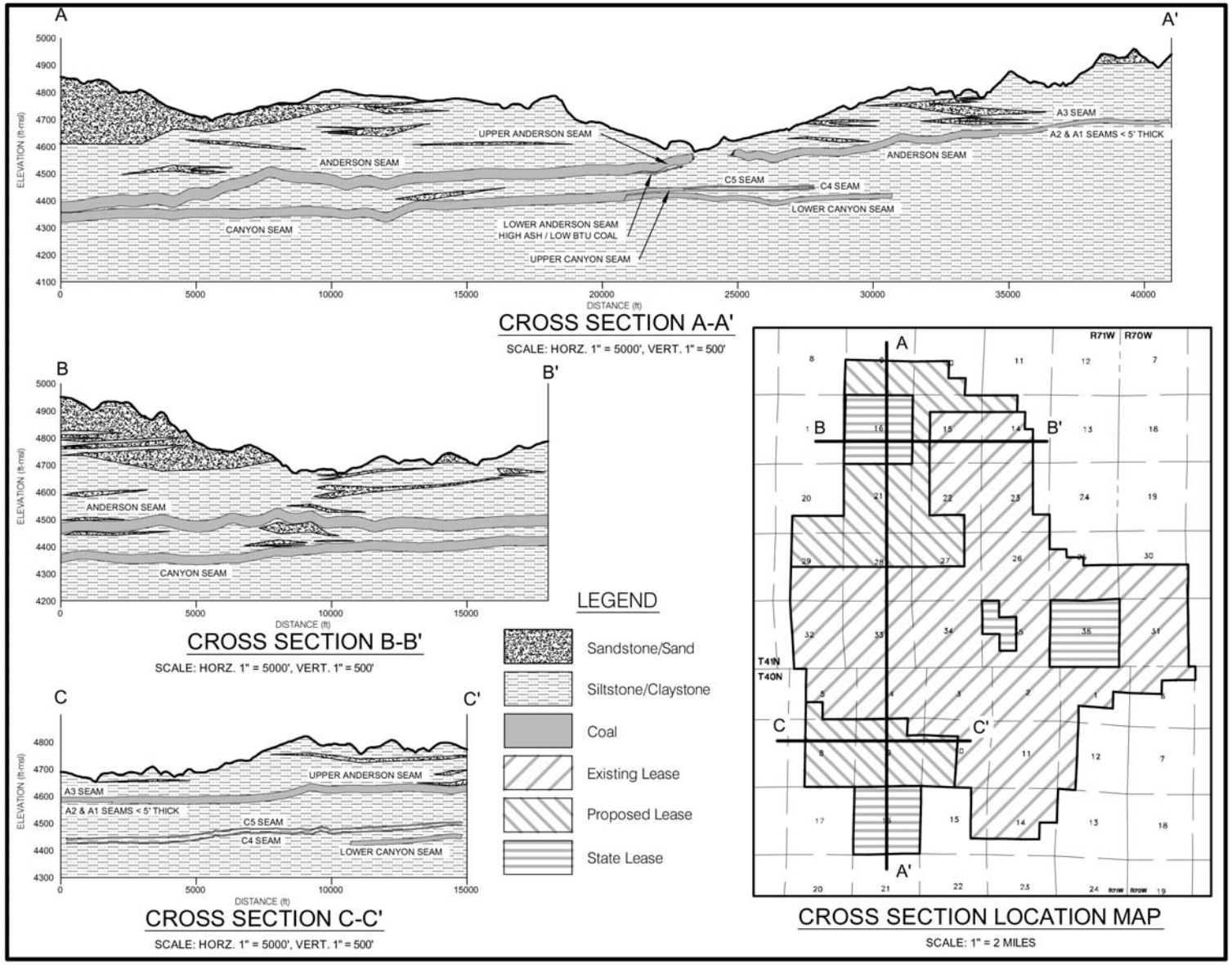


Figure 3-4. North-South and East-West Geologic Sections, West Antelope II LBA tract

3.3.1.2 Environmental Consequences

3.3.1.2.1 Proposed Action and Alternatives 1 and 2

The geology from the base of the coal seam mined to the land surface would be subject to permanent change after the coal is removed on the LBA tract under the Proposed Action or Alternatives 1 and 2. The subsurface characteristics of these lands would be radically changed by mining. The replaced overburden and interburden (backfill) would be a mixture of the geologically distinct layers of sandstone, siltstone, and shale that currently exist. As a result, the physical characteristics of the backfill would be different from the physical characteristics of the existing layered overburden.

Mining would remove an average of 280 ft of overburden and 60 ft of coal on about 4,109 acres under the Proposed Action. Mining would remove an average of 260 ft of overburden and 50 ft of coal on up to 6,309 acres under the tract configuration for Alternatives 1 and 2. These acreage figures represent the estimated area of actual coal removal under the Proposed Action and Alternatives 1 and 2. Table 3-2 presents the average overburden and coal thicknesses for the tract as applied for and Alternatives 1 and 2. The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompacted mixture averaging about 323 ft in thickness under the Proposed Action and about 310 ft in thickness under Alternatives 1 and 2. Approximately 772.1 million tons of coal would be recovered under the Proposed Action, compared to an estimated 848.2 million tons under Alternatives 1 and 2.

3.3.1.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope coal lease application would be rejected and coal removal would not occur on the West Antelope II LBA tract. Mining operations, coal removal and the associated impacts described above would continue as permitted on the existing adjacent Antelope Mine coal leases. Table 3-2 presents the average overburden and coal thicknesses for the existing Antelope Mine permit area. Impacts to the overburden on portions of the West Antelope II LBA tract adjacent to the Antelope Mine would occur in order to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.3.1.3 Regulatory Compliance, Mitigation and Monitoring

Drilling and sampling programs are conducted on existing leases by all mine operators to identify overburden material that may be unsuitable for reclamation (i.e., material that is not suitable for use in reestablishing vegetation or that may

affect groundwater quality due to high concentrations of certain constituents, such as selenium, or adverse pH levels). As part of the mine permitting process, each mine operator develops a management plan to ensure that this unsuitable material is not placed in areas where it may affect groundwater quality or revegetation success. Each mine operator also develops backfill monitoring plans as part of the mine permitting process to evaluate the quality of the replaced overburden. These plans are in place for the existing Antelope Mine and would be developed for the West Antelope II LBA tract if it is leased.

3.3.1.4 Residual Impacts

Geology from the base of the coal to the surface would be subject to significant, permanent change.

3.3.2 Other Mineral Resources

3.3.2.1 Affected Environment

The PRB contains large reserves of fossil fuels including oil, natural gas (from conventional reservoirs and from coal beds), and coal, all of which are currently being produced. In addition, uranium, bentonite, and scoria are mined in the PRB (WSGS 2003).

3.3.2.1.1 Conventional Oil and Gas

Oil and conventional (i.e., non-CBNG) gas have been produced in the PRB for more than 100 years (Crockett 1999) from reservoirs that range in age from Mississippian to Oligocene (WOGCC 2007a). Depth to gas and oil-bearing strata generally ranges from 4,000 ft to 13,500 ft, but some wells are as shallow as 250 ft. The USGS estimated means of the total undiscovered oil and gas resources in the PRB are 639 million barrels of oil, 16.6 trillion ft^3 of gas, and 131 million barrels of natural gas liquids (USGS 2006). The total undiscovered gas resource estimate of 16.6 trillion ft^3 includes an estimated mean of about 14.3 trillion ft^3 of CBNG resources (USGS 2004a), thus the non-CBNG gas resource is estimated to be approximately 2.3 trillion ft^3.

There are several conventional oil and gas fields that produce in the vicinity of the West Antelope II LBA tract, including the Porcupine and Dennell Draw Oil and Gas Fields. The Porcupine Field is producing from or has produced from the Upper Cretaceous Parkman, Sussex, Teapot, and Turner Sandstones and the Niobrara Shale and the Lower Cretaceous Muddy and Dakota Sandstones, and the Dennell Draw Field produces from the Upper Cretaceous Turner Sandstone (WOGCC 2007b).

There are no producing conventional oil and gas wells on the West Antelope II LBA tract under the Proposed Action or Alternatives 1 and 2. One productive well in the Porcupine Field, the Hedgehog State 1-16 operated by Nance Petroleum

Corporation, is located adjacent to the West Antelope II LBA tract in the NE¼NE¼ of Section 16, T.41N., R.71W. The well, which is currently shut in, produced gas and oil from the Cretaceous Turner Sandstone at a depth of 9,677 ft (WOGCC 2007b). There are two plugged and abandoned conventional wells located on the tract, one in the SW¼SE¼ of Section 21, T.41N., R.71W., and one in the SW¼NE¼ of Section 27, T.41N., R.71W.

See Section 3.11 for a discussion of the ownership of the oil and gas resources in the BLM study area.

3.3.2.1.2 Coal Bed Natural Gas (CBNG)

CBNG has been commercially produced in the PRB since 1989 when production began at the Rawhide Butte Field, west of the Eagle Butte Mine. CBNG exploration and development is currently ongoing throughout the PRB in Wyoming.

The following discussion is based on a report on CBNG resources in the lands adjacent to the existing surface coal mines in the Wyoming PRB, prepared by the WSO-RMG in May 2006 (WSO-RMG 2006). Extensive CBNG development has occurred on lands underlying and immediately west of the surface coal mines. The predominant CBNG production to date has occurred from coal beds that the USGS describes as the Wyodak-Anderson zone, which are the same coal beds (or equivalent to the coal beds) being mined by the surface coal mines. The Wyodak-Anderson zone appears to be gas-bearing throughout the PRB and the methane in the coal beds has been determined to be biogenic in origin. CBNG is being produced from other, deeper seams locally throughout the PRB, but not in this area.

In order for CBNG to be produced, the hydrostatic pressure in the coal must be reduced to a level, which can vary from coal to coal, that allows the gas to desorb from the coal. This is accomplished by removing water from the coal seam. CBNG reservoirs can be affected by any nearby activities, including coal mining, that reduce the hydrostatic pressure in the coal seam.

WSO-RMG and the USGS have collected coal gas content data from coal cores near the mines and in other areas of the PRB. Measured gas content was minimal in all of the cores collected in 2000 at locations near the surface coal mines, indicating that the coal seams were already substantially depleted of CBNG in the vicinity of the mines at that time. Average total gas content from the core desorption analyses was approximately 6.8 scf/ton near the coal mines in 2000, compared with an average measured gas content of 37.6 scf/ton from coal cores taken outside the mining areas. Ongoing reservoir depletion from both mining operations and CBNG production since that time has diminished and continues to diminish the gas in place adjacent to the mine areas.

CBNG production was established near the northern and middle groups of coal

mines earlier than it was established in the southern mine group, where the Antelope Mine is located. WOGCC well data from the areas adjacent to the surface coal mines generally show that operator interest peaked prior to 2000 and declined following 2001. By 2005, drilling activity in the areas adjacent to the coal mines had declined significantly, with only 128 applications to drill CBNG wells filed in all of the townships including and bordering the coal mines in 2005.

Currently, there are no active, abandoned or proposed CBNG wells in the southern portion of the LBA tract in T.40N., R.71W. However, CBNG development has been extensive in T.41N., R.71W. WOGCC records show that as of April 2007, 258 wells had been drilled for CBNG production and 181 wells were capable of producing from the Wyodak-Anderson coal zone in T.41N., R.71W. (Appendix E). In the sections that include the BLM study area for the West Antelope II LBA tract (the tract as applied for and the additional area evaluated under Alternatives 1 and 2), 30 of the 40 permitted CBNG wells are capable of producing (WOGCC 2007c).

The ownership of the oil and gas resources in the BLM study area, which includes the CBNG resources, is discussed in Section 3.11.

3.3.2.1.3 Other Minerals

Bentonite, uranium, and scoria are commercially produced in the PRB in addition to conventional oil and gas and CBNG.

Layers of bentonite (decomposed volcanic ash) of varying thickness are present throughout the PRB. Some of the thicker layers are mined where they are near the surface, mostly around the edges of the basin. Bentonite has a large capacity to absorb water, and because of this characteristic it is used in a number of processes and products, including cat litter and drilling mud. No mineable bentonite reserves have been identified on the West Antelope II LBA tract under the Proposed Action or Alternative 1 or 2.

There are substantial uranium resources in southwestern Campbell and northwestern Converse Counties. There is one producing uranium operation in Wyoming, which is located in the southern Powder River Basin (WSGS 2006). No known uranium reserves exist on the West Antelope II LBA tract.

Scoria, which is also referred to as clinker or burn, is present in the general analysis area and has been and continues to be a major source of aggregate for road construction in the area. Scoria consists of sediments that were baked, fused, or melted in place when the underlying coal burned spontaneously. No scoria is present within the West Antelope II LBA tract.

A search of the BLM mining claim index revealed that no active mining claims are presently located within the West Antelope II study area.

3.3.2.2 Environmental Consequences

3.3.2.2.1 Proposed Action and Alternatives 1 and 2

During mining, other minerals present on the LBA tract could not be developed. Some of these minerals could, however, be developed after mining and reclamation is completed.

The conventional oil and gas reservoirs are located below the mineable coal beds and would not be directly disturbed by removal of the coal. There are currently no producing conventional oil and gas wells on the West Antelope II LBA tract under the Proposed Action or Alternatives 1 and 2, as discussed above. In the event that productive conventional oil and gas wells are drilled before the coal is removed, they would have to be removed, along with any associated facilities, to a level below the coal before mining could occur. Following mining and reclamation, the oil and gas lessee could re-complete old wells or drill new wells to recover oil and gas resources from any productive subcoal oil and gas reservoirs. This would only occur if they believe that the value of the reserves would justify the expense of recompleting or drilling wells.

WSO-RMG's analyses have shown that CBNG depletion had already occurred near the mining areas in the Wyodak-Anderson zone by the time that CBNG development began to accelerate in the late 1990s (WSO-RMG 2006). Several analyses prepared in 2002, based on data compiled by GAGMO in 2000-2001 and earlier, show widespread pressure depletion in the coal beds near the active mines. Analyses in the southern and northern mine groups, based on 2000 and 2001 groundwater measurements, indicated that hydrostatic pressure had declined by an estimated 20 to 60 percent since mining was initiated. Coal gas in place can be inferred to have been depleted by similar proportions. Ongoing reservoir depletion from mining and CBNG production has continued to diminish gas in place adjacent to the active mines.

There are active CBNG wells in the northern portion of the West Antelope II LBA tract. Before mining operations could begin, these wells and associated facilities would have to be abandoned. However, mining operations could not be initiated until permitting is completed, which generally requires several years after a lease is acquired. By that time, it is likely that the most of the economically recoverable CBNG resource would have been produced. CBNG reservoirs below the mineable coal seams would not be directly disturbed by surface coal mining operations.

CBNG resources that have not been recovered from the Wyodak-Anderson zone prior to mining would be lost when the coal is removed. Coal seam dewatering in advance of, and as a result of, open pit mining also reduces the hydrostatic pressure, which may allow CBNG to desorb and escape from the coal bed.

Coal mining would not directly affect production of CBNG from coal seams below the Wyodak-Anderson, however, it would delay any proposed CBNG development

in the deeper seams in order to avoid interference with mining.

Section 3.11.1 includes a discussion on the ownership of the oil and gas resources on the LBA tract and the oil and gas facilities in the area of the tract.

3.3.2.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal would not occur on the West Antelope II LBA tract. The limitations to the development of other mineral resources described above and in Table 2-4 would continue on the existing adjacent Antelope Mine coal leases and on portions of the West Antelope II LBA tract adjacent to the Antelope Mine, which would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.3.2.3 Regulatory Compliance, Mitigation and Monitoring

No conventional reservoirs containing producible quantities of oil and/or gas are known to underlie the West Antelope II LBA tract. There are CBNG wells actively producing on the tract, however, the analyses conducted by the BLM's WSO-RMG indicated that most of the recoverable CBNG resources on the tract would be produced before mining operations would begin.

If the federal coal in the tract is leased and conflicts do develop between the operators of the oil and gas wells and the surface coal mine operator, there are several mechanisms that can be used to facilitate recovery of the conventional oil and gas and CBNG resources prior to mining:

- BLM will attach a Multiple Mineral Development stipulation to the federal coal lease, which states that BLM has the authority to withhold approval of coal mining operations that would interfere with the development of mineral leases issued prior to the coal lease (see Appendix D).

- Conventional oil and gas wells must be abandoned while mining and reclamation operations are in progress but could be recompleted or redrilled following mining if the value of the remaining reserves would justify the expense of reestablishing production.

- BLM has a policy in place on CBNG-coal conflicts which directs BLM decision-makers to optimize the recovery of both resources and ensure that the public receives a reasonable return (BLM 2006d). This policy offers royalty incentives to CBNG operators to accelerate production in order to recover the natural gas while simultaneously allowing

uninterrupted coal mining operations. In addition, this memorandum also states that it is the policy of the BLM to encourage oil and gas and coal companies to resolve conflicts between themselves; when requested, the BLM will assist in facilitating agreements between the companies.

- Mining of the West Antelope II LBA tract cannot occur until the coal lessee has a permit to mine the tract approved by the WDEQ/LQD and a MLA mining plan approved by the Secretary of the Interior. Before the MLA mining plan can be approved, BLM must approve the R2P2 for mining the tract. Prior to approving the R2P2, BLM can review the status of CBNG and conventional oil and gas development on the tract and the mining sequence proposed by the coal lessee. The permit approval process generally takes the coal lessee several years, during which time CBNG resources can continue to be recovered.

- Prior to mining the federal coal, the coal lessee can negotiate an agreement with owners and operators of existing oil and gas facilities on the tract, including owners and operators of oil and gas well and pipeline facilities, regarding removal and relocation of those facilities prior to mining.

3.3.2.4 Residual Impacts

CBNG resources not recovered prior to mining would be vented to the atmosphere and permanently lost.

3.3.3 Paleontology

3.3.3.1 Affected Environment

The formations exposed on the surface of the West Antelope II LBA tract are the sedimentary Paleocene Fort Union and Eocene Wasatch Formations, which are known to produce fossil vertebrates of scientific significance throughout Wyoming, including the PRB (Delson 1971, Winterfeld 1978, EVG 2001). The Probable Fossil Yield Classification, developed by the USFS and used by the BLM, is a planning tool used to classify geological units, usually at the formation or member level, according to the probability that they will yield paleontological resources that are of concern to land managers. This classification system is based largely on how likely a geologic unit is to produce scientifically significant fossils. BLM considers the Wasatch Formation to fulfill either the PFYC Class 4 or Class 5, depending on the nature of bedrock exposures present. The Fort Union Formation is classified as a Class 3 unit (BLM 2005c). PFYC classes 3, 4 and 5 are described as follows:

Class 3 - Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence.

Class 4 - These geologic units are Class 5 units (see below) that have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation.

Class 5 - Fossiliferous geologic units that regularly and predictably produce vertebrate fossils and/or scientifically significant non-vertebrate (plant and invertebrate) fossils, and that are at risk of natural degradation and/or human-caused adverse impacts.

Although the Wasatch Formation is known to produce fossil vertebrates of scientific significance in Wyoming, outcrops of the Wasatch Formation in the PRB are not generally well-exposed and the conditions of deposition of the formation have contributed to a low preservation potential for fossils. Vertebrate fossils that have been described from the Wasatch Formation include mammals such as early horses, tapiroids, condylarths, primates, insectivores, marsupials, creodonts, carnivores, and multituberculates; reptiles such as crocodilians, alligators, lizards, and turtles; birds; eggs; amphibians; and fish. Non-marine invertebrates such as mollusks and ostracods have also been described from the Wasatch.

The Fort Union Formation is not as widely distributed as the Wasatch Formation, but occurs around the margins of the basin. This formation contains locally abundant fossil vertebrates, invertebrates, and plants, and displays an important time interval during the early Tertiary evolution of mammals. Invertebrate trace fossils (burrows) occur in sandstones in the Fort Union Formation.

Fossil plant material, primarily leaves and fossilized wood, is common in the Fort Union and Wasatch Formations. The leaves usually occur as lignitic impressions in sandstone and siltstone and as compact masses in shale. Leaves are the most abundant fossils found during paleontological surveys and are frequently encountered during mining operations. Fossilized wood often occurs near the top of a coal seam, in carbonaceous shale or within channel sandstone. Exposures of fossil logs are common, but usually very fragmentary. Like fossil leaves, fossil logs can be readily collected in the PRB.

The West Antelope II general analysis area was covered by pedestrian surveys, either specifically for paleontological resources in 2007 or in conjunction with cultural Class II block clearance surveys in previous years. All but the extreme southeastern corner of the general analysis area was included in those pedestrian surveys. The ¼-mile strip in Sections 16 and 21-23, T40N, R71W was assessed based on comparisons between existing BLM fossil records and maps for the project area and results from extension field coverage of adjacent lands.

Intensive pedestrian inventories by GCM Services (Ferguson 1998, 2000, 2001, 2003; Munson and Ferguson, 1996; and Humphrey and Kingham, 1993) included inspections for paleontological resources. Fossil wood was observed at many unrecorded locations, particularly associated with coal. Invertebrate remains of mollusks, bivalves and gastropods were occasionally observed within weathering

shale exposures. These were typically fragmentary and are considered to be of minimal scientific significance. Because of the ubiquitous nature of fossilized plants and invertebrates, reporting was confined to vertebrate specimens or unique finds. None of these projects reported vertebrate specimens or unique finds.

During 2007, the 240-acre tract on USFS lands in the general analysis area (W½ E½ Section 15; SE¼ SE¼ Section 15; and SW¼ SW¼ Section 14) was intensively inventoried by foot. Fossilized wood, leaves and plant fragments, and invertebrate trace fossils (including *Planolites*) were observed, recorded and collected at several localities in SW¼ SW¼ Section 14, and in NW¼ SE¼ and SE¼ SE¼ Section 15. Just beyond the 240 acres, fossil wood in SE¼ SW¼ Section 15 and invertebrate trace fossils in NW¼ NW¼ Section 23 were observed and recorded. All areas covered in this paleontological survey were within the Paleocene Fort Union Formation.

No significant or unique paleontological resource localities have been recorded on federal lands in the general analysis area, no specific mitigation was recommended for paleontology and no additional paleontological work is recommended.

3.3.3.2 Environmental Consequences

3.3.3.2.1 Proposed Action and Alternatives 1 and 2

The rock outcrops present on the West Antelope II LBA tract were examined for the presence of fossils, as discussed above, and no scientifically significant fossils were located. Fossils with scientific significance could be present on the tract but not exposed at the surface. If the tract is leased under the Proposed Action or Alternatives 1 and 2, paleontological resources located on the tract that are not exposed on the surface would be destroyed when the overburden is removed.

3.3.3.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II lease application would be rejected and coal removal would not occur on the West Antelope II LBA tract. Mining operations and the potential associated impacts to paleontological resources described above would continue as permitted on the existing adjacent Antelope Mine coal leases and on portions of the West Antelope II LBA tract adjacent to the Antelope Mine which would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.3.3.3 Regulatory Compliance, Mitigation and Monitoring

If the West Antelope II LBA tract is leased, BLM will attach a stipulation to the lease requiring the operator to report significant paleontological finds to the authorized federal agency and suspend production in the vicinity of the find until an approved paleontologist can evaluate the paleontological resource (Appendix D).

3.3.3.4 Residual Impacts

Paleontological resources that are not identified and removed prior to or during mining operations would be lost.

3.4 Air Quality

The information in this section and in the air quality appendix (Appendix F) is based on the Air Quality Technical Support Document prepared for ACC by McVehil-Monnett Associates, Inc. for use in this EIS. The Air Quality Technical Support Document (MMA 2007) is a stand alone document which is available for review. This section summarizes the affected environment in the area of the Antelope Mine and the potential environmental impacts if the West Antelope II LBA tract is leased and mined. Appendix F provides background information on the air quality regulatory framework, regional conditions, dispersion model methodology, the BACT process, etc. Existing and projected cumulative air quality impacts are discussed in Section 4.2.3.

3.4.1 Background

The air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. The transport of pollutants from specific source areas can also be strongly affected by local or regional topography and microscale and mesoscale meteorological effects. In the mountainous western United States, topography is particularly important in channeling pollutants along valleys, creating upslope and downslope circulations that may entrain airborne pollutants, and blocking the flow of pollutants toward certain areas. Generally, local effects are superimposed on the overall weather patterns and are most important when the large-scale wind flow is weak.

The general analysis area, shown in Figure 3-1, is located in the southern portion of the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. As discussed in Section 3.2.1, the topography is primarily rolling plains and tablelands of moderate relief (with occasional valleys and buttes). Elevations range from about 4,500 ft to 5,100 ft above sea level. The climate in the general analysis is semiarid with relatively short warm summers and longer cold winters. Evaporation exceeds annual precipitation. Section 3.1.1 includes additional information about the climate in the general analysis area.

Air Quality regulations applicable to surface coal mining may include NAAQS/WAAQS, PSD, NSPS, and the Federal Operating Permit Program (Title V). These regulatory programs are described in Appendix F. Air pollution impacts are limited by local, state, tribal, and federal air quality regulations and standards, and state implementation plans, or SIPs, established under the federal CAA and the CAAA of 1990. In Wyoming, air pollution impacts are managed by WDEQ/AQD under the WAQSR and the EPA-approved SIP.

3.4.1.1 Emission Sources

Air quality conditions in rural areas are probably better than in large urban/industrial centers. Rural areas generally have a smaller number of emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and favorable atmospheric dispersion conditions which can result in relatively low air pollutant concentrations. Occasional high concentrations of CO and particulate matter may occur in more urbanized areas (for example, the cities of Gillette, Sheridan, and Buffalo) and around industrial facilities in these areas, especially under the stable atmospheric conditions that occur during winter.

Surface coal mining activities generate fugitive dust and particulate and gaseous tailpipe emissions from large mining equipment. Specifically, activities such as blasting, excavating, loading and hauling of overburden and coal, and wind erosion of disturbed and unreclaimed mining areas produce fugitive dust. Coal crushing, storage, and handling facilities are the most common stationary or point sources associated with surface coal mining and preparation. Particulate matter is the pollutant emitted from coal mine point sources, although small amounts of gaseous pollutants are emitted from small boilers and off-road diesel engines. Wyoming's ambient air standards for particulates are shown in Table 3-3.

Blasting is responsible for another type of emission from surface coal mining. Overburden blasting sometimes produces gaseous, orange-colored clouds that contain NO_2. Exposure to NO_2 may have adverse health effects, as discussed in Section 3.4.3. NO_2 is one of several products resulting from the incomplete combustion of explosives used in the blasting process. Wyoming's ambient air standards for NO_2 are shown in Table 3-3.

Other types of air pollutant emission sources within the PRB include:

- CO and NO_x from internal combustion engines used at natural gas and CBNG pipeline compressor stations;
- CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2, and VOCs from gasoline and diesel vehicle tailpipe emissions;
- Particulate matter (dust) generated by vehicle travel on unpaved graded roads, agricultural activities such as plowing, and paved road sanding during the winter months, as well as windblown dust from neighboring areas;

Table 3-3. Assumed Background Air Pollutant Concentrations, Applicable AAQS, and PSD Increment Values (in μg/m³).

Pollutant	Averaging Time[1]	Background Concentration	Primary NAAQS[2]	Secondary NAAQS[2]	WAAQS	PSD Class I Increments[3]	PSD Class II Increments[3]
Carbon monoxide	1-hour	3,336[4]	40,000	40,000	40,000	None	None
	8-hour	1,381	10,000	10,000	10,000	None	None
Nitrogen dioxide	Annual	9[5]	100	100	100	2.5	25
Ozone	8-hour	131[6]	157	157	157	None	None
Sulfur dioxide	3-hour	131[7]	None	1,300	1,300	25	512
	24-hour	73[7]	365	None	260	5	91
	Annual	10[7]	80	None	60	2	20
PM_{10}[8]	24-hour	78[9]	150	150	150	8	30
	Annual	12[10]	None	None	50	4	17
$PM_{2.5}$[8]	24-hour	10[11]	35	35	65	None	None
	Annual	3.9[11]	15	15	15	None	None

1 Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.
2 Primary standards are designed to protect public health; secondary standards are designed to protect public welfare.
3 All NEPA analysis comparisons to the PSD increments are intended to evaluate a threshold of concern and do not represent a regulatory PSD Increment Consumption Analysis.
4 Data collected by Amoco at Ryckman Creek for an eight-month period during 1978-1979, summarized in the Riley Ridge EIS (BLM 1983).
5 Data collected at Antelope Site 3, Campbell County, WY, 2004-2006.
6 Data collected at site located 15 miles SSW of Gillette, Campbell County, WY, 2005-2007 (8-hour 4th high).
7 Data collected at Wyodak Site 4, Campbell County, WY, 2005-2007.
8 On October 17, 2006, EPA published final revisions to the NAAQS for particulate matter that took effect on December 18, 2006. The revision strengthens the 24-hour $PM_{2.5}$ standard from 65 to 35 μg/m³ and revokes the annual PM_{10} standard of 50 μg/m³. The State of Wyoming will enter into rulemaking to revise the WAAQS.
9 Data collected at Antelope Site 4 (2005-2007).
10 Background determination developed for recent permitting actions at the Antelope Mine, based on data collected at the Antelope Mine.
11 Data collected at Antelope Site 3 (2005-2007)
Source: (BLM 2005a) and WDEQ/AQD

- NO_2 and PM_{10} emissions from railroad locomotives used to haul coal;
- SO_2 and NO_x from power plants. The closest coal-fired power plants are the Dave Johnston plant, located about 35 miles southwest of the West Antelope II LBA tract, and the Wyodak, Wygen, and Neil Simpson plants, located about 50 miles north of the West Antelope II LBA tract; and
- Air pollutants transported from emission sources located outside the PRB.

3.4.2 Particulate Emissions

3.4.2.1 Affected Environment for Particulate Emissions

The federal standard for particulate matter pollutant was specified as total suspended particulates until 1987. This measurement included all particulates generally less than 100 microns in diameter. In 1987, the form of the standard was changed from TSP to PM_{10} to better reflect human health effects. PM_{10} represents particulate matter with a mean aerodynamic diameter of 10 microns or less that can potentially penetrate into the lungs and cause health problems. In 1997, EPA set separate standards for fine particles ($PM_{2.5}$), based on their link to serious health problems. In 2006, EPA revised the air quality standards for particulate matter by tightening the 24-hour fine particle standard from the previous level of 65 $\mu g/m^3$ to 35 $\mu g/m^3$ and revoking the annual PM_{10} standard of 50 $\mu g/m^3$. EPA retained the existing annual $PM_{2.5}$ standard of 15 $\mu g/m^3$ and the 24-hour PM_{10} standard of 150 $\mu g/m^3$. These revisions took effect on December 18, 2006. The current federal ambient air standards are shown in Table 3-3.

While retaining the TSP standard until March 2000, Wyoming added the PM_{10} standard in 1989. Wyoming also adopted a $PM_{2.5}$ standard in March 2000. In view of the December 2006 revisions to the NAAQS for particulate matter, the State of Wyoming will enter into rulemaking to revise the WAAQS for particulate matter so that they remain as stringent as or more stringent than the NAAQS. Even with the evolution of state or federal small size particulate standards, TSP is still monitored in some PRB locations as a surrogate for PM_{10} and as an indication of overall atmospheric levels of particulate matter.

WDEQ/AQD requires monitoring data to document the air quality at all of the PRB mines. TSP and PM_{10} data have been collected since 1980 and 1989, respectively. As a result, over 57,000 TSP and 27,000 PM_{10} samples were collected through 2004. Information about the monitoring network, the data that have been collected and PM_{10} concentration trends since monitoring began is included in Appendix F.

Air quality and meteorological sampling locations for the Antelope Mine are shown on Figure 3-5. The wind rose diagram for the Antelope Mine is shown in Figure 3-2.

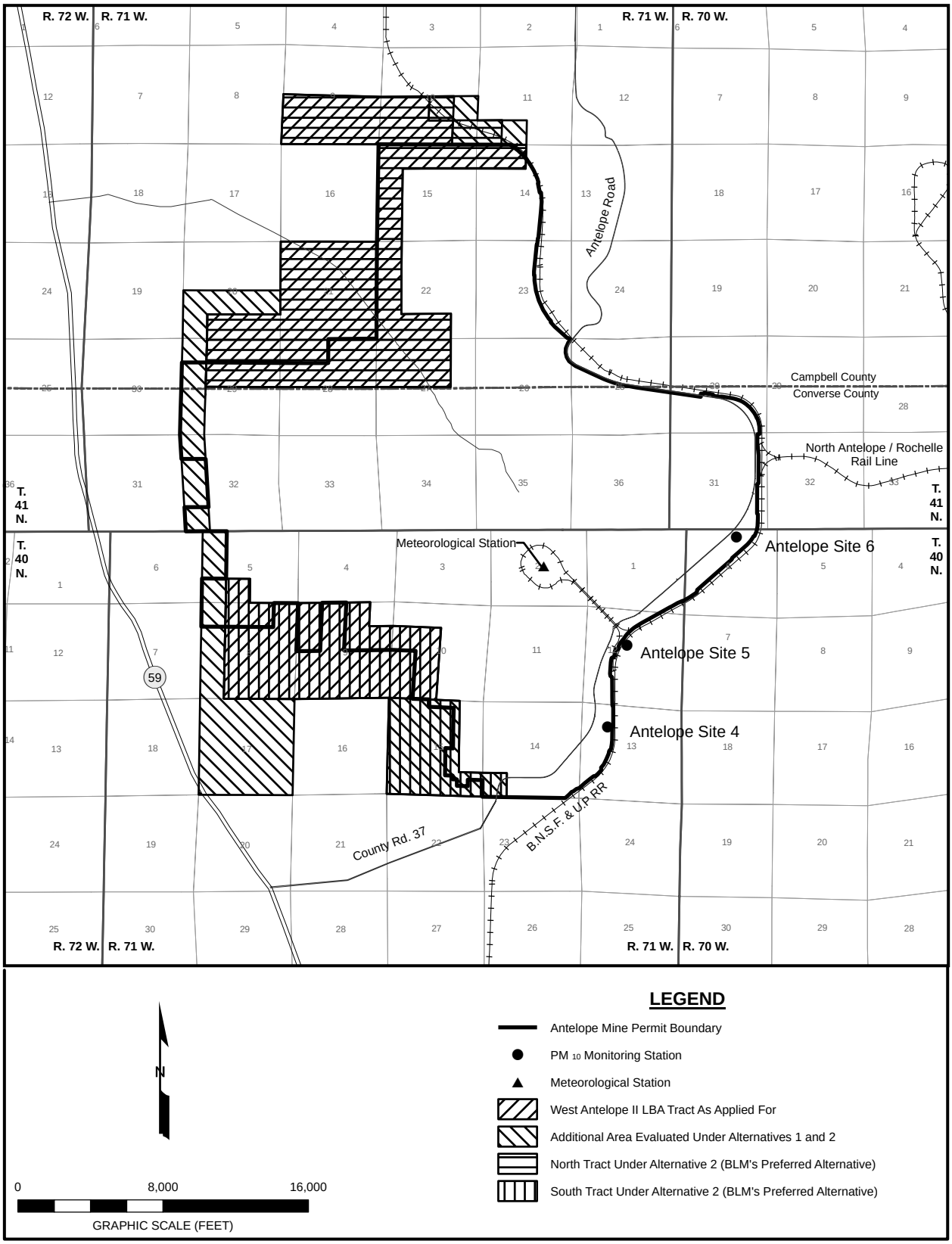


Figure 3-5. Air Quality and Meteorological Stations at the Antelope Mine.

Figure 3-6 presents the annual PM_{10} measured at the Antelope Mine monitoring sites. These data were collected from 2003 through 2006. Cumulative coal and overburden production for the Antelope Mine for these years are also shown in this figure. Table 3-4 presents a summary of 24-hour PM_{10} monitoring data for the Antelope Mine for 2003 through 2005.

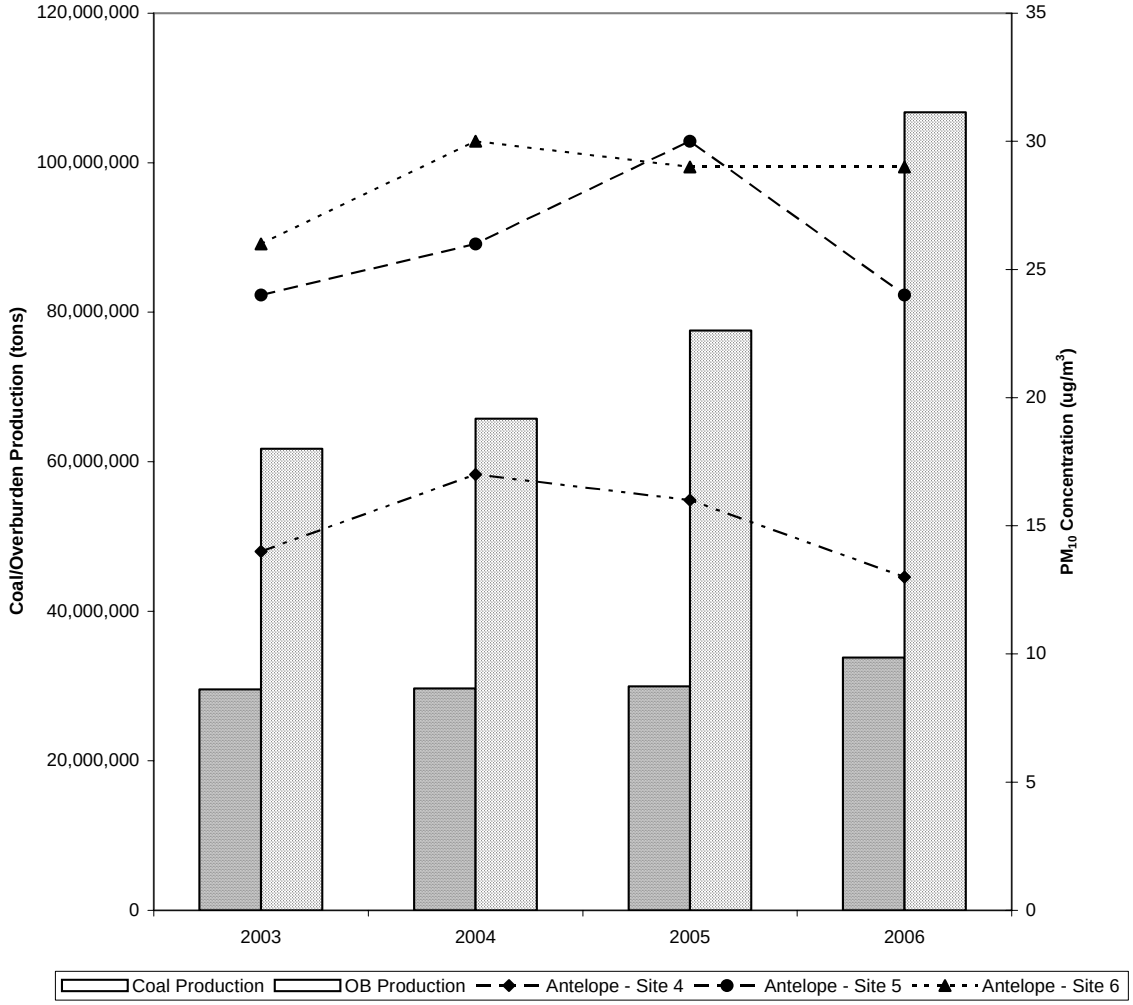


Figure 3-6. Annual Coal Production and Overburden Removal vs. Monitored PM_{10} for the Antelope Mine

Table 3-4. Summary of PM_{10} Monitoring Data for the Antelope Mine (24-hr Highest Second-High Concentrations in $\mu g/m^3$).

Monitor ID	Latitude (degrees N)	Longitude (degrees W)	2005	2006	2007
Site 4	43.83	105.45	40	96	76
Site 5	43.46	105.33	114	117	105
Site 6	43.48	105.31	68	111	94
NAAQS			150	150	150

Source: EPA web page http://www.epa.gov/air/data/reports.html

Table 3-4a. Summary of PM_{10} Monitoring Data for the Antelope Mine (24-hr Highest 4th-High over 3 Years - $\mu g/m^3$)

Monitor ID	Latitude (degrees N)	Longitude (degrees W)	2005	2006	2007
Site 4	43.83	105.45	43	51	76
Site 5	43.46	105.33	73	114	114
Site 6	43.48	105.31	80	91	94
NAAQS			150	150	150

Source: EPA web page http://www.epa.gov/air/data/reports.html

There were no monitored exceedances of the PM_{10} standard in the PRB through 2000. Between 2001 and 2006, there were 29 monitored exceedances of the 24-hour PM_{10} standard at seven operating mines in the Wyoming Powder River Basin (WDEQ/AQD 2006a). In early 2007, nine exceedances were monitored at four mines. Many of these exceedances occurred in the group of mines located south and east of the town of Wright, which is identified as the Wright Area Subregion in Chapter 4 of the EIS. Although the Antelope Mine is located in that group of mines, most of the exceedances were located roughly ten to fifteen miles north of the Antelope Mine. In 2005, one exceedance was recorded at one of the monitoring stations at the Antelope Mine, however, that exceedance was attributed by WDEQ/AQD to maintenance/construction operations on the adjacent railroad line and not to mining operations at the Antelope Mine. In general these exceedances are likely attributable to a variety of causes including long-term drought conditions, associated high winds, contributions from non-mining sources such as increased traffic on unpaved roads proximate to some of the sampling locations, as well as proximity of un-reclaimed mining activity to sampler locations.

PM_{10} monitoring results for the other mines in the Wright Area Subregion are summarized in Table 3-5.

3.4.2.2 Environmental Consequences Related to Particulate Emissions

Particulates include solid particles and liquid droplets that can be suspended in air. Particulates, especially fine particles, have been linked to numerous respiratory related illnesses and can adversely affect individuals with pre-existing heart or lung diseases (EPA 2007a). They are also a major cause of visibility impairment in many parts of the United States. While individual particles cannot be seen with the naked eye, collectively they can appear as black soot, dust clouds, or gray hazes.

Table 3-5. Summary of PM_{10} Monitoring Data for the Wright Area Subregion (24-hr Highest Second-High Concentrations in μg/m³).

Site	2005	2006	2007
North Antelope Rochelle			
NA-5	149	120	145
NA-6B	98	104	67
RO-1	100	108	126
Black Thunder			
31-1	109	138	--
26-2	83	90	92
36-1	116	124	136
E&F	167	96	190
Relocated #1	102	97	128
J	117	94	123
Jacobs Ranch			
JRM-3	83	89	103
JRM-4	47	65	49
JRM-5PM	103	97	143

Source: EPA web page http://www.epa.gov/air/data/reports.html

3.4.2.2.1 Proposed Action and Alternatives 1 and 2

The West Antelope II LBA tract would be mined as an integral part of the Antelope Mine under the Proposed Action and Alternatives 1 and 2. ACC projects that the Antelope Mine would produce between 36 mmtpy and 42 mmtpy after 2007, regardless of whether the LBA tract is leased or not. Comprehensive studies demonstrating compliance with applicable ambient air standards would be required to obtain a permit modification if ACC proposes to increase their permitted production level in the future.

ACC conducted a modeling analysis for a maximum coal production rate of 42 mmtpy as part of a request for an air quality permit modification for the Antelope Mine submitted in May 2006 and issued by the WDEQ on April 23, 2007. For that analysis, mining years 2010 and 2012 were selected as "worst-case" based on Antelope Mine-specific and regional LOM emission inventories for PM_{10} and NO_x. The highest model-predicted PM_{10} impact during year 2012 was 49.9 ug/m³ (as per WDEQ-AQD AP-4809 Application Analysis for the Antelope Coal Company - Antelope Mine, dated February 1, 2007, application received May 2006). The highest model-predicted PM_{10} impact during year 2010 was 47.8 ug/m³ (Figures 3-7 and 3-8).

As discussed in Appendix F, surface coal mines in the Wyoming PRB have not been subject to PSD requirements. The PSD rules, which are intended to prevent deterioration of air quality, are summarized in Appendix F. Only some fraction of the mine emissions included in the WDEQ/AQD air quality permit analyses consumes increment based on permits in place in the baseline year of 1997. As a result, the concentrations predicted by the WDEQ/AQD air quality permit

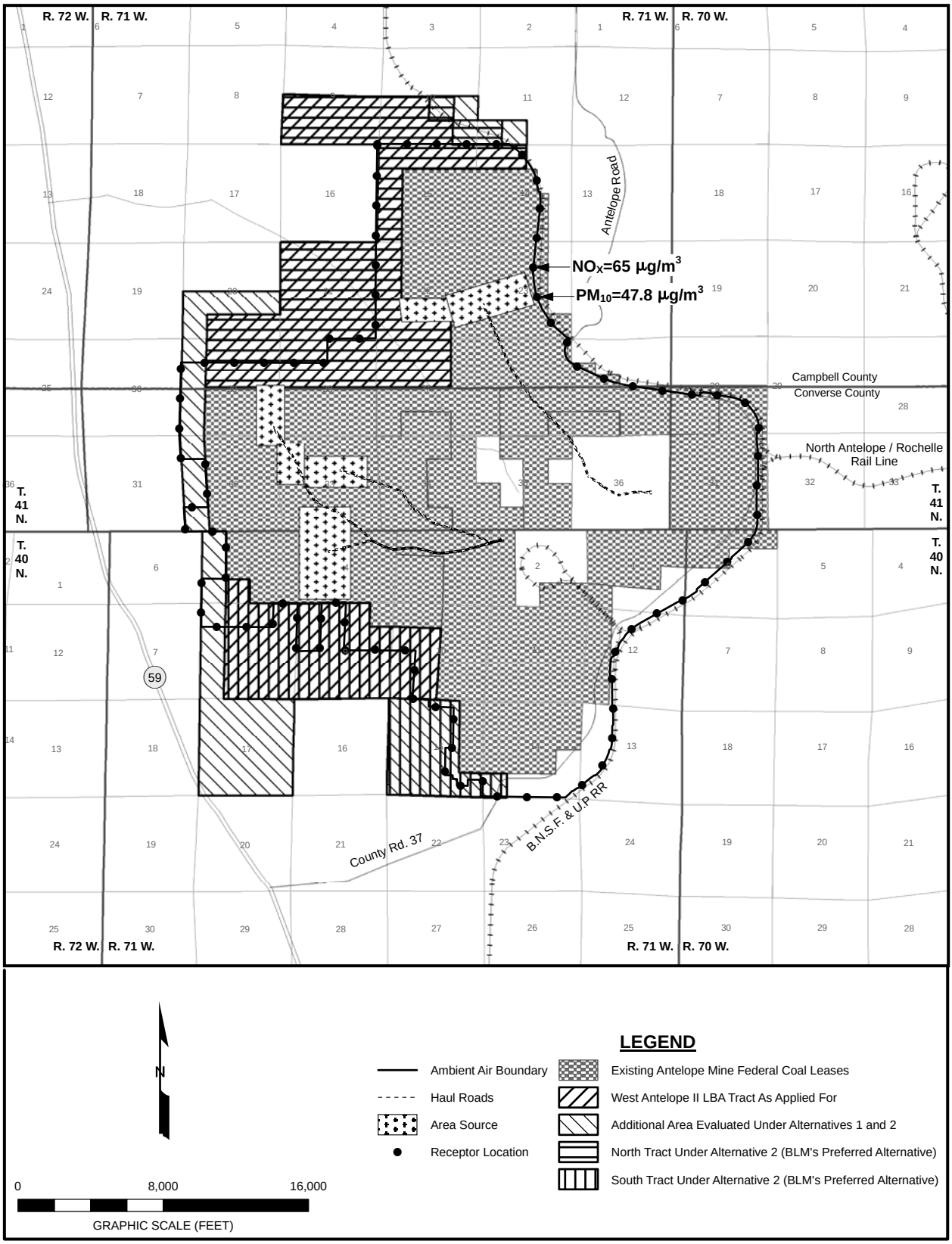


Figure 3-7. Maximum Modeled PM_{10} and NO_X Concentrations at the Antelope Mine Ambient Air Boundary for the Year 2010.

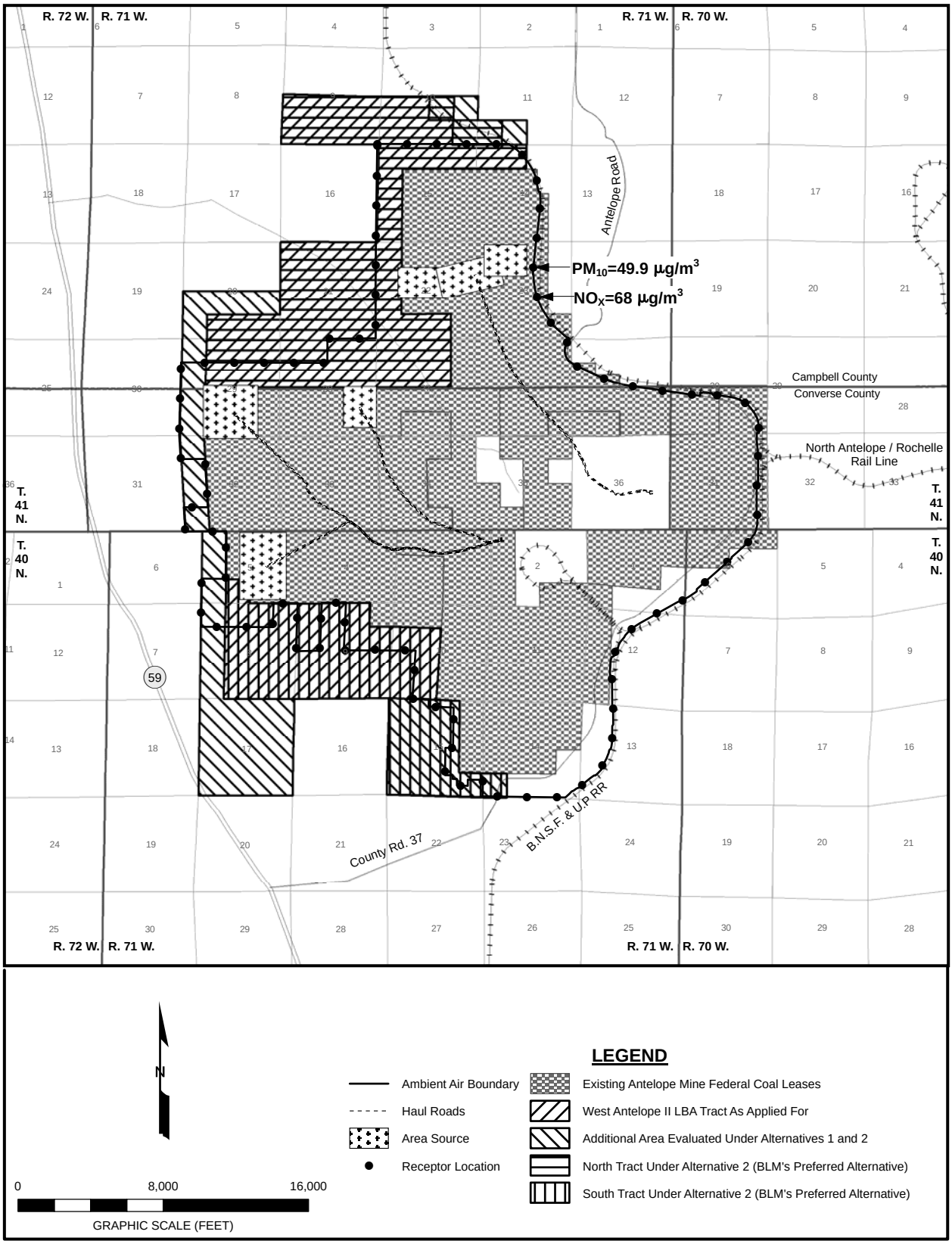


Figure 3-8. Maximum Modeled PM_{10} and NO_X Concentrations at the Antelope Mine Ambient Air Boundary for the Year 2012.

analyses should not be compared to PSD increments.

In Wyoming, monitoring results have been used in lieu of short-term (24-hour) modeling for assessing short-term coal mining-related impacts in the PRB. WDEQ has chosen this procedure in accordance with an agreement between EPA and the State of Wyoming. That agreement recognizes that appropriate models do not exist to accurately predict 24-hour impacts. In accordance with this policy, ACC also prepared a demonstration regarding compliance with the 24-hour PM_{10} standard. The short-term compliance analysis focused on historical monitoring data and continuing employment of BACT on mine-wide emissions and concluded that mining operations would not be expected to cause exceedances of the 24-hour PM_{10} WAAQS.

ACC proposes using the same mining methods and emission mitigation methods to recover the coal on the West Antelope LBA tract as they are currently using to recover the coal on the existing leases. The mine would continue to utilize draglines, shovels, and trucks to remove and replace overburden and shovels and trucks to remove coal. Facilities shown in the current air quality permit would not change as a result of proposed mining of the LBA tract. Haul distances to transport the coal to the rail facilities are not expected to increase because overland conveyors are likely to be extended into the tract. ACC does not plan to change blasting procedures or blast sizes associated with the mining of the LBA tract. However, as indicated in Table 3-2, overburden thicknesses are greater and coal thicknesses are less on the West Antelope II LBA tract as compared to the existing leases at the Antelope Mine. As a result, blasting size and/or frequency may need to increase in order to recover the coal included in the tract, which could result in an increase in fugitive emissions per ton of coal mined. Therefore, blasting-related particulate emissions may increase. However, blasting makes up a very small fraction of the overall mine-wide emissions inventory, so the effect on mine-wide particulates will be minimal.

Under the Proposed Action and Alternatives 1 and 2, mine life would be extended by up to 13 years, assuming a coal production rate from 36 to 42 mmtpy. If ACC acquires the tract, they would need an air quality permit modification from the WDEQ-AQD before they could initiate mining operations on the tract. New air quality modeling would need to be conducted in support of that application demonstrating on-going compliance with all applicable ambient standards.

The modeling conducted for the current Antelope Mine permit predicted no exceedances of the annual PM_{10} WAAQS at the maximum mining rate proposed for the West Antelope II LBA tract. The maximum modeled concentrations predicted by the modeling would occur along the northeast portion of the Antelope Mine's permit boundary, along the railroad right-of-way. Mining operations on the LBA tract will, in general, generate dust emissions farther from this high impact area. As a result, maximum predicted impacts should decrease as the tract is mined. Therefore, fugitive dust emissions should remain in compliance with daily and annual air quality standards.

Public exposure to particulate emissions from surface mining operation is most likely to occur along publicly accessible roads and highways that pass through the areas of mining operations. Occupants of dwellings in the area could also be affected. Roads, highways, occupied dwellings, businesses and school bus stops in the vicinity of the Antelope Mine and the study area for the West Antelope II LBA tract are shown in Figure 3-9.

3.4.2.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the Antelope Mine would continue to operate as currently permitted. The currently permitted mining operations and projected impacts related to PM_{10} emissions are discussed in Section 3.4.2.2.1, above. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases, but coal removal would not occur on the LBA tract and the related impacts would not be extended onto those portions of the LBA tract that will not be affected under the current mine plan.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.4.2.3 Regulatory Compliance, Mitigation, and Monitoring for Particulate Emissions

Control of particulate emissions at all PRB coal mines is accomplished with a variety of measures. The WDEQ/AQD permits for all of the surface coal mines in the Powder River Basin require the following dust control measures, which are considered to be BACT measures:

1. No mines are allowed to have out-of-pit open coal stockpiles. All coal removed from the mine pits must be stored in totally enclosed coal silos or barns.
2. Unless specifically exempted, all coal mine main access roads must be paved.
3. As use and conditions warrant, the minor access roads at coal mines which are unpaved must be watered or treated with dust suppressants.
4. All coal conveyor transfer points must be shrouded or otherwise enclosed to direct coal fines from one belt to the next.
5. The transfer point and crushers within coal processing plants must be equipped with control devices and measures specified in individual permits. These control devices and measures may include, but are not limited to, the use of dust collection baghouses, cyclones, scrubbers, fog systems, and controlled flow transfer chutes.
6. All out-of-pit conveyors must be hooded or contained in a conveyor gallery.

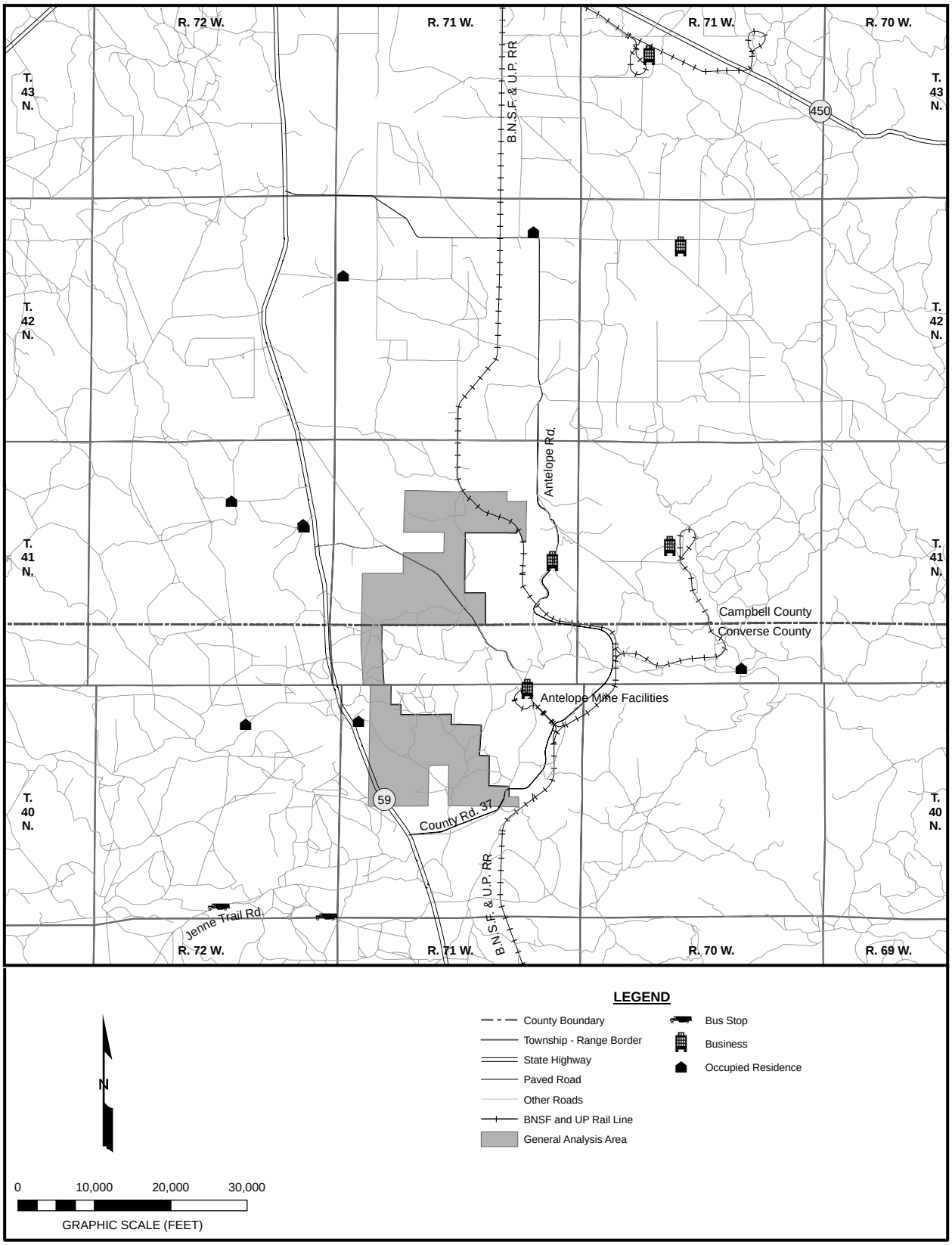


Figure 3-9. Roads, Highways, Occupied Dwellings, Businesses and School Bus Stops in the Vicinity of the Antelope Mine and the West Antelope II General Analysis Area.

7. All out-of-pit coal dump hoppers must be fitted with a dust control stilling shed, water sprays, or a baghouse dust collector.
8. Active longer-term coal haul roads must be treated with dust control chemicals and/or water.
9. Active short-term mine haul roads which must be continuously relocated are maintained and watered while in use.
10. All haul roads must be regularly maintained to reduce the amount of dust re-entrained by haulage equipment (WDEQ/AQD 2006a).

Additional site-specific requirements related to mine-specific layout and mining practices may be included in individual mine permits.

Fugitive emissions are also controlled with a variety of other measures that the WDEQ/AQD considers BACT. Haul truck speed limits are imposed to further help to reduce fugitive emissions from roads. Material drop heights for shovels and draglines (bucket to truck bed or backfill) are limited to the minimum necessary to conduct the mining operations. Timely permanent and temporary revegetation of disturbed areas is utilized to minimize wind erosion. All of these control measures are employed at the Antelope Mine.

Mines often apply dust suppressants to adjoining county roads. In 2006, the Antelope Mine paved its access road.

In April 2006, the WDEQ in a joint effort with PRB mining stakeholders developed a detailed Natural Events Action Plan or NEAP for the coal mines of Campbell and Converse Counties, Wyoming. The NEAP was developed under the framework afforded by U.S. EPA's Natural Events Policy of May 30, 1996. Formal approval of the NEAP by EPA Region VIII was received in January 2007. Additionally, on May 21, 2007, EPA finalized the Exceptional Event Rule (40CFR50 and 40CFR51) which has many of the same features as the NEAP. The PM_{10} control strategies, including BACM, listed in the NEAP are applicable to the Exceptional Event Rule as Reasonable and Appropriate controls. The Antelope Mine is presently complying with the NEAP as approved by EPA and developed jointly by the WDEQ/AQD and the PRB coal operators.

The NEAP recognizes that certain NAAQS exceedances due to natural events are uncontrollable. While all practical mitigation measures need be implemented during those events, the exceedances should not be considered against the NAAQS attainment designation for the region. Specific NEAP goals include:

- Provide for the protection of public health,
- Develop public information program,
- Provide a mechanism for "flagging" exceedances due to uncontrollable natural events,
- Implement BACM and RACM based on the severity of the event, and
- Provide mechanism for excluding flagged data when they meet specific

wind speed criteria and BACM and RACM are in place.

The NEAP identifies two categories of control measures designed to prevent exceedances during high wind events in addition to the BACT measures discussed above (WDEQ/AQD 2006a). One of these categories, BACM, is an additional list of control measures that the mines can implement continuously so that they are in place before a high wind event occurs. These measures are not current requirements in all of the mines' air quality permits. They primarily address the principal mine-controlled sources of fugitive dust, which are large contiguous disturbed areas. These measures include:

1. Stabilizing topsoiled areas as soon as practical following topsoil replacement.
2. Ripping, windrowing, mulching, temporarily seeding or chemically treating areas greater than 300 contiguous acres in size that have been stripped of topsoil but will not be mined in the near future.
3. Ripping, windrowing, temporarily seeding or chemically treating graded backfill areas greater than 300 contiguous acres in size.
4. Ripping, mulching, temporarily seeding or chemically treating long-term out-of-pit overburden and topsoil stockpiles that have been graded.
5. Applying non-vegetative barriers such as gravel or other large-diameter particles to erodible surfaces to reduce surface erosion where appropriate.
6. Cleaning, treating, and maintaining pads in front of truck dumps to prevent accumulations of spilled materials from getting pulverized.
7. Scheduling topsoil removal, backfill grading and topsoil replacements concurrently to minimize open areas when possible.
8. Requiring contractors to apply water and/or chemical dust suppressants in their haulage areas.

The third category of control measures discussed in the Natural Events Action Plan includes measures that are not currently required by all individual air quality permits but are actions that can be taken during a high wind event, depending on site specific conditions (WDEQ/AQD 2006a). These include:

1. The mine operator will consider relevant information, including NWS forecasts and local meteorological information, to confirm that a high wind event is occurring.
2. The mine operator will visually determine areas of mining activity that are generating excessive visible dust and direct water trucks to those areas.
3. The mine operator should direct overburden operations to the shortest haul distance available during a high wind event.
4. The mine operator will evaluate the practicality of dumping the overburden as low as possible.
5. Mine employees will inspect for and extinguish coal fires.
6. The mine operator will evaluate shutting down scoria crushing operations that appear to be generating excess dust.

7. The mine operator will evaluate shutting down road maintenance activities that are generating dust.
8. The mine operator will evaluate ordering contractors to increase water, reduce operating equipment or shut down haulage.
9. The mine operator will evaluate the need to shut down and/or reduce earthmoving activities as the mine schedule and conditions will allow.

WDEQ/AQD may require implementation of these control steps and continual evaluation of activity plans when exceedances are monitored at surface coal mines. Some of these measures have been formally implemented at the Black Thunder, Jacobs Ranch, and former North Rochelle mines through the establishment of a formal, site-specific mitigative response plan at each of those mines. A mitigative response plan will be developed by any mine that records an exceedance or violation of the NAAQS downwind of its mining operations.

Other operational control measures that WDEQ/AQD may require at specific mines when exceedances occur include, but are not limited to, site-specific watering of inactive areas and problem areas; relocation of overburden truck-dumping operations; and deferring blasting. The mines are experimenting with dust control treatments, including magnesium chloride, surfactants, and petroleum-based products. In addition, WDEQ/AQD may require additional monitoring, action levels based on continuous monitoring, expedited reporting of monitored exceedances, detailed reporting of contributing factors (e.g., meteorological conditions), and continual evaluation of activity plans when exceedances are monitored at surface coal mines.

The WDEQ/AQD is continually reviewing the data and considering regulatory options, such as increasing the frequency of monitoring. WDEQ/AQD has increased monitoring frequency requirements and required installation of continuous PM_{10} monitors at all PRB coal mines. The agency has initiated enforcement actions where appropriate. Notices of violation have been issued on occasion, and consent decrees and modified permit conditions have been used as tools to mitigate dust problems. WDEQ/AQD is also coordinating with EPA to develop additional monitoring requirements in CBNG development areas, high PM_{10} mitigation action plans in permits, and additional mitigation measures under the SIP.

WDEQ has required several mines to stop traffic on public roads during blasting due to concerns with fly rock and the “startle factor”. However, the WDEQ has not required that of Antelope Mine. Antelope has voluntarily implemented this measure from time to time, based on blast location and wind direction.

The PRB has one of the most extensive networks of monitoring sites for PM_{10} in the nation; most of these monitoring sites are funded and operated by the coal mines. WDEQ/AQD requires the collection of information documenting the quality of the air resource at each of the PRB mines. A discussion of the monitoring network and monitoring requirements is included in Appendix F.

3.4.3 Emissions of Nitrogen Oxides (NO_x)

3.4.3.1 Affected Environment for NO_x Emissions

Gases that contain nitrogen and oxygen in varying amounts are referred to as nitrogen oxides, or NO_x. One type of NO_x, nitrogen dioxide (NO_2), is a highly reactive, reddish brown gas that is heavier than air and has a pungent odor. NO_2 is by far the most toxic of several species of NO_x. NO_2 can combine with atmospheric moisture to form nitric acid and nitric oxide. Because several NO_x species can be chemically converted to NO_2 in the atmosphere, NO_2 emissions control is focused on all NO_x species, while the ambient standard is expressed in terms of NO_2.

According to the EPA (EPA 2001a):

- NO_2 may cause significant toxicity because of its ability to form nitric acid with water in the eye, lung, mucous membranes, and skin.
- Acute exposure may cause death by damaging the pulmonary system.
- Chronic or repeated exposure to lower concentrations of NO_2 may exacerbate pre-existing respiratory conditions, or increase the incidence of respiratory infections.

Nitrogen oxides form when fuel is burned at high temperatures. They can be formed naturally or by human activities. The primary manmade sources are motor vehicles, electric utilities, and other fuel-burning sources. According to EPA, motor vehicles produce about 55 percent of the manmade NO_x emissions, utilities and industrial/commercial/residential activities each produce about 22 percent of the manmade NO_x emissions, and other sources account for the remaining one percent of the manmade emissions (EPA 2007b).

The primary direct source of emissions of nitrogen oxides during coal mining operations is tailpipe emissions from large mining equipment and other vehicle traffic inside the mine permit area. Blasting that is done to remove the material overlying the coal (the overburden) can result in emissions of several products, including NO_2, as a result of the incomplete combustion of nitrogen-based explosives used in the blasting process. When this occurs, gaseous, orange-colored clouds may be formed and they can drift or be blown off mine permit areas. The rate of release is not well known but is believed to be dependent on a wide number of factors which likely include, but are not necessarily limited to: downhole confinement; downhole moisture; type/blend of ammonium nitrate, fuel oil (ANFO), and emulsion; and detonation velocity.

3.4.3.1.1 Site Specific NO_x Emissions

Sources of NO_x emissions at the Antelope Mine include the tailpipe emissions from

the mining equipment and the emissions from the trains used to haul the coal from the mine. There are no NO_x point sources at the mine. To date, there have been no reported events of public exposure to NO_2 from blasting activities at the Antelope Mine. The WDEQ has not required the mine to implement any specific measures to control or limit public exposure to NO_2 from blasting, although cast blasting has been conducted at Antelope and will be continued to be implemented in the west tract. Antelope has instituted voluntary measures based on blast locations and wind direction to mitigate exposure to railroad employees and other segments of the population as necessary.

NO_x modeling was also conducted in support of the May 2006 permit application. Similar in scope to the PM_{10} analysis, NO_x emissions from the Antelope Mine and other regional sources were modeled for the two worst-case years of 2010 and 2012 (Figures 3-7 and 3-8.) A maximum annual NO_2 impact of 67.5 $\mu g/m^3$ was predicted in 2012, as compared to the annual NO_2 NAAQS of 100 $\mu g/m^3$.

3.4.3.2 Environmental Consequences Related to Short-Term NO_x Emissions

There are various compounds and derivatives in the family of nitrogen oxides, including NO_2, nitric acid, nitrous oxide, nitrates, and nitric oxide, which may cause a wide variety of health and environmental impacts. According to EPA, the main causes of concern with respect to NO_x are:

- it is one of the main ingredients involved in the formation of ground level ozone, which can trigger serious respiratory problems;
- it reacts to form nitrate particles, acid aerosols, as well as NO_2, which also cause respiratory problems;
- it contributes to the formation of acid rain;
- it contributes to nutrient overload that deteriorates water quality;
- it contributes to atmospheric particles which cause visibility impairment, most noticeably in national parks;
- it reacts to form toxic chemicals;
- one member of the NO_x family, nitrous oxide or N_2O, is a greenhouse gas that contributes to global warming; and
- it can be transported over long distances (EPA 2007c).

Potential health risks associated with inhalation of ground level ozone and NO_x-related particles include acute respiratory problems, aggravated asthma, decreases in lung capacity in some healthy adults, inflammation of lung tissue, respiratory-related hospital admissions and emergency room visits, and increased susceptibility to respiratory illnesses, including bronchitis and pneumonia (EPA 2007d).

Neither the EPA nor the WDEQ have established NAAQS for NO_2 for averaging times shorter than one year. According to EPA, "…the exact concentrations at which NO_2 will cause various health effects cannot be predicted with complete accuracy because the effects are a function of air concentration and time of

exposure, and precise measurements have not been made in association with human toxicity. The information that is available from human exposures also suggests that there is some variation in individual response" (EPA 2001a).

While extensive expert testimony was provided to the Wyoming EQC during hearings in 2002 arguing for the establishment of a de facto "standard" ranging from 0.5 to 5.0 ppm for a 10-minute exposure, the EQC determined there was insufficient evidence to establish a short-term exposure limit and concluded additional study was required. The primary control measure for mitigating exposures to offsite residences is to avoid shooting cast blasts when wind direction or atmospheric conditions are unfavorable. Such approaches are employed at Antelope and will be continued to be employed. Studies that have been conducted to evaluate NO_2 exposures from blast clouds in the PRB are described in Appendix F.

Although there is no NAAQS that regulates short-term NO_2 levels, there is concern about the potential health risk associated with short-term exposure to NO_2 from blasting emission. NIOSH, OSHA, and EPA have identified the following short-term exposure criteria for NO_2:

- NIOSH's recommended Immediately Dangerous to Life and Health level is 20.0 ppm (37,600 $\mu g/m^3$);
- EPA's Significant Harm Level, a one-hour average, is 2.0 ppm (3,760 $\mu g/m^3$);
- OSHA's Short-Term Exposure Limit, a 15-minute time weighted average, which was developed for workers, is 5.0 ppm (9,400 $\mu g/m^3$, which must not be exceeded during any part of the workday, as measured instantaneously);
- NIOSH's recommendation for workers is a limit of 1.0 ppm (1,880 $\mu g/m^3$) based on a 15-minute exposure that should not be exceeded at any time during the workday; and
- EPA recommends that concentrations not exceed 0.5 ppm (940 $\mu g/m^3$) for a 10-minute exposure to protect sensitive members of the public (EPA 2003a).

Blast clouds are of a short-term, transient nature. While disagreement still exists regarding acceptable exposure levels, a large amount of actual data are now available from which informed decisions can be made regarding blasting practices. The data show clearly that reduction in blast (agent) size and increases in setback distances are effective methods for mitigating the frequency and extent of public exposure to blasting clouds. See Appendix F for additional information about studies that were conducted to evaluate the levels of public exposure to NO_x.

3.4.3.2.1 Proposed Action and Alternatives 1 and 2

The West Antelope II LBA tract would be mined as an integral part of the Antelope Mine. The average annual coal production is not anticipated to exceed the projected post-2006 coal production rate of 42 mmtpy, with or without the West Antelope II LBA tract. Coal production is anticipated to increase to a rate of 42 mmtpy, then taper off during the mine's later years, with or without the West Antelope II LBA tract. The Antelope Mine's currently approved air quality permit from the WDEQ/AQD allows up to 42 million tons of coal to be mined per year. If the mine acquires the additional coal in the LBA tract, they would continue to produce between 36 and 42 mmtpy for a longer period of time (up to 13 more years). Potential NO_x emissions related to mining operations at the existing Antelope Mine are described below.

The WDEQ-AQD has determined that an assessment of annual NO_x impacts must be included as part of an air quality permitting analysis for new surface coal mines and existing mine plan revisions. As discussed in Section 3.4.2.2.1, ACC conducted a modeling analysis for PM_{10} and NO_x for a maximum coal production rate of 42 mmtpy as part of a request for an air quality permit modification for the Antelope Mine submitted in May 2006. On April 23, 2007, WDEQ issued Permit MD-1543 for this modification which allows 42 mmtpy production at the mine.

There have been no reported events of public exposure to NO_2 from blasting activities at the Antelope Mine through 2005. The mine has, however, employed measures to control/limit public exposure to intermittent, short-term (blasting) releases as discussed in Section 3.4.3.3.

Public exposure to emissions caused by surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. Figure 3-9 shows occupied dwellings, businesses, and bus stops in the vicinity of the West Antelope II LBA tract. If the West Antelope II LBA tract is mined, blasting operations will be conducted in closer proximity to Highway 59 and some residences located west of the existing mine. However, because the prevailing wind direction is from the southwest (Figure 3-2), emissions from blasting are not expected to substantially affect public exposure. There will be no significant changes in blasting techniques except when mining occurs in the LBA tract. Because overburden is thicker in the LBA tract, Antelope would employ state-of-the-art methods to minimize any increases in blast sizes and/or total agent used. Those methods would include, but would not necessarily be limited to, the use of more efficient agent formulations and use of electronic detonators. Thus, emissions from blasting are not expected to increase significantly, notwithstanding the large overburdens to be excavated in the tract.

If ACC acquires the West Antelope II LBA tract, current mining techniques (i.e., blasting, excavating, hauling, etc.) would be expected to continue for a longer period of time than is shown in the currently approved air quality permit.

Modeling for the current Antelope Mine permit projected no exceedances of the annual NO_x NAAQS at a 42 mmtpy production. Therefore, air quality impacts that result from mining the West Antelope II LBA tract by the applicant should also be within annual NAAQS limits.

3.4.3.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the mine would continue to operate as currently permitted. A discussion of the currently permitted mining operations and projected impacts related to NO_x emissions is included in Section 3.4.3.2.1, above. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases, but coal removal would not occur on the LBA tract and the related impacts would not be extended onto those portions of the LBA tract that will not be affected under the current mine plan. As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.4.3.3 Regulatory Compliance, Mitigation, and Monitoring for NO_x Emissions

Several of the surface coal mines in the PRB have undertaken voluntary blasting restrictions to avoid NO_x impact to the public. WDEQ has required several mines, including North Antelope Rochelle, Black Thunder, Belle Ayr, Eagle Butte, and Wyodak (Figure 1-1), to stop traffic on public roads during blasting due to concerns with fly rock and the "startle factor". However, the WDEQ has not required that of Antelope Mine. The mine has voluntarily implemented this measure from time to time, based on blast location and wind direction.

To date, there have been no reported events of public exposure to NO_2 from blasting activities at the Antelope Mine. The WDEQ has not required the mine to implement any specific measures to control or limit public exposure to NO_2 from blasting, although the mine has voluntarily committed to control blasting emissions.

Voluntary measures that have been instituted, particularly when large blasts are planned include:

- neighbor telephone notification (both private parties and other mining operations) in the general area of the mine prior to large blasts;
- monitoring of weather and atmospheric conditions prior to the decision to detonate a large blast;
- minimizing blast size to the extent possible;
- posting of signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area;

- closing public roads that enter the general mine area, depending on wind conditions and blast location with respect to the road; and

- providing post-blast notification to neighbors of potential exposure to the blasting cloud.

After WDEQ received reports of public exposure to NO_2 from blasting operations at some of the PRB mines prior to 2001, measures to prevent future such incidences were instituted at those mines when large overburden blasts are planned. Two mines in the Wyoming PRB, Black Thunder and Eagle Butte, currently have blasting restrictions in their permits to address NO_x.

Measures that have been instituted as mine permit requirements include:

- notification of neighbors and workers in the general area of the mine prior to the blast;

- blast detonation between 12:00 p.m. and 3:00 p.m. whenever possible to avoid temperature inversions and minimize inconvenience to neighbors;

- monitoring of weather and atmospheric conditions prior to the decision to detonate a blast;

- posting of signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area;

- closing public roads when appropriate to protect the public; and

- establishment of safe setback distances for blasting operations from the mine boundary.

Mine operators in the PRB have also been working with blasting agent manufacturers to reduce NO_x emissions. Efforts to eliminate NO_x production have included use of different blasting agents, different blends of blasting agents, different additives, different initiation systems and sequencing, borehole liners, and smaller cast blasts. Operators have tried adding substances like microspheres and rice hulls, using different blends of ANFO and slurries and gels, using electronic detonation systems that can vary shot timing, different shot hole patterns, and using plastic liners within the shot holes. No one single procedure or variation has proven consistently successful due to the numerous factors that are believed to contribute to the production of NO_2. The most successful control measure has been reducing the size of the cast blasting shots (Emme 2003, Chancellor 2003). The Eagle Butte Mine, which does not use cast blasting techniques, has almost eliminated NO_x production. The North Antelope Rochelle Mine has had success in eliminating NO_x in over 75 percent of their cast blasting

through the use of borehole liners and changing their blasting agent blends (Chancellor 2003). Both mines are shown in Figure 1-1.

Annual mean NO_2 concentrations have been periodically measured in the PRB since 1975. NO_2 was monitored in Gillette from 1975 through 1983 and then from 2003 to 2006 in the PRB. The results of these monitoring programs are summarized in Tables 3-6 and 3-7.

NO_2 data have been measured in the vicinity of the Antelope Mine since 2003. The maximum annual average NO_2 concentration measured at the Antelope site was 9.4 µg/m^3 in 2005 and again in 2006, as compared to the NAAQS of 100 µg/m^3 (Table 3-7).

Table 3-6. Annual Ambient NO_2 Concentration Data (µg/m^3).

Site	Gillette, WY	Black Thunder Mine	Belle Ayr Mine	Bill, WY
Year	**Percent of Standard[1]**	**Percent of Standard[1]**	**Percent of Standard[1]**	**Percent of Standard[1]**
1975	6*			
1976	4*			1*
1977	4*			5*
1978	11*			
1979	11			
1980	12			
1981	14			
1982	11			
1983[2]	17			
1996[3]	16	16	22	22

1 Based on arithmetic averaging of data.
2 Monitoring discontinued December 1983, reactivated March 1996 to April 1997.
3 Arithmetic average – actual sampling ran from March 1996 to April 1997.
* Inadequate number of samples for a valid annual average.
Source: (McVehil-Monnett 1997)

Table 3-7. 2003 Through 2006 Annual Ambient NO_2 Concentration Data (µg/m^3).

Year	Antelope Mine	Belle Ayr Mine	TBNG	Tracy Ranch
2003	7.5	13.2	5.6	
2004	7.5	13.2	3.8	7.5
2005	9.4	15	3.8	
2006	9.4	15	3.8	

Source: EPA web page http://www.epa.gov/air/data

Due to public concerns about emissions of nitrogen dioxides as a result of blasting and a general concern of the WDEQ about levels of nitrogen dioxides as a result of development of all types in the PRB, the coal mining industry instituted a monitoring network in cooperation with WDEQ/AQD to gather data on NO_2 beginning in 2001. Industry funded and operated the network for approximately three years. The WDEQ now funds and operates the NO_2 monitoring network along the east side of the basin. Ownership of the monitoring equipment was transferred to WDEQ by the mines and the mines have given ongoing access to the monitoring sites and provide electrical power for the instrumentation. WDEQ/AQD and respective mines maintain these monitoring stations. The WDEQ/AQD is relying on the ongoing monitoring data and emission inventories in air quality permit applications to demonstrate compliance with the annual NO_2 ambient air standard (Table 3-3).

3.4.4 Visibility

Visibility refers to the clarity with which scenic vistas and landscape features are perceived at great distances. Visibility can be defined as the distance one can see and the ability to perceive color, contrast, and detail. Fine particulate matter ($PM_{2.5}$) is the main cause of visibility impairment. Visual range, one of several ways to express visibility, is the furthest distance a person can see a landscape feature. Without the effects of human-caused air pollution, a natural visual range is estimated to be about 140 miles in the western U.S. and 90 miles in the eastern U.S. (EPA 2001b).

Visibility impairment is expressed in terms of deciview (dv). The dv index was developed as a linear perceived visual change (Pitchford and Malm 1994), and is the unit of measure used in the EPA's Regional Haze Rule to achieve the National Visibility Goal. The National Visibility Goal was established as part of the CAA in order to prevent any future, and remedy any existing, impairment of visibility in mandatory Federal Class I areas that result from manmade air pollution. The deciview index is a scale related to visual perception that has a value near zero for a pristine atmosphere. A change in visibility of 1.0 dv represents a "just noticeable change" by an average person under most circumstances. Increasing dv values represent proportionately larger perceived visibility impairment.

3.4.4.1 Affected Environment for Visibility

An AQRV is a resource identified by a federal land manager that may be adversely affected by a change in air quality. Visibility is a potentially affected resource. The potential air pollutant effects on visibility are applied to PSD Class I and Class II areas. The land management agency with jurisdiction for the Class I area sets an LAC or LOC for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards. Table 3-8 shows the distances from 31 PSD Class I and Class II areas in the vicinity of the PRB and their distances from the West Antelope II general analysis area.

Table 3-8. Approximate Distances and Directions from the West Antelope II General Analysis Area to Mandatory Federal Class I, Tribal Class I, and Federal Class II PSD Areas.

Receptor Area	Distance (miles)	Direction to Receptor
Mandatory Federal PSD Class I Area		
Badlands Wilderness Area[1]	152	E
Bridger Wilderness Area	219	W
Fitzpatrick Wilderness Area	217	W
Gates of the Mountain Wilderness Area	401	NW
Grand Teton National Park	275	W
North Absaroka Wilderness Area	256	WNW
Red Rocks Lake Wilderness Area	330	WNW
Scapegoat Wilderness Area	440	NW
Teton Wilderness Area	234	WNW
Theodore Roosevelt National Park (North Unit)	275	NNE
Theodore Roosevelt National Park (South Unit)	259	NNE
U.L. Bend Wilderness Area	266	NNW
Washakie Wilderness Area	239	WNW
Wind Cave National Park	94	E
Yellowstone National Park	269	WNW
Tribal Federal PSD Class I		
Fort Peck Indian Reservation	329	N
Northern Cheyenne Indian Reservation	155	NNW
Federal PSD Class II		
Absaroka-Beartooth Wilderness Area	255	WNW
Agate Fossil Beds National Monument	109	SE
Bighorn Canyon National Recreation Area	182	NW
Black Elk Wilderness Area	94	ENE
Cloud Peak Wilderness Area	108	NW
Crow Indian Reservation	183	NW
Devils Towner National Monument	86	NNE
Fort Belknap Indian Reservation	363	NNW
Fort Laramie National Historic Site	97	SSE
Jewel Cave National Monument	78	ENE
Mount Rushmore National Memorial	98	ENE
Popo Agie Wilderness Area	202	WSW
Soldier Creek Wilderness Area	127	ESE

[1] The U.S. Congress designated the Wilderness Area portion of Badlands National Park as a mandatory Federal PSD Class I area. The remainder of Badlands National Park is a PSD Class II area.

The Regional Haze Rule calls for improved visibility on the most impaired days and no additional impairment on the least-impaired days. EPA participates in the IMPROVE visibility monitoring program as part of its visibility protection program. The IMPROVE monitoring sites were established to be representative of all Class I areas. Figure 3-10 shows annual averages for the 20 percent best, average, and worst visibility days at Badlands and Bridger Wilderness Areas from 1989 through 2004. To date, Badlands National Park has statistically shown improved visibility on the least impaired days and no change in visibility on the average and most impaired days. Bridger Wilderness has shown no statistically significant change in visibility on the least, average, or most impaired days (IMPROVE 2005).

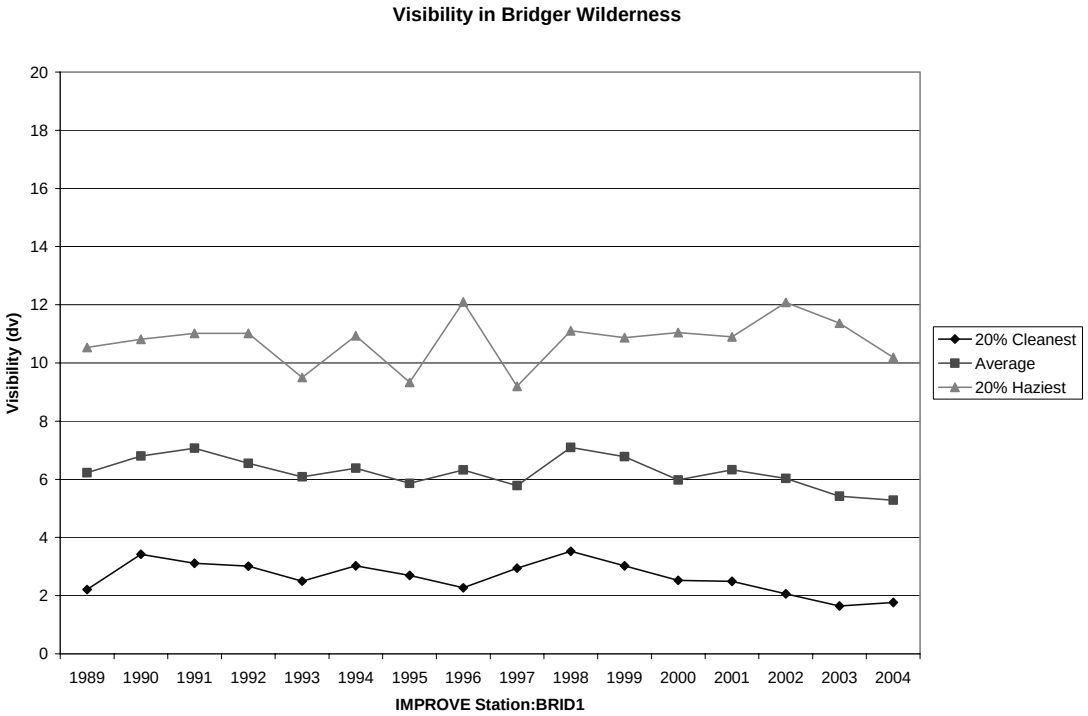
The *Wyoming State Implementation Plan for Class I Visibility Protection* states: "Wyoming's long term strategy will focus on the prevention of any future visibility impairment in Class I areas that can be attributed to a source or small group of sources as the Federal Land Managers have not identified any current impairment in the State's Class I areas due to such sources" (WDEQ/AQD 2005d). WDEQ/AQD prepared the 2*003 Review Report on Wyoming's Long Term Strategy for Visibility Protection in Class I Areas*, as required by WAQSR, which calls for AQD to review and revise, if appropriate, the Long Term Strategy every three years. The 2003 Review Report is available on the WDEQ/AQD website at http://deq.state.wy.us/aqd/visibility.asp.

3.4.4.2 Environmental Consequences for Visibility

3.4.4.2.1 Proposed Action and Alternatives 1 and 2

The impacts to visibility from mining the West Antelope II LBA tract have been inferred from the currently permitted impacts of mining the existing coal leases at the Antelope Mine. The West Antelope II LBA tract would be mined as an integral part of the Antelope Mine. The maximum annual coal production is not anticipated to exceed the projected post-2006 rate of up to 42 mmtpy, with or without the West Antelope II LBA tract. ACC's currently approved air quality permit allows up to 42 million tons of coal to be mined per year. If the mine acquires the additional coal in the LBA tract, they anticipate that the coal production rate would continue to be between 36 and 42 mmtpy for up to 13 additional years. Therefore, impacts to visibility under the Proposed Action and Alternatives 1 and 2 would be similar to the impacts under the No Action Alternative, but they would be extended by as many as 13 years.

Current mining techniques for blasting, coal removal, and coal hauling would be expected to continue for a longer period of time than is shown in the currently approved air quality permit. Material movement would continue to utilize shovels and trucks in overburden and coal. ACC does not propose to change the facilities shown in the current air quality permit or the blasting procedures or blast sizes if they acquire the tract; however, the blasting processes and required mitigation measures would be reviewed when the mining permit is amended to include the new lease area. At that time, the blasting plan would be reviewed and modified to



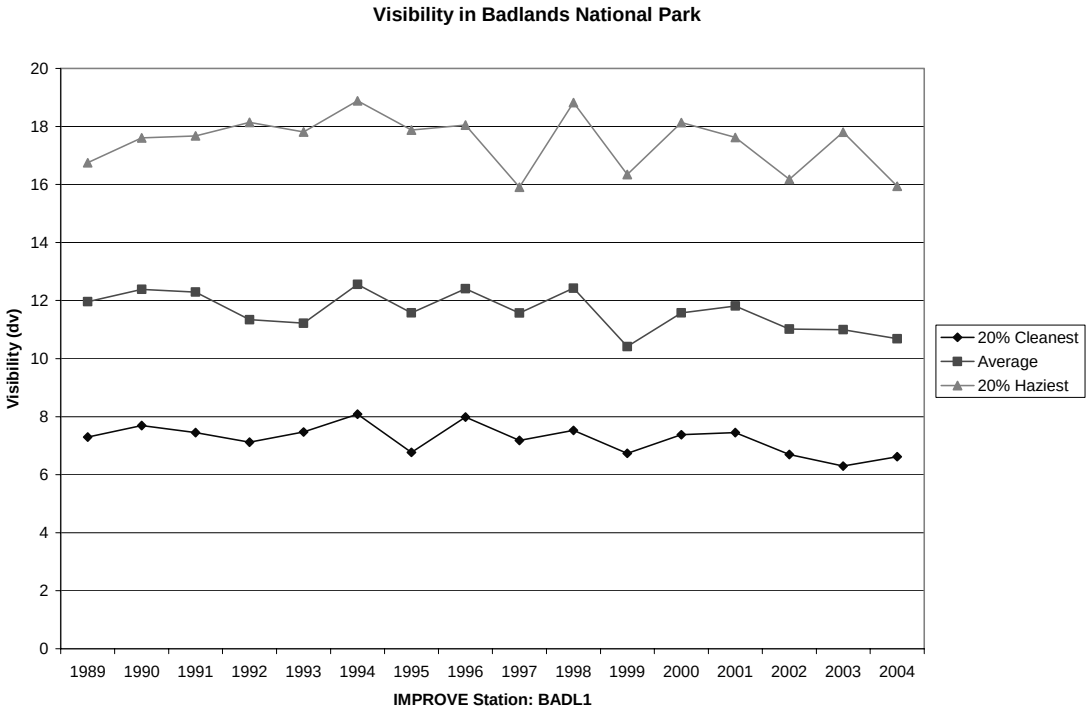


Figure 3-10. Visibility in the Badlands and Bridger Wilderness Areas.

incorporate the BACT protection measures that are in effect at that time. No significant changes in blasting techniques are proposed except when mining occurs in the LBA tract. However, because overburden is thicker in the LBA tract, Antelope will employ state-of-the-art methods to minimize any increases in blast sizes and/or total agent used. Those methods will include, but not necessarily be limited to, the use of more efficient agent formulations and use of electronic detonators. Thus, emissions from blasting are not expected to increase significantly, notwithstanding the large overburdens to be excavated in the tract.

Surface coal mines are not considered to be major emitting facilities in accordance with Chapter 6, Section 4 of WDEQ/AQD Rules and Regulations. Therefore, the State of Wyoming does not require mines to evaluate their impacts on Class I areas; however, BLM considers such issues during leasing.

3.4.4.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the mine would continue to operate as currently permitted. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases, but coal removal would not occur on the LBA tract and there would not be visibility impacts related to mining any portions of the LBA tract that will not be affected under the current mine plan.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.4.4.3 Regulatory Compliance, Mitigation and Monitoring for Visibility Impacts

As discussed above, fine particulate matter ($PM_{2.5}$) is the main cause of visibility impairment. Mitigation measures being used to limit emissions of particulate matter are discussed in Section 3.4.2.3.

Visibility monitoring within the State of Wyoming consists of both the WDEQ/AQD sponsored Wyoming Visibility Monitoring Network and the IMPROVE program. WDEQ has sited two visibility-monitoring stations in the PRB. One of these sites (the TBNG site) is 32 miles north of Gillette and includes a nephelometer, a transmissometer, an IMPROVE aerosol sampler, instruments to measure meteorological parameters (temperature, RH, wind speed, wind direction), a digital camera, instruments to measure ozone and instruments to measure oxides of nitrogen (NO, NO_2, NO_x). The second visibility monitoring station (the Cloud Peak Wilderness Area site) is located 14 miles west of Buffalo and includes a nephelometer, a transmissometer, an IMPROVE aerosol sampler, instruments to measure meteorological parameters, and a digital camera.

These sites are being utilized to characterize the extent, frequency of occurrence,

and magnitude of visual air quality. The IMPROVE Steering Committee approved the incorporation of the Thunder Basin and Cloud Peak sites into the IMPROVE network in June 2002. Although these stations are not located in areas classified as Class I areas, the collected data will be comparable to monitoring data available from the state's Class I areas. This information can help scientists determine the types and concentrations of air pollutants and their direction of travel in order to project visibility impacts to Class I areas. The Wyoming Visibility Monitoring Network was recently supplemented with the development of a website at http://www. wyvisnet.com/all.html to allow public access to real-time monitored visibility and air quality conditions (WDEQ/AQD 2005a).

3.4.5 Acidification of Lakes

The acidification of lakes and streams is caused by atmospheric deposition of pollutants (acid rain). According to EPA, sulfur dioxide and NO_x, primarily derived from the burning of fossil fuels, are the primary causes of acid rain. Most lakes and streams have a pH between 6 and 8, although some lakes are naturally acidic even without the effects of acid rain. Acid rain primarily affects sensitive bodies of water, which are located in watersheds whose soils have a limited ability to neutralize acidic compounds (called "buffering capacity"). Lakes and streams become acidic (pH value goes down) when the water itself and its surrounding soil cannot buffer the acid rain enough to neutralize it. In areas where buffering capacity is low, acid rain also releases aluminum from soils into lakes and streams; aluminum is highly toxic to many species of aquatic organisms.

Several regions in the U.S. were identified in a national surface water survey as containing many of the surface waters sensitive to acidification. They include the Adirondacks and Catskill Mountains in New York state, the mid-Appalachian highlands along the east coast, the upper Midwest, and mountainous areas of the western U.S.

Scientists predict that the decrease in SO_2 emissions required by the Acid Rain Program will significantly reduce acidification due to atmospheric sulfur. Without the reductions in SO_2 emissions, the proportions of acidic aquatic ecosystems would remain high or dramatically worsen (EPA 2005b). The USDA-FS has been monitoring air quality in the Wind River Mountain Range in Wyoming since 1984 and is seeing a general trend of decreasing sulfates. Nitrates, on the other hand, have been increasing globally.

3.4.5.1 Affected Environment

AQRVs, including the potential air pollutant effects on the acidification of lakes and streams, are applied to PSD Class I and Class II areas. The land management agency responsible for the Class I area sets a LAC for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards. Lake acidification is expressed as the change in ANC measured in microequivalents per liter (μeq/L), the lake's capacity to resist acidification from

acid rain. Table 3-9 shows the existing ANC monitored in some mountain lakes and their distance from the West Antelope II general analysis area.

Table 3-9. Existing Acid Neutralizing Capacity in Sensitive Lakes.

Wilderness Area	Lake	Background ANC (μeq/L)	Distance from General Analysis Area (miles)
Bridger	Black Joe	69.0	200
	Deep	61.0	225
	Hobbs	68.0	221
Cloud Peak	Upper Frozen	5.8[1]	106
	Emerald	55.3	120
	Florence	32.7	111
Fitzpatrick	Ross	61.4	225
Popo Agie	Lower Saddlebag	55.5	195

[1] The background ANC is based on only six samples taken between 1997 and 2001.
Source: Argonne (2002)

3.4.5.2 Environmental Consequences

3.4.5.2.1 Proposed Action and Alternatives 1 and 2

The West Antelope II LBA tract would be mined as an integral part of the Antelope Mine. In April, 2007, Antelope received a permit modification to have the opportunity to increase production to 42 mmtpy in the future. Therefore, impacts to air quality related to lake acidification under the Proposed Action and Alternatives 1 and 2 could be slightly higher than the impacts under the No Action Alternative and would be extended for up to13 years. Antelope would employ the best measures available to mitigate any potential emission increases associated with mining the LBA tract. These would include, but would not necessarily be limited to, extension of overland conveyors to minimize haul distances and associated particulate and gaseous (nitrogen oxides, carbon oxides) emissions from coal haulage, as well as state-of-the-art blasting practices to mitigate any potential increases in nitrogen oxide emissions, which can also contribute to acidification.

3.4.5.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the mine would continue to operate as currently permitted. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases, but coal removal would not occur on the LBA tract and there would not be any impacts that contribute to lake acidification related to mining any portions of the LBA tract that will not be affected under the current mine plan. As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.4.5.3 Regulatory Compliance, Mitigation, and Monitoring

Mitigation and monitoring for coal mine emissions, including the emissions that contribute to the acidification of lakes, are discussed in Sections 3.4.2.3, , 3.4.3.3, 3.4.4.3 and 3.4.5.3. Other air quality monitoring programs that are in place in the PRB include WARMS monitoring of sulfur and nitrogen concentrations near Buffalo, Sheridan, and Newcastle, and NADP monitoring of precipitation chemistry in Newcastle.

3.4.6 Residual Impacts to Air Quality

No residual impacts to air quality would occur following mining and reclamation.

3.5 Water Resources

3.5.1 Groundwater

3.5.1.1 Affected Environment

Within the West Antelope II LBA tract, there are five water-bearing geologic units that could be disturbed by mining. In descending order, these units are recent alluvium, the Wasatch Formation overburden, the Anderson coal seam, the Fort Union Formation interburden (where present), and the Canyon coal seam. Although saturated, the interburden between the Anderson and Canyon coal seams is not considered an aquifer because it is usually comprised of claystone and siltstone which are not considered aquifer materials though they can be water-bearing (i.e. saturated). The Antelope Mine WDEQ/LQD permit document (ACC 2006a) defines the interburden as a confining unit for the Canyon coal seam. As such, the interburden is not included in this discussion. The underlying sub-coal Fort Union Formation would not be physically disturbed by mining activities but is utilized for water supply by coal mines within the general area, including the Antelope Mine.

Antelope Mine has completed 18 monitoring wells within and adjacent to the West Antelope II LBA tract: one in the alluvium of Horse Creek (PZ-HCAL-13), one in the Alluvium of Antelope Creek (WA-OWAL-1), four in the overburden (HC-OWO-7, WA-OWO-6, WA-OWO-5, WA-OWO-1), six in the Anderson coal seam (HC-OWA-8, WA-OWA-6, WA-OWA-5, WA-OWA-1, OWA-17, OWA-18), two in the interburden between Anderson and Canyon coal seams (WA-OWI-3, WA-OWI-2), three in the Canyon coal seam (HC-OWC-8, WA-OWC-3, WA-OWC-2), and one in the Anderson and Canyon combined seams (HC-OWAC-7). The locations of these monitoring wells, as well as other existing monitoring wells completed by the Antelope Mine, are shown on Figure 3-11. Data from these wells, as well as additional groundwater data collected at the Antelope Mine, were used to prepare the following description of baseline groundwater conditions within the LBA tract.

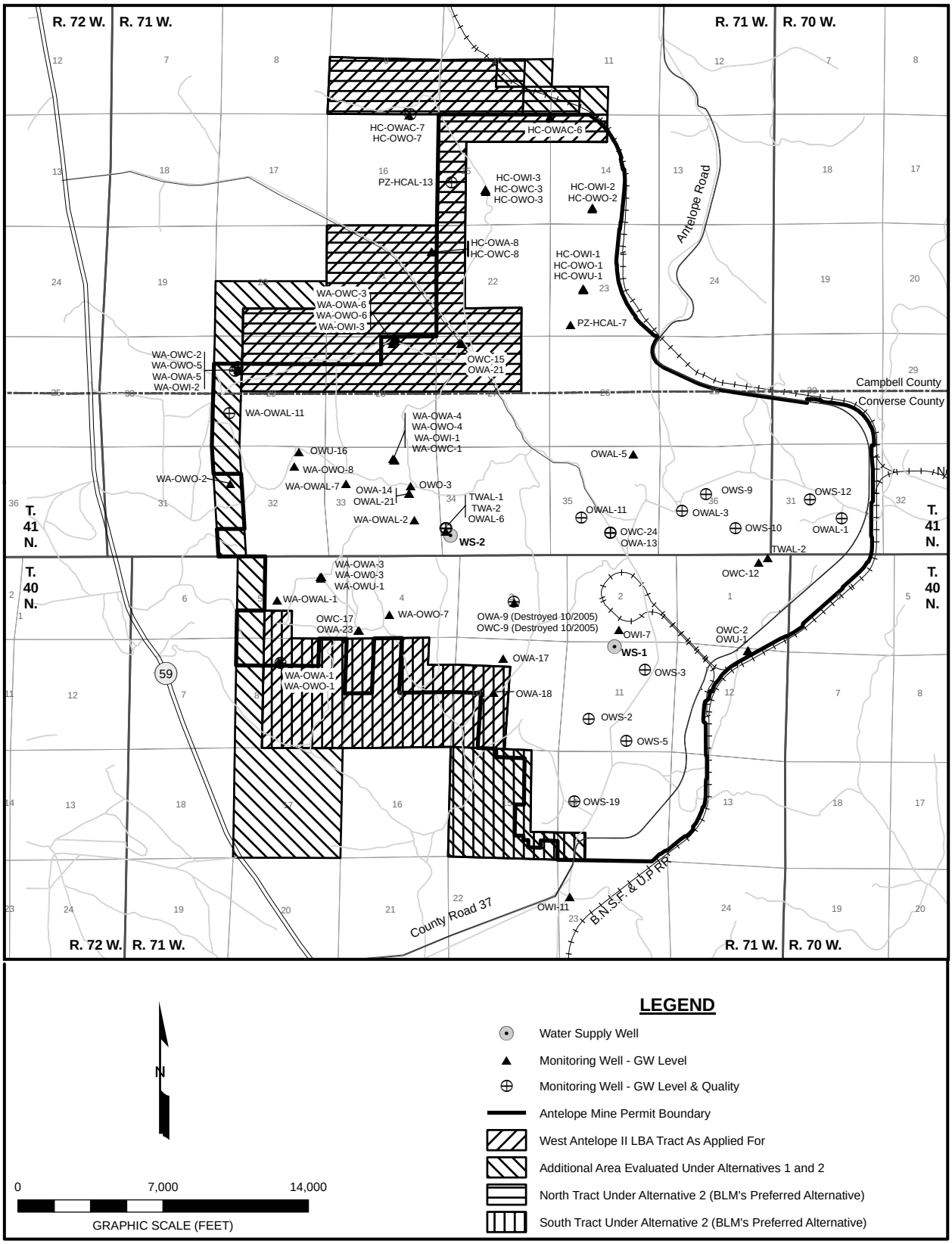


Figure 3-11. Locations of Groundwater Monitoring and Water Supply Wells at the Antelope Mine.

3.5.1.1.1 Recent Alluvium

Within the general analysis area, alluvium occurs along Horse Creek, Spring Creek and Antelope Creek. The Horse Creek alluvium typically consists of silty to clayey sand and varies from 5 to 15 ft thick within the Antelope Mine (ACC 2006a). The alluvium of Spring Creek consists of silty to clayey sand which varies from less than one foot in the upper reaches to about 20 feet thick near the confluence with Antelope Creek (ACC 2006a). The Antelope Creek alluvium generally consists of mixtures of silt and fine- to medium-grained sand and gravel which ranges in thickness from zero to 40 feet (ACC 2006a).

Minor amounts of alluvium may occur in tributaries to Horse Creek and Antelope Creek such as Spring Creek and other unnamed, normally dry tributary draws. The alluvial and colluvial deposits associated with these tributary draws are generally thin and not laterally extensive enough to be considered aquifers. The unconsolidated deposits associated with these dry draws are typically very fine-grained and have very limited permeabilities, precluding any significant storage and movement of groundwater.

Antelope Mine (ACC 2006a) has conducted aquifer tests on wells adjacent to West Antelope II LBA tract: one well was completed in the alluvium of Horse Creek and one well was completed in the alluvium of Antelope Creek. The hydraulic conductivity calculated for the Horse Creek alluvium is 0.17 ft/day. The hydraulic conductivity calculated for the Antelope Creek alluvium is 33.2 ft/day. This value may be slightly high due to leakage from underlying coal seams. The hydraulic conductivity of the Spring Creek alluvium varies from 0.01 ft/day (WA-OWAL-13) to 51.3 ft/day (WA-OWAL-9) and averages 16 ft/day for the ten alluvial wells constructed along Spring Creek (ACC 2006a).

The quality of the alluvial groundwater within and adjacent to the West Antelope II LBA tract is variable among the Horse Creek alluvium, Spring Creek alluvium and the Antelope Creek alluvium. 2006 TDS concentrations in the Horse Creek alluvial groundwater (ACC 2006) were 3,770 mg/L. TDS concentrations in the Spring Creek alluvium range from 3,730 mg/L (WA-OWAL-3) to 20,800 mg/L (WA-OWAL-6) (ACC 2006a). TDS concentrations in 2004 in the Antelope Creek alluvium were 4,705 mg/L. The alluvial groundwater is of the calcium-magnesium-sodium sulfate type, and only suitable for livestock and wildlife use.

3.5.1.1.2 Wasatch Formation

Within the PRB, the Wasatch Formation consists of interbedded sandstones, siltstones, and shale with occasional discontinuous coal stringers and clinker deposits. This description basically holds true for the West Antelope II LBA tract. Saturated strata within the Wasatch are limited in areal extent and are typically thin, lenticular sandstones which are separated laterally and vertically by finer-grained siltstone and shale deposits. The hydraulic connection between sandstone lenses is tenuous due to the intervening shales; thus, groundwater

movement through the Wasatch Formation overburden is limited. The sandstone and thin coal stringers, where saturated, will yield water to wells. This water is primarily used for livestock watering. Since the saturated sandstone and coal units within the Wasatch Formation are not continuous, the Wasatch is not considered to be a regional aquifer. However, discontinuous aquifers can be quite important locally if utilized for stock well or domestic well development.

Another geologic unit that may be considered a part of the Wasatch Formation is scoria, also called clinker or burn, which is described in Section 3.3.2.1.3 . Clinker deposits can be very permeable aquifers and can extend laterally for miles in the eastern PRB. The hydrologic function of clinker is to provide infiltration of precipitation and recharge to laterally contiguous overburden and coal beds. Scoria deposits are not present within the West Antelope II LBA tract.

Recharge to the Wasatch Formation is from the infiltration of precipitation and lateral movement of water from adjacent clinker bodies. Regionally, groundwater is discharged from the Wasatch Formation by evaporation and transpiration, by pumping wells, by vertical leakage into the underlying coal seams, by drainage into mine excavations, and by seepage into the alluvium along stream drainages.

For the Wasatch Formation as a whole, the discontinuous nature of the water-bearing units results in low overall hydraulic conductivity and low groundwater flow rates. Because of the varied nature of the aquifer units within the Wasatch, hydraulic properties are variable as well. Martin et al. (1988) reported that hydraulic conductivities within the Wasatch ranged from 10^{-4} ft/day to 10^{2} ft/day, and the geometric mean hydraulic conductivity based on 203 tests was 0.2 ft/day. The geometric mean hydraulic conductivity from 70 aquifer tests using wells completed in sandstone in the Wasatch overburden was 0.35 ft/day, while that from 63 aquifer tests using wells completed in siltstone and claystone in the Wasatch overburden was 0.007 ft/day (Rehm et al. 1980). The hydraulic conductivity of the Wasatch Formation within and adjacent to the West Antelope II LBA tract ranges from a high of 5.6 ft/day to a low of 0.03 ft/day.

Water quality in the Wasatch Formation near the West Antelope II LBA tract is variable, with TDS concentrations ranging from 380 mg/L to 2,610 mg/L. This compares with a median TDS of 2,000 mg/L in the Wasatch Formation for the group of mines south and east of Wright, as calculated by WDEQ/LQD based on 1,052 samples, (Ogle et al. 2006). The water type is also somewhat variable, but predominantly of the sodium-sulfate type. This water is usually unsuitable for domestic use, marginal to unsuitable for irrigation and suitable for livestock and wildlife.

3.5.1.1.3 Anderson Coal

Due to its continuity, the Wyodak coal seam is considered to be a regional aquifer within the PRB. Historically, the coal seams have been considered a source of groundwater for domestic and livestock uses in the eastern PRB where they are

shallow enough to be an economical source of water.

The Wyodak coal is a single seam to the north and west of West Antelope II LBA tract. Within the tract, partings divide the Wyodak into two mineable seams: the Anderson and the Canyon (see Figure 3-4). The Anderson coal seam is the upper of the two seams and is exposed along the Antelope Creek channel due to erosional downcutting by Antelope Creek. Elsewhere within the West Antelope II LBA tract, the Anderson coal seam ranges from 30 to 40 ft thick and dips west-northwest at less than 5 degrees.

Hydraulic conductivity within the Anderson coal seam is highly variable and is reflective of the amount of fracturing the coal has undergone, as unfractured coal is virtually impermeable. The yield of groundwater to wells and mine pits is the smallest where the permeability of the coal is derived primarily from localized unloading fractures. These fractures, which are the most common, were created by the expansion of the coal as the weight of the overlying sediments was slowly removed by erosion. The highest permeability is imparted to the coal by tectonic fractures. These are through-going fractures of areal importance created during deformation of the south Powder River structural basin. The presence of these fractures can be recognized by their linear expression at the ground surface, controlling the orientation of stream drainages and topographic depressions. Due to their pronounced surface expression, these tectonic fractures are often referred to as “lineaments”. Coal permeability along lineaments can be increased by orders of magnitude over that in the coal fractured by unloading only.

Aquifer test data collected by Antelope Mine in the vicinity of the West Antelope LBA tract indicate that the Anderson coal possesses higher permeability north and east of the tract along the Horse Creek lineament. Antelope Mine (ACC 2006a) reported Anderson seam hydraulic conductivity in the LBA tract to be 2.4 ft/day at TWA-2, while that east of the tract along Horse Creek is approximately 14 ft/day based on tests of wells (TWA-1, OWA-1, OWA-2, OWA-3).

With the exception of the exposure along Antelope Creek, the Anderson coal aquifer is deeply confined in the West Antelope II LBA tract, which results in low storage coefficients. Storage coefficients measured in the vicinity of the LBA tract range from approximately 1.6×10^{-5} to 4.1×10^{-4}.

Groundwater from the Anderson coal aquifer in the vicinity of the West Antelope II LBA tract is of the sodium/bicarbonate type with TDS concentrations ranging from 370 mg/L to 5,610 mg/L. This compares to a median TDS of 952 mg/L in the Wyodak Anderson coal aquifer for the group of mines located south and west of the town of Wright, based on 832 samples, as calculated by WDEQ/LQD (Ogle et al. 2006). This water is usually unsuitable for domestic and irrigation use and suitable for livestock and wildlife because the TDS concentrations commonly exceed many suitability criteria for domestic uses. Further, at the higher TDS concentrations, the Anderson groundwater also sometimes exceeds the Wyoming agricultural standards for SAR of 8, rendering it unsuitable for agricultural uses.

SAR values measured near the West Antelope LBA II tract range from 4.4 at well TWA-2 to 9.4 at WA-OWA-1 (ACC 2006). The lower TDS groundwater may be suitable for domestic, irrigation, stock and wildlife use, however.

Prior to mining, the direction of groundwater flow within the Anderson coal aquifer was generally from recharge areas near the outcrop into the basin, following the dip of the coal. Site-specific data collected by Antelope Mine in the vicinity of the West Antelope LBA tract and presented in the GAGMO 20-year report (Hydro-Engineering 2001a) indicate that the groundwater flow directions have been influenced by mining activities and CBNG development (ACC 2006). Groundwater flow within the Anderson coal aquifer in the vicinity of the West Antelope LBA II tract is now toward a regional cone of depression located north and west of the LBA tract.

3.5.1.1.4 Canyon Coal

The Canyon coal seam is the lower of the two West Antelope LBA II tract coal aquifers, and is bounded above and below by Fort Union Formation claystones, siltstones and occasional sand lenses. Within the LBA tract the Canyon coal seam ranges from less than 15 ft to nearly 40 ft thick and dips west-northwest at less than 5 degrees. Just north of Antelope Creek, the Canyon coal seam splits into the Upper and Lower Canyon Coal seams. South of Antelope Creek, the splits in the Canyon coal seam are extensive and ACC considers the coal to be uneconomic for mining. In the northern portion of the LBA tract, in the vicinity of Horse Creek, the Canyon and Anderson seams coalesce into the single Wyodak seam (Figure 3-4).

Hydraulic conductivity within the Canyon coal seam is dependent on the amount and type of fracturing. Localized unloading fractures are primarily responsible for Canyon coal permeability within the LBA tract. Secondary permeability caused by weathering is also thought to contribute to Canyon coal permeability near Antelope Creek. East of the LBA tract the Horse Creek lineament may also locally increase the permeability.

Aquifer test data collected by Antelope Mine in the vicinity of the West Antelope II LBA tract indicate that hydraulic conductivity in the Canyon coal seam ranges from 0.17 ft/day to 1.9 ft/day for the three wells (WA-OWC-1, WA-OWC-2, WA-OWC-3) evaluated. Measured storage coefficients ranged from approximately 1.1×10^{-5} to 2.7×10^{-5}.

Based on 10 samples, groundwater from the Canyon coal aquifer at the West Antelope LBA tract is of the sodium-bicarbonate type with average TDS concentrations ranging from 300 mg/L to 620 mg/L and averaging approximately 389 mg/L. Within this range, the water is suitable for domestic, irrigation, livestock and wildlife use. As discussed above, WDEQ/LQD has calculated a median TDS of 952 mg/L in the Wyodak Anderson coal aquifer for the group of mines locates south and west of the town of Wright, based on 832 samples (Ogle

et al. 2006).

Prior to mining, the direction of groundwater flow within the Canyon coal aquifer was generally from the southwest and north toward the suboutcrop beneath the Antelope Creek alluvium (ACC 2006a). This flow pattern has been reinforced by Canyon coal removal and dewatering in the Antelope Mine east of the LBA tract. According to the GAGMO 20-Year Report (Hydro-Engineering 2001a), groundwater within the Canyon coal seam in the West Antelope LBA tract currently flows to the northwest toward a regional cone of depression (ACC 2006).

3.5.1.1.5 Subcoal Fort Union Formation

In the vicinity of the West Antelope II LBA tract, the Fort Union Formation can be divided into three hydrogeologic units: the Tongue River aquifer, the Lebo confining unit, and the Tullock aquifer (Law 1976). The Tongue River aquifer consists of lenticular fine-grained sandstone, shale, and coal. The Lebo member of the Fort Union Formation consists of siltstones and claystones interbedded with discontinuous coal and sandstone lenses of varying thicknesses. The Tullock aquifer consists of lenticular fine-grained sandstone separated by interbedded shale and siltstone.

Transmissivities are generally higher in the deeper Tullock aquifer than in the Tongue River aquifer, and many mines in the PRB have water supply wells completed in this interval (Martin et al. 1988). The average transmissivity for this member as reported by OSM (1984) is 290 ft^2/day. The water quality of the Fort Union Formation underburden is generally good. The water is of the sodium-bicarbonate type and is marginal to suitable for domestic and irrigation use and suitable for livestock and wildlife watering.

Mining does not directly disturb the hydrogeologic units below the mineable coal but many PRB mines use them for industrial water supply wells. The Antelope Mine has two water supply wells (WS-1 and WS-2) completed in the subcoal Fort Union Formation (Figure 3-11). In 2006, the measured TDS concentration in water collected from wells WS-1 and WS-2 was 590 mg/L and 470 mg/L, respectively (ACC 2006).

3.5.1.2 Environmental Consequences

3.5.1.2.1 Proposed Action and Alternatives 1 and 2

Surface coal mining impacts the quantity of the groundwater resource in two ways: 1) the coal aquifer and any water-bearing overburden strata on the mined land are removed and replaced with unconsolidated backfill, and 2) water levels in the coal and overburden aquifers adjacent to the mine pits are depressed as a result of seepage into and dewatering from the open excavations in the area of coal and overburden removal.

If the West Antelope II LBA tract is leased, the area of coal removal and

reclamation would increase, which would result in an increase in the area of impacts to groundwater quantity. While there would be variations in hydrologic properties, the time the pits are open, the distance from mining and dewatering that has occurred as a result of previous mining and CBNG development, the area subject to lower water levels would be increased roughly in proportion to the increase in area affected by mining.

Currently approved mining will remove the overburden, interburden (if present), and coal on the existing leases at the Antelope Mine and replace these separate units with backfill material composed of an unlayered mixture of the shale, siltstone, and sand that makes up the existing Wasatch Formation overburden and Fort Union Formation interburden (if present). The existing leases currently include approximately 11,636 acres. Mining the LBA tract as a maintenance lease would extend these impacts onto an additional area ranging from about 4,109 acres (Proposed Action) to up to about 6,309 acres (Alternatives 1 and 2).

If the West Antelope II LBA tract is leased and mined, the coal and overburden aquifers within the tract would be completely dewatered and removed and the area of drawdown caused by coal and overburden removal would be extended further to the northwest and southwest of the active mine area. The extent that drawdowns would propagate away from the mine pits is a function of the water-bearing properties of the aquifer materials. In materials with high transmissivity and low storativity, drawdowns will extend further from the pit face than in materials with lower transmissivity and higher storage capacity.

In general, due to the geologic makeup of the Wasatch Formation overburden (discontinuous sandstone lenses in a matrix of siltstone and shale), drawdowns in the overburden do not extend great distances from the active mine pits. Due to the varied nature of the water-bearing units within the Wasatch Formation overburden, the extent of water level drawdowns is variable as well. The change in the water levels for the overburden range from an increase in the water level of 6.76 ft in WA-OWO-5 to a drawdown of 23.27 ft in WA-OWO-4, which is approximately 2,000 ft west of the active mine pit (Figure 3-11). The majority of the overburden wells have less then 2 ft of drawdown (ACC 2006).

Water level drawdowns propagate much farther and in a more consistent manner in the Anderson and Canyon coal seams than in the overburden because of the regional continuity and higher transmissivity within the coal aquifer. Drawdowns in the coal seam are primarily a function of distance from the pit, although geologic and hydrologic barriers and boundaries such as crop lines, fracture zones, and recharge sources can also influence drawdowns. Drawdowns within the coal from 1980 to 1995 were generally in excess of five ft within four miles of the active pits at the Antelope Mine (Hydro-Engineering 1996). In 2005 and 2006, Antelope Mine monitored water levels in 12 monitor wells completed in the Anderson coal seam and 10 monitor wells in the Canyon coal seam.

Prior to 1993, mining occurred in relatively dry portions of the Anderson coal

seam and little to no drawdown occurred within that aquifer. The maximum drawdown measured in 2005 and 2006 in an Anderson monitor well was about 95.3 ft at well WA-OWA-5 located approximately 9,300 ft (1.76 miles) northwest of the active pit (ACC 2006).

The water level in the Canyon coal seam has shown a drawdown trend in most monitor wells since 1988, apparently due to mining activities to the north of the Antelope Mine. The downward trend accelerated from 1988 to the present as a result of mining a fully saturated Canyon coal seam in the northeastern part of the Antelope Mine. The maximum drawdown measured to date in the Canyon coal seam is about 146.6 ft at WA-OWC-2, located within 9,300 ft (1.76 miles) northwest of the active pit (ACC 2006).

Drawdowns in both seams have resulted not only from mining, but also from CBNG development. Water levels and maps showing drawdowns in the vicinity of the pit are included in the annual report for the Antelope Mine filed by Antelope Mine with WDEQ/LQD each year.

Antelope Mine used a linear analytical model (line sink analysis) to predict the extent of water level drawdown in the Anderson and Canyon coal seam aquifers as a result of mining the existing leases at Antelope Mine. The results of the groundwater modeling are reported in the Mine Plan, Section MP5, Addendum MP-C of the Antelope Mine 525-T7 permit document (ACC 2006a). The predicted extent of drawdown (five ft contour) in the Anderson-Canyon coal seam over the life of the mine if the Antelope Mine acquires the West Antelope II LBA tract is shown on Figure 3-12. This prediction is approximate and is based on extrapolation of Antelope Mine's earlier predictions by extending the drawdowns westward and northward by the dimensions of the West Antelope II LBA tract. More precise predictions of the extent of drawdowns would be required in order to revise the Antelope Mine permit to include the West Antelope II LBA tract, if the Antelope Mine acquires a lease for the tract.

The subcoal aquifers are not removed or disturbed by mining, so they are not directly impacted by coal mining operations. As discussed above, Antelope Mine has two water supply wells completed in aquifers below the coal. If the LBA tract is leased by the applicant, water would be produced from these wells for a longer period of time, but Antelope Mine probably would not require additional sub-coal wells to mine the LBA tract.

As discussed in Section 3.3.1.2.1, the existing layers of sediment and rock in the area of coal removal would be replaced by generally homogenous, unconsolidated backfill material, which would recover as a single hydrostratigraphic unit. The backfill unit in the LBA tract would be in hydraulic communication with the adjacent undisturbed coal, overburden and existing backfill aquifer units. Surface infiltration recharge rates for the backfill materials should be equivalent to or somewhat greater than infiltration recharge through undisturbed overburden, due

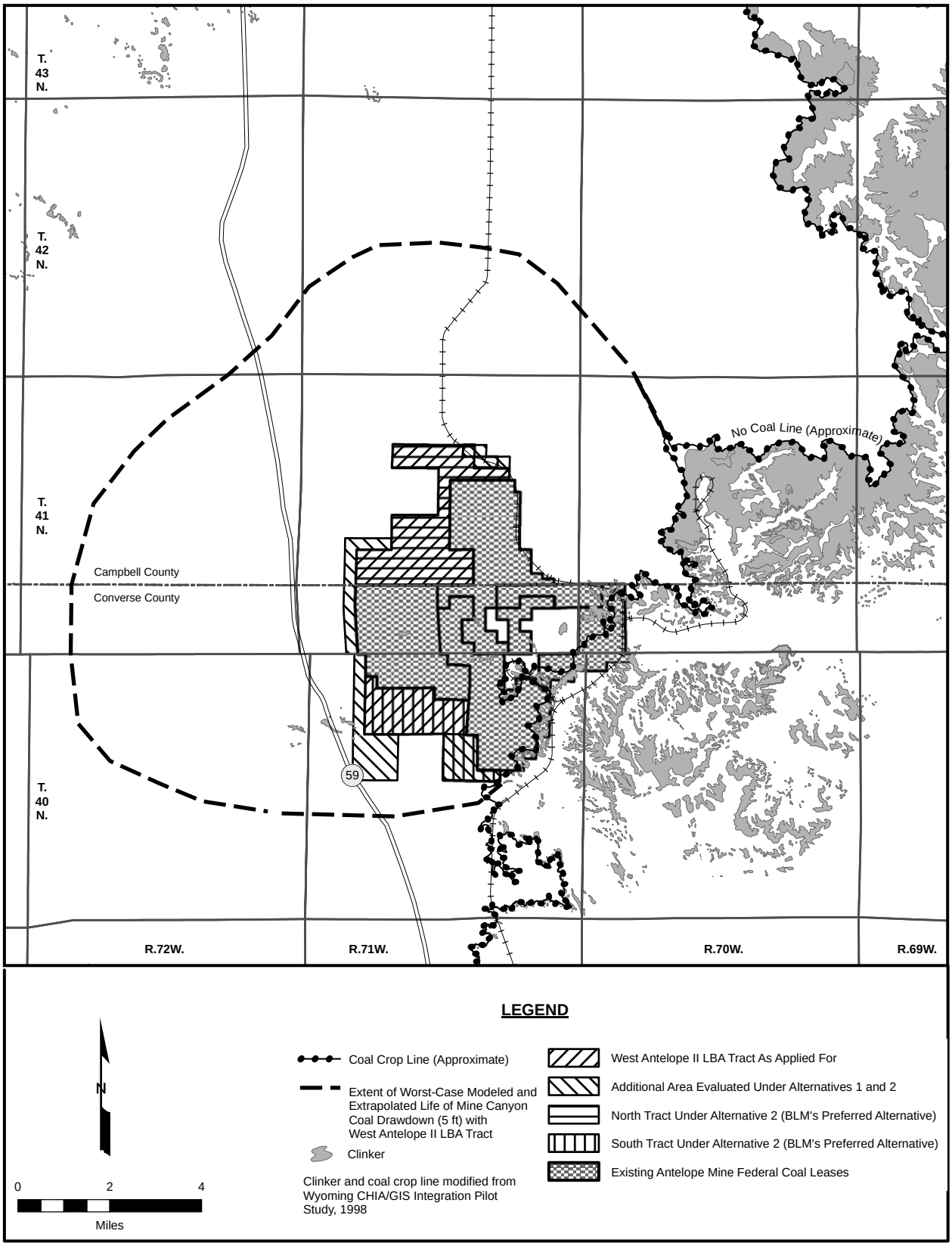


Figure 3-12. Life of Mine Drawdown Map, Resulting from Currently Approved Mining with Addition of the West Antelope II LBA Tract.

primarily to the generally flatter topography resulting in less surface runoff. The hydraulic properties of the backfill aquifer, based on the results of aquifer testing at mines in the PRB, are quite variable although they are generally equal to or greater than the undisturbed overburden and coal aquifers (Van Voast et al. 1978 and Rahn 1976). The hydraulic properties of the backfill aquifer at the West Antelope II LBA tract would likely be similar to the hydraulic properties measured in existing wells completed in the backfill at nearby mines. To date, no site-specific data are available for the hydraulic properties of the mine's backfill. The hydraulic properties measured in existing wells completed in the backfill at North Antelope Rochelle Mine, located northeast of the Antelope Mine, are variable but in general comparable to the Wasatch Formation overburden and Wyodak coal. At North Antelope Rochelle Mine, the backfill aquifer has been tested at four wells, and the average hydraulic conductivity is 36 ft/day, which exceeds the average hydraulic conductivity (9.5 ft/day) reported for the Wyodak coal seam in the vicinity of the North Antelope Rochelle Mine. The data available indicate that the hydraulic conductivity of the backfill would be greater than or equal to premining coal values, suggesting that wells completed in the backfill would provide yields greater than or equal to premining coal wells.

Mining and reclamation also impact groundwater quality; the TDS concentration in the water resaturating the backfill is generally higher than the TDS concentration in groundwater from the coal seam aquifer prior to mining. This is due to the exposure of fresh mineral surfaces to groundwater that moves through the backfill. Research conducted by Van Voast and Reiten (1988), who analyzed data from the Decker and Colstrip Mine areas in Montana, indicates that upon initial saturation, mine backfill is generally high in TDS concentration and contains soluble salts of calcium, magnesium and sodium sulfates. As the backfill is resaturated, the soluble salts are leached by groundwater inflow and TDS concentrations tend to decrease with time, indicating that the long term groundwater quality in mined and off-site lands would return to approximate pre-mine conditions (Van Voast and Reiten 1988). Using data compiled from 10 surface coal mines in the eastern PRB, Martin et al. (1988) concluded that backfill groundwater quality improves markedly after the backfill is leached with one pore volume of water. Clark (1995) conducted a study to determine if the decreases predicted by laboratory studies actually occur onsite. In the area of the West Decker Mine near Decker, Montana, his study found that dissolved solids concentrations increased when water from an upgradient coal aquifer flowed into a backfill aquifer, and apparently decreased along an inferred path from a backfill aquifer to a downgradient coal aquifer.

Groundwater quality within the backfill aquifer at the West Antelope II LBA tract would be expected to be similar to groundwater quality measured in existing wells completed in the backfill at Antelope Mine. To date, seven wells have been installed to monitor water levels and water quality in backfill at the Antelope Mine. Four of these backfill monitoring wells are located in the southern part of the mine and have not yet been sampled due to a lack of saturation. Three backfill monitoring wells that were added to Antelope Mine's monitoring program in 2000

are located in the northeastern part of the mine and had sufficient saturation to be sampled. TDS concentrations in these three monitoring wells range from 2,660 to 6,000 mg/L (ACC 2006). WDEQ/LQD calculated a median TDS concentration of 3,670 mg/L for the backfill aquifer in the group of mines south and east of the town of Wright, which includes the Antelope Mine, based on 869 samples (Ogle et al. 2006).

3.5.1.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II lease application would be rejected and coal removal would not occur on the West Antelope II LBA tract. The impacts to groundwater resources described above would continue as a result of existing approved mining and CBNG development. The surface and potentially some shallow aquifers in portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.5.1.3 Regulatory Compliance, Mitigation and Monitoring

In order to obtain a surface coal mining permit, the Antelope Mine was required to evaluate regional and site-specific baseline hydrogeologic environments within and around the mine and use a groundwater flow model to predict the extent of cumulative water level drawdown in the Wyodak coal seam aquifer that would occur as a result of mining the existing leases at the Jacobs Ranch, Black Thunder, North Antelope Rochelle and Antelope Mines. Results of these studies are included in the WDEQ/LQD mine permit (ACC 2006a). If the West Antelope II LBA tract is leased and mined, the permit for the Antelope Mine will have to be amended to include the tract, and these studies will be revised accordingly.

As discussed in Section 3.5.3, SMCRA and Wyoming regulations require mine operators to provide the owner of a water right whose water source is interrupted, discontinued, or diminished by mining with water of equivalent quantity and quality.

The surface coal mines are also required to monitor water levels and water quality in the overburden, coal, interburden, underburden, and backfill. Groundwater monitoring wells installed by Antelope Mine within and around the current permit area have been used to evaluate groundwater conditions since 1979. Through the years, some of the wells have been removed by mining, some have become gaseous and were removed from the monitor plan, and others have been added as mining has progressed. The data gathered from these wells is included in the annual reports prepared by the mine (ACC 1982-2006). The locations of the current monitoring wells are shown on Figure 3-11.

3.5.2 Surface Water

3.5.2.1 Affected Environment

The West Antelope II general analysis area is located within the Antelope Creek drainage basin, which is a major tributary of the Cheyenne River. The area within and surrounding the West Antelope II LBA tract consists of gently rolling topography. In general, the streams within this area are typical for the region, and their flow events are closely reflective of precipitation patterns. Flow events frequently result from snowmelt during the late winter and early spring. Although peak discharges from such events are generally small, the duration and therefore percentage of annual runoff volume can be considerable. During the spring, both rain and snow storms increase soil moisture, hence decreasing infiltration capacity, and subsequent rainstorms can result in both large runoff volumes and high peak discharges. The area's surface water quality varies with streamflow rate; the higher the flow rate, the lower the TDS concentration but the higher the suspended solids concentration.

The northern portion of the general analysis area is drained by several unnamed tributaries of Spring Creek and the upper reaches of Horse Creek (Figure 3-13). A short reach of Spring Creek and two short reaches of Horse Creek cross the general analysis area. Spring Creek and Horse Creek are southward-flowing ephemeral tributaries of Antelope Creek.

The southern portion of the general analysis area is drained by a few small, unnamed tributaries of Antelope Creek. A short reach of Antelope Creek crosses the southern portion of the general analysis area (Figure 3-13). Antelope Creek is an intermittent stream that, prior to mining, received a small degree of baseflow from coal seams in the Antelope Mine area.

Except for two crossings, Antelope Creek flows undisturbed from west to east across Antelope Mine's current permit area. The Antelope Creek drainage area is 796 square miles upstream of Station SW-2, which was established on Antelope Creek in March 1979 immediately downstream of the Spring Creek confluence (station SW-2 was removed from the monitoring network in 2006).

Flows and water quality data in Antelope Creek, Spring Creek, Horse Creek, and several minor tributaries have been and continue to be monitored on and near the Antelope Mine and are reported annually to the WDEQ/LQD. According to hydrologic correlation using the mine's SW-2 gauging station data on Antelope Creek, the annual average discharge is approximately 5.6 cfs (4,013 ac-ft/yr) (ACC 2005). The surface water of Antelope Creek is generally classified as a calcium-sulfate type, with an average TDS concentration of approximately 1,800 mg/L. Suspended sediment concentrations measured in samples collected from Antelope Creek within the Antelope Mine permit areas have historically ranged from 100 to 300 mg/L for stream flows up to 21.5 cfs (ACC 2005). This water, when available, is usually unsuitable for domestic use, marginal for irrigation, and suitable for

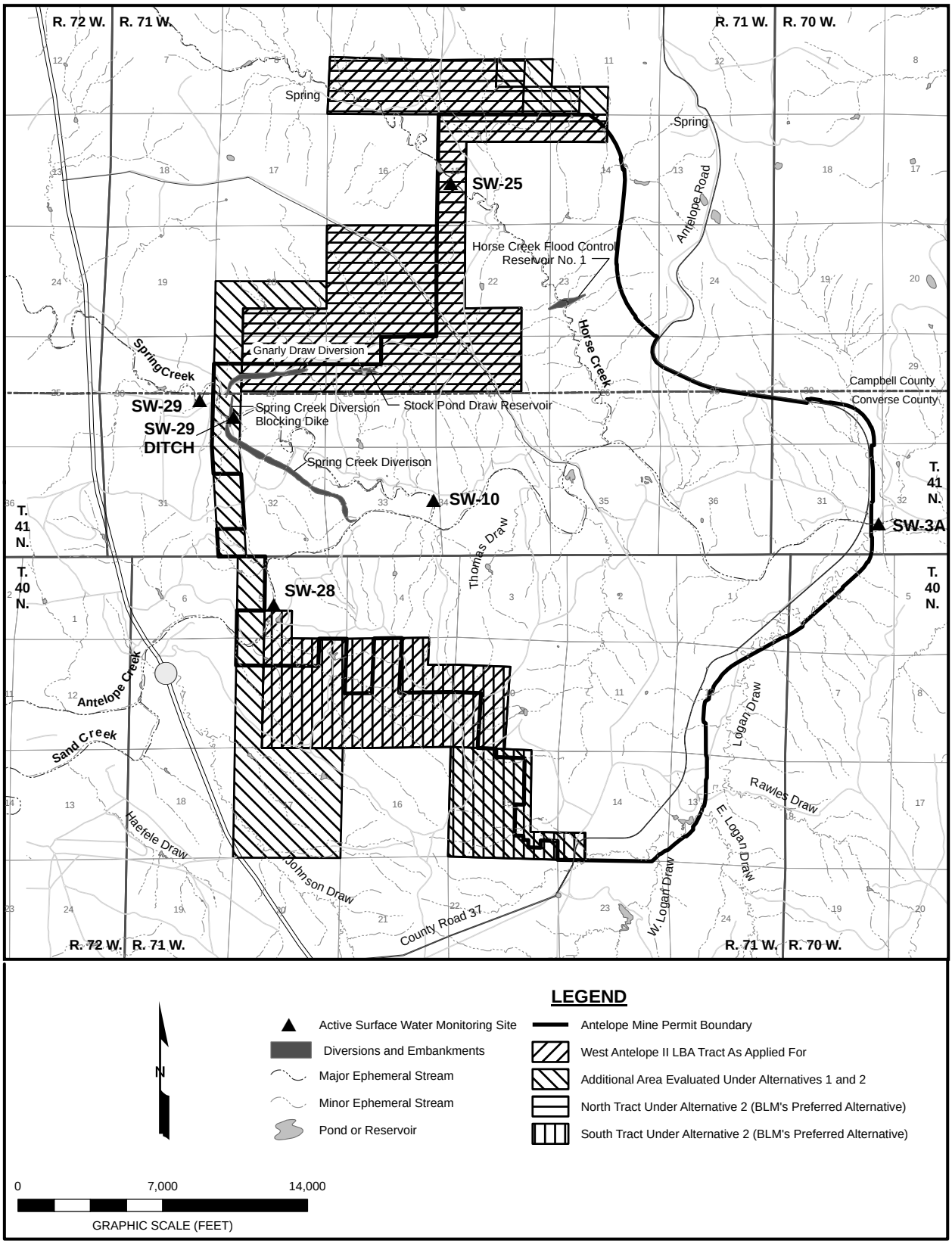


Figure 3-13. Surface Water Features Within and Adjacent to the West Antelope II Study Area.

stock and wildlife use.

Spring Creek has a relatively large drainage area of approximately 66.8 square miles. It is classified as ephemeral because it receives no measurable base flow from groundwater and flows only in response to snowmelt and precipitation runoff. Two locally-named ephemeral tributaries of Spring Creek, Stock Pond Draw and Gnarly Draw, drain a portion of the LBA tract. Recently, there has been sustained flow from April through July that is due to discharge water from CBNG activity on Spring Creek. All of the water quality and TSS samples that have been collected from Spring Creek have been during low-flow conditions. TDS concentrations of all samples collected at Spring Creek range from 210 to 8,050 mg/L, while TSS concentrations ranged from 3.3 to 2,510 mg/L.

Antelope Mine recently constructed a channel to divert Spring Creek around its upcoming mining activities and plans to disturb Spring Creek in 2007. Gnarly Draw and Stock Pond Draw are within the current permit area for the Antelope Mine and will be disturbed under the currently approved permit. Gnarly Draw will be diverted and Stock Pond Draw will receive a flood control reservoir (Figure 3-13). Both Gnarly Draw and Stock Pond Draw will be disturbed within the next five years of mining.

Horse Creek has a drainage area of about 15 square miles. It is classified as ephemeral and the average annual runoff near its confluence with Antelope Creek is 140 ac-ft/yr for the years 1991 through 1996. In 1997 an anomalously large runoff volume of 3,134 ac-ft/yr was measured at Station SW-9. Horse Creek is currently disturbed by mining in the Horse Creek Amendment Area of the Antelope Mine. As part of the mining activities in Horse Creek, Station SW-9 was removed in 1998. Replacement monitoring stations have been installed, but these sites do not have a long history of data to obtain an effective average of annual runoff. The surface water in Horse Creek is typically of the calcium-magnesium-sodium-sulfate type. TDS concentrations range from 1,020 to 5,888 mg/L, and average 3,507 mg/L.

3.5.2.2 Environmental Consequences

3.5.2.2.1 Proposed Action and Alternatives 1 and 2

Changes in runoff characteristics and sediment discharges would occur during mining of the LBA tract as a result of the destruction and reconstruction of drainage channels and the use of sediment control structures to manage discharges of surface water. Erosion rates could be high on the disturbed areas because of vegetation removal. However, both state and federal regulations require treatment of surface runoff from mined lands to meet effluent standards. Generally, the surface runoff sediment is deposited in ponds or other sediment control devices that are located inside the mine permit area before the surface runoff water is allowed to leave the permit area.

Because the LBA tract would be mined as an extension of the existing mine under the Proposed Action and Alternatives 1 and 2, there would not be a large increase in the size of the area that is disturbed and not reclaimed at any given time as a result of leasing the tract. The presence of disturbed areas creates a potential that sediment produced by large storms (i.e., greater than the 10-year, 24-hour storm) could potentially adversely impact areas downstream of the mining operation. This potential for adverse downstream impacts would be extended if the LBA tract were leased.

The loss of soil structure would act to increase runoff rates in reclaimed areas of the LBA tract after the coal is removed. However, the general decrease in average slope in reclaimed areas, as discussed in Section 3.2.2, would tend to counteract the potential for an increase in runoff. Soil structure would gradually reform over time, and vegetation (after successful reclamation) would provide erosion protection from raindrop impact, retard surface flows, and maintain runoff to approximately premining levels.

Significant runoff from the West Antelope II LBA tract may occur in the Antelope Creek, Horse Creek, and/or Spring Creek drainages. No mining has been conducted on Antelope Creek nor on an adjacent buffer zone of 100 ft on either side of the creek within the existing Antelope Mine coal leases. No mining is planned through the Antelope Creek channel nor through the adjacent buffer zone; therefore, with the exception of two crossings, it passes unimpeded through the LBA tract and mine area.

A flood control reservoir is located on Horse Creek upstream of the mining activities. Based on Antelope Mine's permitted mine plan, another flood control reservoir is planned to be constructed upstream of the existing structure. An additional flood control reservoir may be required to provide flood control for the West Antelope II LBA tract. This structure would be located on Horse Creek west of the tract. Under the Proposed Action, the existing diversion on Spring Creek will provide adequate flood protection for the downstream mining activities. Under Alternatives 1 and 2, the channel would either be diverted or a large flood control reservoir would be constructed. The remaining channels within the West Antelope II LBA tract are small enough that flood control structures would not be constructed; flows would accrue to the mine pits and would be evacuated by pump.

The impacts described above would be similar for both the Proposed Action and Alternatives 1 and 2, and they are similar to the expected impacts for the currently permitted mining operation.

<u>3.5.2.2.2 No Action Alternative</u>

Under the No Action Alternative, the West Antelope coal lease application would be rejected and coal removal would not occur on the tract. The impacts to surface water resources described above would continue within the existing mine permit

area as a result of currently approved mining and CBNG development. The surface in portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.5.2.3 Regulatory Compliance, Mitigation and Monitoring

In accordance with SMCRA and Wyoming State Statutes, major channels that are disturbed by surface coal mining operations on the West Antelope II LBA tract would be restored. Surface water flow, quality, and sediment discharge would approximate premining conditions. The drainages that are disturbed when the coal is recovered from the tract would be reclaimed to exhibit channel geometry characteristics similar to the premining characteristics. The major channels would be restored in approximately the same location as the natural channel and hydrologic functions and features, including alluvial groundwater-surface water interaction and premining pools and runs, would be restored.

Other WDEQ/LQD permit requirements for the existing Antelope Mine include constructing sediment control structures to manage discharges of surface water from the current mine permit area, treatment of all surface runoff from mined lands as necessary to meet effluent standards, and restoration of stock ponds and playas disturbed during mining. These requirements would be extended to include the West Antelope II LBA tract during the permitting process, if it is leased.

Monitoring requirements for the existing Antelope Mine include a monitoring program to assure that ponds always have adequate space reserved for sediment accumulation and for collection of water quality samples from Antelope Creek at both the Upper (SW-28) and Lower (SW-3A) Stations (Figure 3-13) on a quarterly basis. These requirements would be extended to include the West Antelope II LBA tract when the mine permit is amended to include the tract.

3.5.3 Water Rights

3.5.3.1 Affected Environment

Wyoming SEO administers water rights in Wyoming. Water rights are granted for both groundwater and surface water. Water Records of the SEO were searched for groundwater rights within a three-mile radius of the West Antelope II LBA tract, as required for WDEQ mine permitting. At the time of the search, SEO data indicated there are 980 permitted water wells within three miles of the tract. The majority of these wells (884) are owned by either coal mining companies or CBNG producers. Of the 96 other wells, 51 are permitted for stock watering purposes, 15 are permitted for domestic and/or stock use, 3 for industrial purposes, and 27

for monitoring or miscellaneous use. A listing of the non-coal mine related groundwater rights is presented in Appendix G.

SEO records were searched for surface water rights using the SEO's AREV program. The search was conducted for surface-water rights within one-half mile of the tract and three miles downstream from the tract, as required for WDEQ mine permitting.

At the time of the search, SEO records indicated 260 permitted surface water rights within the search area for the LBA tract. One hundred eighty four of the surface water rights are held by coal mining companies. Of the remaining 76 surface water rights, 71 are permitted for stock watering, 2 for irrigiation, 1 for stock watering or irrigation, and 2 for industrial purposes. A listing of the non-coal mine related surface water rights is presented in Appendix G.

3.5.3.2 Environmental Consequences

3.5.3.2.1 Proposed Action and Alternatives 1 and 2

In November 2007, Wyoming SEO records indicate a total of 980 permitted water wells are located within three miles of the LBA tract. As discussed above, most of these wells are owned by coal mining or CBNG companies. Of the non-coal mine related wells within the search area, approximately 53 percent are permitted for stock watering, 16 percent are permitted for domestic and/or stock use, 28 percent are permitted for monitoring or miscellaneous use, and three percent are permitted for industrial uses.

Some of these privately permitted water wells would likely be impacted (either directly by removal of the well or indirectly by water level drawdown) by approved mining operations occurring at the Antelope and adjacent mines. Additional water wells would likely be affected if the LBA tract is leased and mined. Several of the permitted water wells listed in Section 3.5.3.1 are located within the expanded five-ft drawdown contour with completion depths that indicate they produce water from the coal seam (this excludes wells constructed for monitoring, mine dewatering, or CBNG production). These wells are presented in Table 3-10.

3.5.3.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal would not occur on the tract. The impacts to water rights associated with existing approved mining and CBNG development would continue to occur. The surface of portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

Table 3-10. Water Supply Wells Possibly Subject to Drawdown if the West Antelope II LBA Tract is Mined.

SEO Permit Number	Applicant	Use	Yield (gpm)	Well Depth (ft)	Depth to Water (ft)
P95333W	Frances Putnam	Domestic, Stock	6	360	45
P5611P	Robert E. Isenberger	Stock	5	344	280
P23598W	Patricia L. Isenberger	Stock	10	252	100
P5612P	Patricia L. Isenberger-Litton	Stock	1	350	60
P23601P	Patricia L. Isenberger	Stock	7	250	-1
P23595P	Patricia L. Isenberger	Stock	10	525	-4
P18856P	Floyd C. Reno & Son's	Stock	10	300	140
P17459W	Floyd C. Reno & Son's	Stock	20	357	180
P18149P	WY Board of Land Commissioners	Stock	10	362	100
P130523W	Floyd C. Reno & Son's Bill Moore, Jr., / W.I. Moore Ranch Co. Moore	Stock	4	370	190
P94894W	Ray Bell	Stock	5	549	230
P29020W	USDA Forest Service	Stock	5	440	140
P18147P	Floyd C. Reno & Son's Wyoming Board of Land Commissioners	Stock	5	350	110

Note: Based on their reported completion intervals, wells in this table are believed to be completed in the Wyodak coal seam and are within the additional area of five ft or more drawdown caused by mining the West Antelope II LBA tract. Wells impacted by the No Action Alternative are already addressed in the Antelope Mine's WDEQ/LQD mine permit document (ACC 2006a).

3.5.3.3 Regulatory Compliance, Mitigation and Monitoring

In compliance with SMCRA and Wyoming regulations, mine operators are required to provide the owner of a water right whose water source is interrupted, discontinued, or diminished by mining with water of equivalent quantity and quality; this mitigation is thus part of the Proposed Action and Alternatives 1 and 2. The most probable source of replacement water would be one of the aquifers underlying the Anderson and Canyon coal seams. For example, the subcoal Fort Union Formation aquifers are not removed or disturbed by coal mining, so they are not directly impacted by coal mining activity.

If the West Antelope II LBA tract is leased, the mine operator would be required to update the list of potentially impacted private water supply wells and predict impacts to those wells within the five-ft drawdown contour as part of the permitting process. The operator would be required to commit to replacing those water supplies with water of equivalent quality and quantity if they are determined to be affected by mining.

3.5.4 Residual Impacts

The area of coal and overburden removal and replacement of overburden and associated groundwater drawdowns would be increased under the Proposed Action and Alternatives 1 and 2 compared with the area of coal and overburden removal and overburden replacement and associated groundwater drawdowns if the West Antelope II LBA tract is not leased and mined. The postmining backfill may take in excess of 100 years to reach equilibrium water levels and water quality. Less time would be required near the mining boundaries. Monitoring data from wells completed in existing backfill area in the PRB suggest that there would be an adequate quantity of water in the backfill to replace current use, which is generally for livestock. Water quality in the backfill would generally be expected to meet the Wyoming Class III standards for use as stock water, which was the primary premining use of water from the coal seams.

3.6 Alluvial Valley Floors

3.6.1 Affected Environment

SMCRA prohibits surface coal mining and reclamation operations that would interrupt, discontinue, or preclude farming on AVFs or cause material damage to the quantity or quality of water systems that supply AVFs. These prohibitions do not apply if the premining land use of the affected AVF is undeveloped rangeland that is not significant to farming or if the affected AVF is of such small acreage that it would have a negligible impact on a farm's agricultural production. The prohibitions also apply to AVFs that are downstream of the area of disturbance but might be affected by disruptions of streamflow. If WDEQ determines that an AVF is not significant to agriculture, that AVF can be disturbed during mining but must be restored as part of the reclamation process.

WDEQ regulations define AVFs as unconsolidated stream-laid deposits where water availability is sufficient for subirrigation or flood irrigation agricultural activities. Guidelines established by OSM and WDEQ/LQD for the identification of AVFs require detailed studies of geomorphology, soils, hydrology, vegetation, and land use. These studies are used to identify 1) the presence of unconsolidated stream laid deposits, 2) the possibility for artificial flood irrigation, 3) past and/or present flood irrigation, and 4) apparent subirrigated areas and the possibility for natural flood irrigation. Areas that are identified as AVFs following these studies are evaluated for their significance to farming by WDEQ/LQD.

Investigations have been conducted by the Antelope Mine to determine the presence of AVFs within the existing Antelope Mine permit area. These AVF studies were conducted as part of the WDEQ/LQD mine permitting process for the purpose of recovering coal in the mine's existing leases. The results of these studies for the existing permit area are as follows:

- Antelope Creek has been investigated for the presence of an AVF (ACC

2005a). The area of the investigation extends more than a mile upstream of the current permit area and includes a portion of the West Antelope II LBA tract. A portion of Antelope Creek within the current permit area has been designated by WDEQ/LQD as "possible subirrigated AVF of minor importance to agriculture". Antelope Mine's approved mining plan avoids disturbing Antelope Creek and an adjacent buffer zone.

- Horse Creek has been investigated for the presence of an AVF (ACC 2005a). WDEQ/LQD has designated 61.2 acres in a narrow band adjacent to the channel and extending about a half mile upstream of the current permit boundary as an AVF designation. ACC's current mining plan would disturb 50.6 acres of that AVF (ACC 2001a). The portions of Horse Creek that have been declared an AVF were determined to be insignificant to farming by WDEQ/LQD (ACC 2001a).

- Spring Creek has been investigated for the presence of an AVF (ACC 2005a). Spring Creek was determined to contain 27.6 acres of AVF, however, historical efforts to employ flood irrigation within the Spring Creek Valley have not been successful (ACC 2006). The portions of Spring Creek that have been declared an AVF were determined to be non-significant to farming by WDEQ/LQD (ACC 2006a).

The general analysis area for the West Antelope II LBA tract includes short reaches of Antelope, Horse, and Spring Creeks which have not yet been formally evaluated for the presence of AVFs. The portions of those creeks that have not been formally evaluated for AVFs are upstream of the areas that have been investigated for the presence of AVFs within the current permit area (Figure 3-14).

As discussed previously, the declared AVF on Antelope Creek will not be disturbed by mining operations at the Antelope Mine. There are stream-laid deposits in portions of Horse Creek and Spring Creek within the general analysis area that are potential AVFs and may be mined and reclaimed in accordance with the WDEQ/LQD regulations.

A site-specific study will be part of the mine permitting process if a lease sale is held and the LBA tract is permitted for mining. Declarations of the presence or absence of AVFs, their significance to agriculture, and the appropriate perimeters will then be made by the WDEQ/LQD. The BLM study area for the West Antelope II LBA tract is undeveloped rangeland; therefore, it is reasonable to assume that mining would be permitted if the WDEQ/LQD determines AVFs are present within the LBA tract that is leased.

3.6.2 Environmental Consequences

3.6.2.1 Proposed Action and Alternatives 1 and 2

As indicated above, the entire West Antelope II general analysis area has not yet

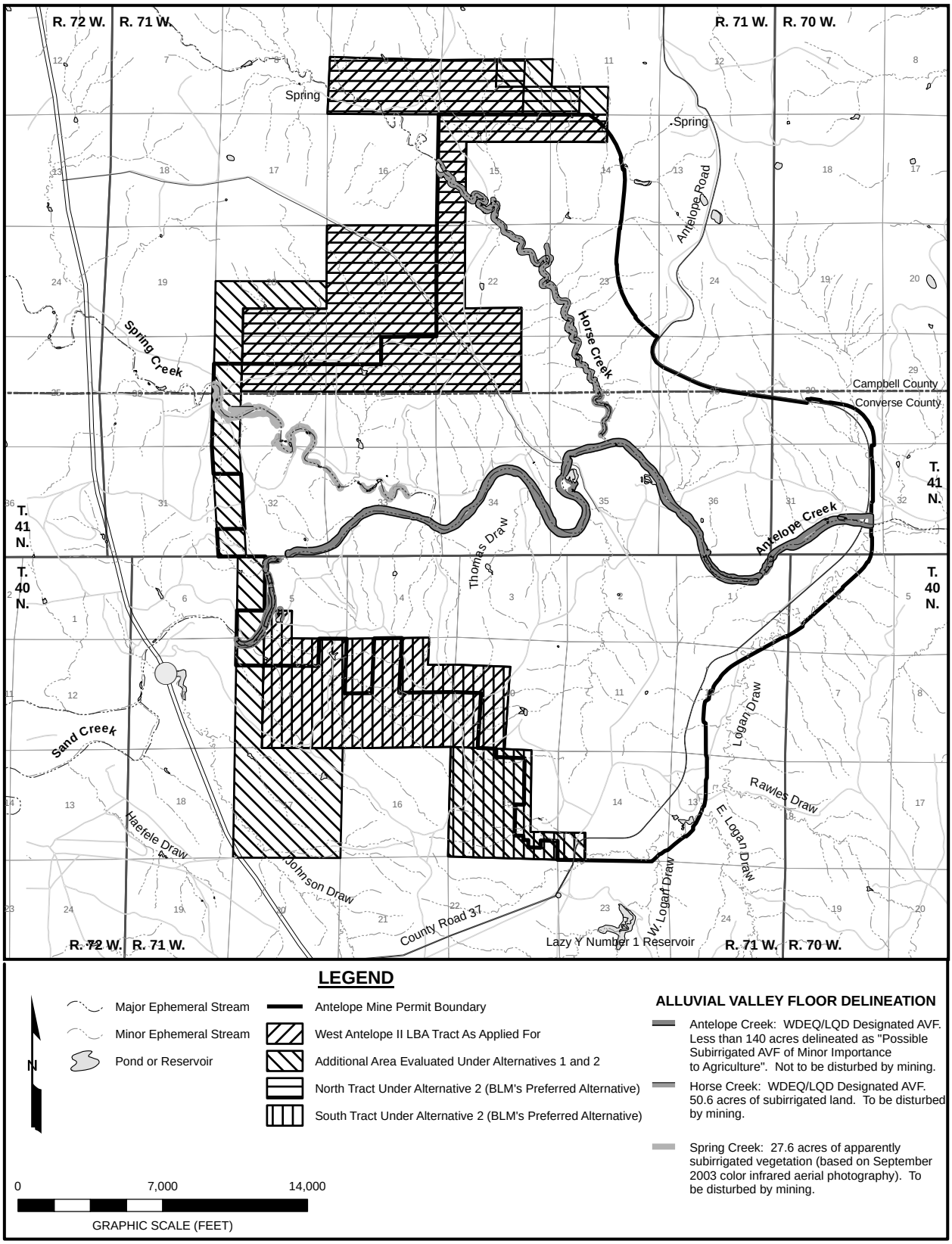


Figure 3-14. Declared Alluvial Valley Floors Within and Adjacent to the West Antelope II Study Area.

been formally evaluated for the presence of AVFs, however, previous investigations have identified AVFs along Antelope Creek, Spring Creek and Horse Creek within and adjacent to the West Antelope II LBA tract.

ACC's approved mining plan avoids disturbing Antelope Creek and an adjacent designated buffer zone. Therefore, any portions of the Antelope Creek valley that are included in the BLM study area for the West Antelope II LBA tract would not be mined, if the tract is leased and ACC acquires the tract.

WDEQ/LQD has determined that the AVFs on Horse Creek and Spring Creek within the current Antelope Mine permit area are not significant to agriculture (ACC 2006a). With the exception of an unsuccessful attempt at flood irrigation on Spring Creek, there is no present or historical record of agricultural use, other than undeveloped rangeland, in this area. Therefore, if WDEQ/LQD determines that an AVF is present in the general analysis area on either Horse Creek or Spring Creek, it would be reasonable to assume that mining would be permitted on that AVF because the lack of agricultural development in this area would preclude a determination of significance to agriculture.

Streamflows in drainages within the West Antelope II LBA tract would be diverted around the active mining areas in temporary diversion ditches or captured in flood control reservoirs above the pit. If flood control impoundments are used, it would be necessary to evacuate them following major runoff events to provide storage volume for the next flood. Consequently, disruptions to streamflows that might supply downstream AVFs are expected to be negligible. Groundwater intercepted by the mine pits would be routed through settling ponds to meet state and federal water quality criteria, and the pond discharges would likely increase the frequency and amount of flow in these streams, thereby increasing surface water supplies to downstream AVFs.

If the LBA tract is mined as an extension of existing operations, the mining would extend upstream on streams already in active mine areas. Therefore, no direct, indirect, or cumulative impacts are anticipated to off-site AVFs through mining of the West Antelope II LBA tract.

3.6.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope coal lease application would be rejected and coal removal would not occur on the tract. The impacts to AVFs associated with existing approved mining would continue to occur. The surface of portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.6.3 Regulatory Compliance, Mitigation and Monitoring

As discussed above, AVFs must be identified because SMCRA restricts mining activities that affect AVFs that are determined to be significant to agriculture. Impacts to designated AVFs are generally not permitted if the AVF is determined to be significant to agriculture. If the AVF is determined not to be significant to agriculture, or if the permit to affect the AVF was issued prior to the effective date of SMCRA, the AVF can be disturbed during mining but must be restored as part of the reclamation process. The determination of significance to agriculture is made by WDEQ/LQD, and it is based on specific calculations related to the production of crops or forage on the AVF and the size of the existing agricultural operations on the land of which the AVF is a part. For any designated AVF, regardless of its significance to agriculture, it must be demonstrated that the essential hydrologic functions of the valley will be protected. Downstream AVFs must also be protected during mining.

3.6.4 Residual Impacts

No residual impacts to AVFs would occur following mining.

3.7 Wetlands

3.7.1 Affected Environment

Waters of the U.S. is a collective term for all areas subject to regulation by the COE under Section 404 of the Clean Water Act. Waters of the U.S. include *special aquatic sites,* wetlands, and jurisdictional wetlands. Special aquatic sites are large or small geographic areas that possess special ecological characteristics of productivity, habitat, wildlife protection or other important and easily disrupted ecological values (40 CFR 230.3). Wetlands are a type of special aquatic site (that includes "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328.3(a)(7)(b)).

There are effectively three categories of wetlands:

- Jurisdictional wetlands, which are defined as those wetlands which are within the extent of COE regulatory review. They must contain three components: hydric soils, a dominance of hydrophytic plants, and wetland hydrology.

- Non-jurisdictional wetlands, which are non-navigable, isolated intrastate wetlands (e.g., playas) and other Waters of the U.S. These wetlands are not considered to be jurisdictional as a result of a Supreme Court ruling (Solid Waste Agency of Northern Cook County *v.* United States Army Corps of Engineers, January 9, 2001 and consolidated cases Rapanos *v.* United

States and Carabell *v.* United States, known as the "Rapanos" decision, June 19, 2006). Navigable, non-isolated wetlands and other Waters of the U.S. are still considered jurisdictional by the COE.

- Functional wetlands, which are areas that contain only one or two of the three criteria listed under jurisdictional wetlands. The USFWS used this categorization in producing the NWI maps. These maps were produced using aerial photo interpretation, with limited or no field verification.

Several types of wetland systems are present within the general analysis area (Figure 3-15). These wetland systems are limited in size; however, the vegetation in most of these environments is highly productive and diverse, and provides habitat for many wildlife species. Further, the systems as a whole play important roles in controlling flood waters, recharging groundwater, and filtering pollutants (Niering 1985).

Wetlands occur in a variety of forms within the general analysis area. Palustrine wetlands defined by their close association with emergent herbaceous marshes, swales, and wet meadows, support a variety of lush plant life and occur along the major drainages. Palustrine wetlands are the most common and abundant wetland on the analysis area and occur primarily along Antelope Creek, Horse Creek and Spring Creek. These wetland areas are supported by the saturated soils along the banks of the drainages with hydrology provided primarily from surface runoff from adjacent uplands and discharged CBNG waters.

In addition to wetlands, the general analysis area may include jurisdictional other waters of the U.S. as defined by 33 CFR 328.3. These other waters of the U.S. are primarily ephemeral stream channels, open water and other stream channels that carry water but do not meet the criteria for classification as wetlands.

Wetland inventories were based on USFWS NWI mapping, 2006-2007 vegetation mapping in the field and wetland inventories completed for the Antelope Mine in areas within or adjacent to the general analysis area. The area of investigation includes the BLM study area for the West Antelope II LBA tract (the tract as applied for and the additional area evaluated under Alternatives 1 and 2) and a ¼-mile disturbance buffer for lands not located within a currently approved mine permit area. Some wetland areas previously mapped by the USFWS NWI project have been recently altered somewhat due to CBNG-related water production within and upstream of the general analysis area. Within the entire wetland analysis area (9,520.8 acres, of which 2,115.5 acres are within the current Antelope Coal Mine permit area), a total of approximately 42.9 acres of wetlands and other waters of the U.S. have been identified (Figure 3-15). Of this 42.9 acres identified, approximately 31.7 acres are vegetated wetlands and the remaining 11.2 acres are pond or channel other waters of the U.S. The majority of the wetlands are associated with the Antelope Creek, Horse Creek and Spring Creek stream channels. The majority of the channel other waters of the U.S. are associated with the ephemeral stream channels present on the area.

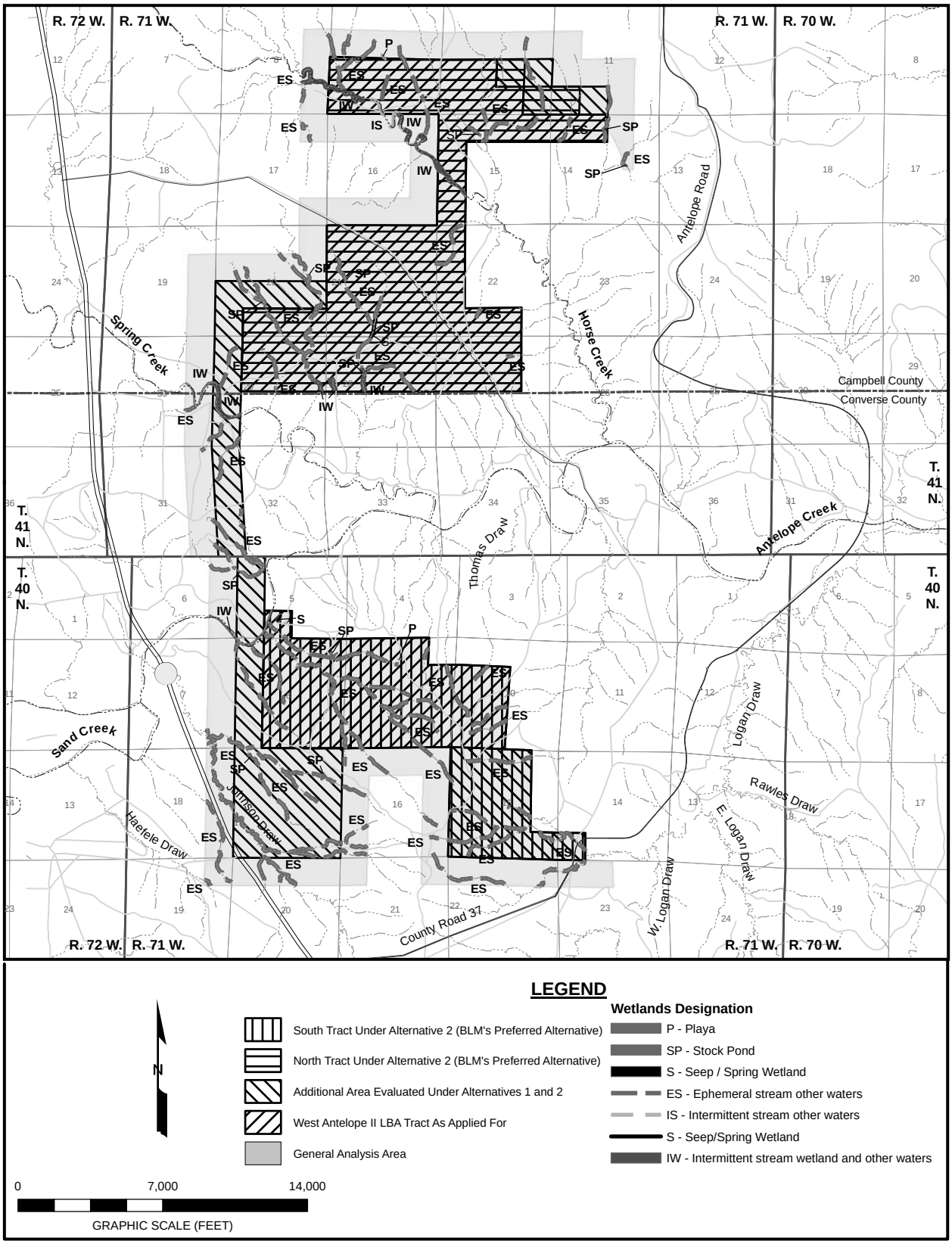


Figure 3-15. Wetlands and Other Waters Within the West Antelope II General Analysis Area.

Non-jurisdictional wetlands or other waters of the U.S. were included in the above acreages and were not identified separately in the study area because only the COE has the authorization to make such determinations. However, two small playas (less than one acre) were observed in the general analysis area (Figure 3-15). A formal wetland inventory would be completed and submitted to the COE for verification as part of the permitting process.

3.7.2 Environmental Consequences

3.7.2.1 Proposed Action and Alternatives 1 and 2

Based on previous surveys approved by the COE, NWI mapping by USFWS, and the vegetation mapping completed in 2006-2007, a maximum of approximately 42.9 acres of wetland and other waters of the U.S. would be disturbed if the LBA tract is leased and subsequently mined under the largest tract configuration (Alternatives 1 or 2).

A formal wetland delineation has been confirmed by the COE for the wetlands and other waters in the 2,116 acres of the wetland analysis area that lie within Antelope Coal Mine's current permit area. Wetland inventories covering the remainder of the wetland analysis area have been conducted but have not yet been submitted to the COE for verification. This wetland inventory would be submitted to the COE for verification as part of the process of obtaining a surface coal mining permit. In Wyoming, once the delineation has been verified, it is made a part of the mine permit document. The reclamation plan is then revised to incorporate the replacement of at least equal types and numbers of jurisdictional wetland acreages.

During the period of time after mining and before replacement of wetlands, all wetland functions would be lost. The replaced wetlands may not duplicate the exact function and landscape features of the premine wetlands, but replacement plans would be evaluated by the COE and replacement would be in accordance with the requirements of Section 404 of the Clean Water Act as determined by the COE.

3.7.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal would not occur on the West Antelope II LBA tract. The impacts to wetlands on the existing Antelope Coal Mine leases would occur as currently permitted. The surface portions of the West Antelope II LBA tract within the Antelope Coal Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.7.3 Regulatory Compliance, Mitigation and Monitoring

The presence of jurisdictional wetlands and other waters on a mine property does not preclude mining. A wetland delineation must be completed according to approved procedures (COE 1987) and submitted to the COE for verification as to the amounts and types of jurisdictional wetlands and other waters present. There are special required permitting procedures to assure that after mining there will be no net loss of wetlands. The COE requires replacement of all impacted jurisdictional wetlands in accordance with Section 404 of the Clean Water Act.

Section 404 of the Clean Water Act does not cover non-jurisdictional or functional wetlands; however, Executive Order 11990 requires that all federal agencies protect all wetlands. Mitigation for impacts to non-jurisdictional wetlands located on the tract will be specified during the permitting process as required by the authorized state or federal agency (which may include the WDEQ, the Office of Surface Mining, or the federal surface managing agency, if any federal surface is included in the tract) or the private surface owner. Surface land ownership on the West Antelope II general analysis area is private and federal (see Section 3.11). The federal surface is administered by the USDA-FS. WDEQ/LQD allows and sometimes requires mitigation of non-jurisdictional wetlands affected by mining, depending on the values associated with the wetland features. WDEQ/LQD may also require replacement of sites with hydrologic significance. If any playas with hydrologic significance are located on the tract that is leased, WDEQ/LQD would also require their replacement.

Wetland mitigation may begin prior to actual mining of this tract depending on hydrologic resources available. Interim mitigation may be provided through the many sediment control structures (ponds) created during mining, drainage diversions, removal of livestock from riparian areas and repair of damaged wetlands. Actual final mitigation will be at a minimum of one to one for all jurisdictional wetland features as required and dictated by the COE.

Reclaimed wetlands are monitored using the same procedures used to identify pre-mining jurisdictional wetlands.

3.7.4. Residual Impacts

Replaced wetlands (jurisdictional or functional) may not duplicate the exact function and landscape features of the premining wetland, but all wetland replacement plans would be approved by the COE, which has special required permitting procedures to assure that there will be no net loss of wetlands after reclamation.

3.8 Soils

3.8.1 Affected Environment

The soils analysis area for the West Antelope II EIS includes the general analysis area (approximately 9,521 acres) as well as an additional 481 acres, for a total soils study area of about 10,002 acres. Part of the soils analysis area (approximately 2,116 acres) lies within portions of three previously permitted Antelope Coal Mine areas: Antelope Permit Boundary (236.5 acres), Horse Creek Amendment (949.3 acres), and the West Antelope Amendment (929.7 acres). The entire soils analysis area is included in portions of the Natural Resources Conservation Service (NRCS) Order 3 soil surveys of southern Campbell County, Wyoming, (Westerman and Prink, 2004) and northern Converse County, Wyoming, (Reckner 1986). The permitted portions of the soils analysis area have been previously mapped to the detailed Order 1-2 level as part of the Antelope Coal integrated baseline soil survey - Antelope (Commonwealth Associates 1980), Horse Creek (Sugnet and Associates, 1999), and West Antelope (Western Water Consultants 2004). The detailed soil survey of the remaining portion of the West Antelope II soils analysis area (areas not previously mapped to the Order 1-2 level) was conducted during late 2007 and the spring of 2008. This survey included detailed soils mapping, profile descriptions, and sampling for laboratory characterization of all dominant soils.

All soil surveys were completed to the Order 1-2 or Order 3 level of intensity in accordance with criteria contained in WDEQ/LQD Guideline No. 1, Soils and Overburden (WDEQ 1996), which outlines the required soils information necessary for a coal mining operation. The inventories included soils field sampling, profile descriptions and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples. Soils within the analysis area were identified by series, which consist of soils that have similar horizons in their profile.

The soil types and depths on the soils analysis area are similar to soils currently being salvaged and utilized for reclamation at the adjacent Antelope Mine and other nearby mines in the southern PRB. A total of 36 map unit groups are delineated in the West Antelope II soils study area. There are 21 soil consociations, 12 soil complexes, and 3 miscellaneous units (Disturbed Land, Reclaimed Land, and Water).

Soils vary depending upon where and how they were formed. Major factors involved in the formation of soils include whether or not the material was transported and how the material was weathered during transportation. Four primary soil formation processes causing different soil types were noted in the study area: 1) soils developing predominantly in thin residuum from sandstone or shale on upland ridges, 2) soils developing predominantly in slopewash, colluvium, or alluvial fan deposits from mixed sources on gently sloping uplands, 3) soils developing predominantly in coarse-textured alluvium or sandy eolian

deposits on rolling uplands, and 4) drainage soils developing in mixed stream laid alluvium on terraces and channels, and in fine-textured playa deposits in depressions and closed basins. The major soil series encountered within the study area were grouped according to these categories as follows:

Soils developing predominantly in thin residuum from sandstone or shale on upland ridges (4,417.8 acres, 44.2% of total soils analysis area)

- Samday clay, 0 to 15% slopes (map unit 24)
- Shingle clay loam, 0 to 15% slopes (map unit 26)
- Tassel sandy loam, 0 to 30% slopes (map unit 28)
- Worf sandy loam, 0 to 6% slopes (map unit 37)
- Samday-Shingle-Worf complex, 0 to 15% slopes (map unit 101)
- Shingle-Samday complex, 3 to 30% (map unit 104)
- Wibaux-Rock Outcrop-Shingle complex, 6 to 45% slopes (map unit 106)
- Shingle-Worf-Rock Outcrop complex, 3 to 30% slopes (map unit 108)
- Rock Outcrop-Shingle-Samday-Tassel complex, 3 to 30% slopes (map unit 110)
- Niobrara-Rock Outcrop-Tullock, dry complex, 3 to 30% slopes (map unit 171)
- Ustic Torriorthents, gullied (map unit 401)

Soils developing predominantly in fine-loamy and fine-textured slopewash, colluvium, or alluvial fan deposits from mixed sources on gently sloping uplands (3,288.5 acres, 32.9% of total)

- Cushman sandy loam, 0 to 10% slopes (map units 7 and 7SL)
- Forkwood loam, 0 to 9% (map unit 11)
- Kim loam, 0 to 3% and 9 to 35% slopes (map units 15 and 15E)
- Razor clay loam, 0 to 6% slopes (map unit 22)
- Renohill clay loam, 0 to 6% slopes (map unit 23)
- Cushman-Shingle complex, 3 to 35% slopes (map unit 25)
- Thedalund clay loam, 0 to 6% slopes (map unit 31 and 32)
- Thedalund-Shingle clay loams, 9 to 30% slopes (map unit 32)
- Ulm clay loam, 0 to 6% slopes (map unit 33)
- Forkwood-Cushman complex, 0 to 15% slopes (map unit 38)
- Zigweid loam to clay loam, 0 to 3% and 3 to 6% slopes (map units 39, 39B)

Soils developing predominantly in coarse-textured alluvium and sandy eolian deposits on rolling uplands (2,180.6 acres, 21.8% of total)

- Terro-Tassel sandy loams, 3 to 15% slopes (map unit 29)
- Orpha loamy sand, 0 to 15% slopes (map unit 34)
- Vonalee fine sandy loam, 0 to 6% slopes (map unit 35)
- Otero sandy loam, 3 to 6% slopes (map unit 36)

- Niobrara-Rock Outcrop-Tullock, dry complex, 3 to 30% slopes (map unit 171)
- Vonalee-Terro fine sandy loams, 2 to 10% slopes (map unit 236)

Drainage soils developing in mixed streamlain alluvium on terraces and channels, and in fine-textured playa deposits in depressions and closed basins (567.5 acres, 5.7% of total)

- Absted-Arvada-Bone complex, 0 to 6% slopes (map unit 1)
- Draknab loamy sand, 0 to 3% slopes (map unit 2)
- Clarkelen sandy loam, 0 to 3% slopes (map units 13 and 13M)
- Haverdad loam, 0 to 9% slopes (map unit 14)
- Typic Fluvaquents complex, very wet (map unit 301)
- Typic Fluvaquents complex (map unit 302)

The soil surveys indicate that the amount of suitable topsoil available for redistribution on all disturbed acres within the soils analysis area during reclamation would have an average depth of about 19 inches (1.6 ft). Areas of unsuitable soils include sites with high salinity, high sodicity, or excessive clay content. The area is expected to have adequate quality and quantity of soil for reclamation. The soil surveys have located hydric soils and/or inclusions of hydric soils which are one component used in identifying wetlands.

3.8.2 Environmental Consequences

3.8.2.1 Proposed Action and Alternatives 1 and 2

Potential impacts to soil resources on the LBA tract after final reclamation under the Proposed Action or Alternatives 1 or 2 are quantified as follows. Under the currently approved mining and reclamation plan, approximately 12,105 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Antelope Mine (Table 3-1). If the West Antelope II LBA tract is leased, disturbance related to coal mining would directly affect approximately 4,314 additional acres of soil resources on and adjacent to the tract under the Proposed Action, and up to 6,625 additional acres under Alternatives 1 and 2 (Table 3-1). Average topsoil thickness would be about 19 inches (1.6 ft) across the entire reclaimed surface. The types of soils and quantities of suitable soil included in the West Antelope II LBA tract under the Proposed Action and Alternatives 1 and 2 are similar to the soils on the existing leases at the Antelope Mine.

Removal and replacement of soils during mining and reclamation would cause changes in the soil resources. In reclaimed areas, soil chemistry and soil nutrient distribution would generally be more uniform and average topsoil quality would be improved because soil material that is not suitable to support plant growth would not be salvaged for use in reclamation. This would result in more uniform vegetative productivity on the reclaimed land.

The replaced topsoil should support a stable and productive vegetation community adequate in quality and quantity to support the planned postmining land uses (wildlife habitat and rangeland).

There most likely would be an increase in the near-surface bulk density of the soil resources on the reclaimed areas. As a result, the average soil infiltration rates would likely decrease, which would increase the potential for runoff and soil erosion. Topographic moderation following reclamation would potentially decrease runoff, which would tend to offset the effects of decreased soil infiltration capacity. The change in soil infiltration rates would not be permanent because revegetation and natural weathering action would form a new soil structure in the reclaimed soils, and infiltration rates would gradually return to premining levels. The reclaimed landscape would contain stable landforms and drainage systems that would support the postmining land uses. Reconstructed stream channels and floodplains would be designed and established to be erosionally stable.

Direct biological impacts to soil resources on the West Antelope II LBA tract would include short-term to long-term reduction in soil organic matter, microbial populations, seeds, bulbs, rhizomes, and live plant parts for soil resources that are stockpiled before placement.

3.8.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts to soils would not occur on the portion of the 4,314 acres (Proposed Action) or up to 6,625 acres (Alternatives 1 and 2) of land that will not be disturbed under the currently approved surface coal mining permit. Soil removal and replacement would occur on the existing Antelope Mine leases as currently permitted. Soils on portions of the West Antelope II area adjacent to the Antelope Mine may be disturbed to recover the coal in the existing leases. As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.8.3 Regulatory Compliance, Mitigation and Monitoring

Soils suitable to support plant growth would be salvaged for use in reclamation. Soil stockpiles would be protected from disturbance and erosional influences. Soil material that is not suitable to support plant growth would not be salvaged. Soil or overburden materials containing potentially harmful chemical constituents (such as selenium) would be specially handled.

At least four feet of suitable overburden would be selectively placed on the graded backfill surface below the replaced topsoil to meet guidelines for vegetation root zones. After topsoil is replaced on reclaimed surfaces, revegetation would reduce wind erosion. The mine would construct sediment control structures as needed to trap eroded soil. Regraded overburden would be sampled for compliance with root

zone criteria. Vegetation growth would be monitored on reclaimed areas to determine if soil amendments are needed.

These measures are required by regulation and are therefore considered to be part of the Proposed Action and Alternatives 1 and 2 for the West Antelope II LBA tract.

3.8.4 Residual Impacts

Existing soils would be mixed and redistributed, and soil-forming processes would be disturbed by mining. This would result in long-term alteration of soil characteristics.

3.9 Vegetation

3.9.1 Affected Environment

The vegetation analysis area (9,520.8 total acres) is the general analysis area, which includes the BLM study area for the West Antelope II LBA tract (the tract as applied for and the additional area evaluated by BLM under Alternatives 1 and 2) and a ¼-mile buffer, which is the assumed area that would be disturbed in order to recover the coal in the LBA tract. The ¼-mile buffer includes only those lands that are not already approved for disturbance under currently approved coal leases and mine plans. Portions of the vegetation analysis area lie within the current Antelope Mine permit area and were previously mapped and sampled in accordance with the current WDEQ/LQD mine permitting requirements. The balance of this vegetation assessment was completed by Intermountain Resources of Laramie, Wyoming in 2006 and 2007. The vegetation communities in this area were appraised and mapped to provide a baseline assessment.

The vegetation within the analysis area consists of species common to eastern Wyoming and is consistent with vegetation that occurs within the adjacent Antelope Coal Mine permit area. A total of nine vegetation types/map units have been identified and mapped within the West Antelope II LBA vegetation analysis area. Previously disturbed areas were also mapped. The vegetation types include blue grama roughland, blue grama upland, birdsfoot sagebrush upland, grassy bottom, big sagebrush upland, silver sagebrush lowland, greasewood lowland, wetland/water, and treated grazing land ("treated grazing land" is defined in WDEQ/LQD Rules, Chapter 1, section 2 (xi)). The predominant vegetation types, in terms of total acres of occurrence in the vegetation analysis area, are the blue grama upland (41.65 percent), blue grama roughland (20.36 percent), big sagebrush upland (14.10 percent) and birdsfoot sagebrush upland (14.14 percent), which occur primarily on the level uplands and adjacent breaks (Table 3-11).

The blue grama upland vegetation type was the dominant type mapped on the analysis area and is characterized by perennial grasses. Dominant plant species are blue grama, needleandthread, western wheatgrass, Sandberg bluegrass and

other upland grasses of the region. Threadleaf sedge, pricklypear cactus and alkali sacaton are also common on some areas. Annual grasses and forbs were common on this type in 2007 while full shrubs and subshrubs were generally uncommon. This type is generally found on relatively flat to gently sloping areas with loamy and sandy loam soils.

Table 3-11. Vegetation Types Identified and Mapped Within the West Antelope II LBA Tract Vegetation Analysis Area.

Vegetation Type	Acres	Percent of Area
Blue Grama Upland	3,965.38	41.65
Blue Grama Roughland	1,938.35	20.36
Big Sagebrush Upland	1,342.40	14.10
Birdsfoot Sagebrush Upland	1,346.01	14.14
Treated Grazing Land	475.50	4.99
Grassy Bottom	102.57	1.08
Disturbed Land	109.76	1.15
Wetland/Water	42.90	0.45
Silver Sagebrush Lowland	193.00	2.03
Greasewood Lowland	4.88	0.05
Total	**9,520.75**	**100.00**

Source: Intermountain Resources (2006 & 2007)

The blue grama roughland vegetation type total vegetation cover is sparser than on the blue grama upland with the diversity of vascular plant species slightly lower. Common species include most of those found in the more extensive blue grama upland type~~s~~, but in addition, such species as prairie sandreed, scarlet globemallow, birdsfoot sagebrush and broom snakeweed are also common. Full shrubs and subshrubs are present in more abundance than on the blue grama upland type but do not dominate these areas. The blue grama roughland type is generally found on sloping to steeply sloping and erosive topography with shallow to deep soils.

The big sagebrush upland is dominated by big sagebrush and perennial grasses. Other common plant species, besides big sagebrush, are blue grama, needleandthread, pricklypear cactus and western wheatgrass. Annual grasses and forbs were common on this area in 2007. Big sagebrush is obviously the dominant full shrub and fringed sagewort is the most common subshrub. This type is predominantly found on relatively flat to gently sloping areas on moderately deep loamy soils. This type was also mapped in some small gently sloping draws, also with moderately deep loamy soils.

The birdsfoot sagebrush upland type is typically composed of sparsely vegetated uplands which are on relatively flat to gently sloping areas with relatively shallow soils. Soils characteristically are somewhat clayey and slightly alkaline. Dominant plant species include blue grama, birdsfoot sagebrush, threadleaf sedge, needleandthread, Gardner saltbush, wild buckwheat, and western wheatgrass. Full shrubs are uncommon but the subshrubs birdsfoot sagebrush, Gardner saltbush, wild buckwheat and broom snakeweed are common.

Treated grazing land is composed of lands where big sagebrush was removed. This type is found at one locale where big sagebrush was removed by a controlled burn. The treated grazing land type resembles the blue grama upland in terms of vegetation composition with blue grama, western wheatgrass, needleandthread, threadleaf sedge, Sandberg bluegrass and prickly pear cactus being the most common perennial plant species. Annual forbs and grasses were abundant on this area in 2007. Shrubs and subshrubs are generally absent. This type is found on gently rolling plains with moderately deep soils.

The grassy bottom exists in the form of narrow bands that range from approximately ten to 50 ft in width along the edges of Antelope Creek, Spring Creek, Horse Creek and some other associated minor drainages. Although this vegetation type comprises limited acreage, these sites are the most productive within the analysis area. The predominant plants are usually some combination of Kentucky bluegrass, sedges, alkali sacaton, inland saltgrass, yellow sweetclover, western wheatgrass, other wheatgrasses, dandelion, and western yarrow. Full shrubs were generally absent from this type but the subshrub fringed sagewort was common. Soils are usually loamy and moderately deep. Some dense patches of the noxious weed Canada thistle are present within this map unit.

Several areas of disturbed lands are located in the vegetation analysis area. These disturbed lands consist primarily of roads, pipelines and CBNG development. Some of these areas, such as roads and facilities, will remain disturbed into the future. Other disturbances, such as pipelines, will be reclaimed as soon as the work is completed.

Wetlands and open water are found in several locations in the vegetation analysis area, primarily along Horse Creek, Spring Creek and Antelope Creek and qualifying tributaries. The stockponds found within the analysis area are also included in this category. These sites were identified based on COE criteria for wetlands and pond other waters but may or may not be jurisdictional as discussed in Section 3.7. Wetland vegetation consists primarily of cattails, bulrushes, rushes, spikerush, sedges, and horsetails. Typically the open water is surrounded by wetlands or the grassy bottom type. Soils are primarily loams, clay loams and sandy clay loams.

A very small amount of silver sagebrush lowland is present on the vegetation analysis area for the West Antelope II LBA tract. This type is dominated by silver sagebrush, needleandthread, blue grama and western wheatgrass. Annual grasses and forbs were abundant on this type in 2007. Silver sagebrush was the most common full shrub while fringed sagewort was the most common subshrub. This map unit is found on relatively flat to gently sloping areas with typically sandy loam soils.

A minor amount of greasewood lowland (0.05 percent of the total area) was identified in the vegetation analysis area. This type is dominated by greasewood, blue grama, needleleaf sedge, Sandberg bluegrass, and western wheatgrass.

Annual grasses and forbs were abundant on this type in 2007. Greasewood was the most common full shrub while fringed sagewort and winterfat were the most common subshrubs. This type is found on relatively flat to gently sloping terrain with clayey and somewhat alkaline soils.

Previous vegetation inventories and additional inventories completed in 2007 identified approximately 223 plains cottonwood trees and five peachleaf willow trees within the vegetation analysis area. Most of these trees were found along Antelope Creek. Ten trees were found along Spring Creek. These trees were generally found associated with the bottomland grassland type or in the blue grama upland type adjacent to the bottomland grassland type. A few trees were also found in ephemeral drainages as well as adjacent to stockponds and adjacent to stock tanks.

3.9.2 Environmental Consequences

3.9.2.1 Proposed Action and Alternatives 1 and 2

As indicated in Table 3-1, under the currently approved mining and reclamation plan, approximately 12,105 acres of vegetation will be disturbed in order to mine the coal in the existing leases at the Antelope Coal Mine. Under the Proposed Action, mining of the West Antelope II LBA tract as applied for would progressively remove the native vegetation on 4,314 additional acres. Under the Alternatives 1 and 2, mining of the LBA tract would progressively remove the native vegetation on up to 6,625 additional acres.

Short-term impacts associated with the removal of vegetation from the West Antelope II LBA tract would include increased soil erosion and habitat loss for wildlife and livestock. Potential long-term impacts include loss of habitat for some wildlife species as a result of reduced plant species diversity, particularly big sagebrush, on reclaimed lands. However, grassland-dependent wildlife species and livestock would benefit from the increased grass cover and production.

Reclamation, including revegetation of these lands, would occur contemporaneously with mining on adjacent lands, i.e., reclamation would begin after an area is mined. Estimates of the time elapsed from topsoil stripping through reseeding of any given area range from two to four years. This would be longer for areas occupied by stockpiles, haulroads, some sediment-control structures, and other mine facilities. Some roads and facilities would not be reclaimed until the end of mining. ACC does not propose to locate any new life-of-mine facilities on the West Antelope II LBA tract under the Proposed Action or Alternatives 1 or 2 because the tract would be mined as an extension of an existing mine.

Grazing restrictions prior to mining and during reclamation would remove up to 100 percent of the general analysis area from livestock grazing. This reduction in vegetative production would not seriously affect livestock production in the region,

and long-term productivity on the reclaimed land would return to premining levels within several years following seeding with the approved final seed mixture. Wildlife use of the area would not be significantly restricted throughout the operations.

In an effort to approximate premining conditions, the applicant would plan to reestablish vegetation types that are similar to the premine types during the reclamation operation. Reestablished vegetation would be dominated by species mandated in the reclamation seed mixtures (to be approved by WDEQ). The majority of the approved species are native to the area. Initially, the reclaimed lands would be dominated by grassland vegetation, which would be less diverse than the premining vegetation. At least 20 percent of the native vegetation area would be reclaimed to native shrubs at a density of one per square meter or as required by current regulations. Estimates for the time it would take to restore shrubs, including sagebrush, to premining density levels range from 20 to 100 years. The reclamation standards call for restoration of sagebrush or other native shrubs to at least 20 percent of the reclaimed area. As indicated previously, sagebrush is a component of the big sagebrush upland, birdsfoot sagebrush upland, and silver sagebrush upland vegetation types, which account for approximately 30 percent of the vegetation analysis area. The reduction in sagebrush would result in a long term reduction of habitat for some species and may delay use of the reclaimed area by shrub-dependent species, such as the sage-grouse. An indirect impact of this vegetative change could be decreased big game habitat carrying capacity. Following completion of reclamation (seeding with the final seed mixture) and before release of the reclamation bond (a minimum of 10 years), a diverse, productive, and permanent vegetative cover would be established on the LBA tract. The decrease in plant diversity would not seriously affect the potential productivity of the reclaimed areas, and the proposed postmining land use (wildlife habitat and rangeland) should be achieved even with the changes in vegetation composition and diversity.

Surface disturbance would occur on the tract under all of the alternatives. By the time mining ceases, over 75 percent of these disturbed lands would have been reseeded. The remaining 25 percent would be reseeded during the following two to three years as the life-of-mine facilities area is reclaimed.

The reclamation plan for the existing Antelope Mine includes steps to control invasion by weedy (invasive nonnative) plant species because WDEQ/LQD requires surface coal mine operators to control and minimize the introduction of noxious weeds until bond release, in accordance with federal and state regulatory requirements. Section 3.9.4 includes a discussion of the steps that the Antelope Mine uses to control noxious weeds. As a result there are few occurrences of noxious weeds in the mine area. The reclamation plan for the West Antelope II LBA tract would also include steps to control invasion from such species.

Wyoming, including the PRB, has been experiencing drought conditions for the past seven or eight years. The climatic record of the western U.S. suggests that

droughts could re-occur periodically during the life of the mine. Droughts tend to hamper revegetation efforts because a lack of sufficient moisture reduces germination and could damage newly established plants. Same-aged vegetation is more susceptible to disease than plants of various ages. Severe thunderstorms could also adversely affect newly seeded areas. Once a stable vegetative cover is established, however, these events would have similar impacts as would occur on native vegetation.

Changes expected in the surface water network on the LBA tract as a result of mining and reclamation would affect the reestablishment of vegetation patterns on the reclaimed areas to some extent. The postmining maximum overland slope would be 20 percent, in accordance with WDEQ policy. The average reclaimed overland slope on the LBA tract would not be known until WDEQ's technical review of the permit revision application is complete. No significant changes in the average overland slope are predicted.

Following reclamation, the LBA tract would be primarily a mixture of upland prairie grasslands with graminoid/forb-dominated areas. An overall reduction in species diversity, especially for the shrub component, would occur. Following reclamation bond release, management of the privately owned surface areas would revert back to the private surface owners, who would have the right to manipulate the reclaimed vegetation.

There would be no net loss of jurisdictional wetlands. They would be restored under the jurisdiction of the COE (Section 3.7). Functional wetlands would be restored in accordance with the requirements of the surface landowner.

The decrease in plant diversity would not seriously affect productivity of the reclaimed areas, regardless of the alternative selected. The proposed postmining land use (wildlife habitat and rangeland) would generally be achieved even with the changes in vegetative species composition and diversity, although there would be some long term reduction in habitat for some wildlife species.

3.9.2.2 No Action Alternative

Under the No Action Alternative (Alternative 3), the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts to vegetation would not occur on from 4,314 up to 6,625 acres that would be disturbed under the Proposed Action or Alternatives 1 and 2, respectively. Coal removal and the associated vegetation removal and replacement would occur on the existing Antelope Mine leases as currently permitted. Vegetation on portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.9.3 Threatened, Endangered, Proposed, and Candidate Plant Species, and BLM Sensitive Species

Refer to Appendices H and I.

3.9.4 Regulatory Compliance, Mitigation and Monitoring

Reclaimed areas would be revegetated as specified in the approved mine plan using reclamation seed mixtures which would be approved by WDEQ/LQD. The majority of the species would be native to the LBA tract. At least 20 percent of the native vegetation area would be reclaimed to native shrubs at a density of one per square meter or as required by current regulations. Shrubs would be selectively planted in riparian areas and trees would be replaced in a one-to-one ratio.

WDEQ/LQD Rules and Regulations require that:

- Permit applications for surface coal mines include a description of any weeds or other plants listed by the local Weed and Pest Control District as harmful (Chapter 2, Section 2(a)(vi)(C)(2)); and

- Surface coal mine operators control and minimize the introduction of noxious weeds in accordance with federal or state requirements (Chapter 4, Section 2 (d)(xiv)).

Steps to control invasion by weedy (invasive nonnative) plant species using chemical and mechanical methods would be included in the amended mine plan. The mine currently has an active noxious weed control program. The most common and problematic noxious weed in the area is Canada thistle. The mine annually contracts with a weed control expert certified by the state of Wyoming. This contractor completes chemical applications to noxious weed infestations identified by mine personnel and also traverses the remainder of the mine permit area and applies chemical control to any other noxious weed infestations encountered. The Antelope Coal Mine works with the local county weed and pest control agents to control noxious weeds as necessary. The mine also conducts other control programs including mowing, tillage, and reseeding of weedy areas. Detailed wetland mitigation plans would be developed and approved by the COE during the permitting stage to ensure no net loss of jurisdictional wetlands occurs within the total disturbance area (Section 3.7). Non-jurisdictional and functional wetlands would be restored in accordance with the requirements of the surface landowner or as required by WDEQ/LQD.

Revegetation growth and diversity would be monitored until the final reclamation bond is released (a minimum of 10 years following seeding with the final seed mixture). Erosion would be monitored to determine if there is a need for corrective action during establishment of vegetation. Controlled grazing would be used during revegetation to determine the suitability of the reclaimed land for post-

mining land uses.

3.9.5 Residual Impacts

Reclaimed vegetative communities may never completely match the surrounding native plant community.

3.10 Wildlife

3.10.1 General Setting

This section discusses the affected environment and potential environmental consequences to wildlife in general. The subsequent sections address the potential impacts to specific groups of wildlife species. The balance of this wildlife assessment was completed by Jones & Stokes (formerly Thunderbird Wildlife Consulting), of Gillette, Wyoming in 2006 and 2007.

3.10.1.1 Affected Environment

The BLM study area for the West Antelope II LBA is defined as the original tract, as applied for, plus all lands added by the BLM under Alternatives 1 and 2. The wildlife general analysis area is defined as the BLM study area plus surrounding lands within a one-quarter mile perimeter that could be disturbed by mining the coal within the BLM study area. Coincidentally, the general analysis area for this discussion also represents the extent of the anticipated permit amendment study area for the Antelope Mine, should the mine acquire the tract.

The wildlife general analysis area abuts the existing Antelope Mine permit area. Consequently, portions of the wildlife general analysis area lie within the current Antelope Mine permit area and were previously monitored in accordance with the current WDEQ/LQD mine permitting requirements. Those requirements include surveys that extend 0.5 mile to 2.0 miles beyond the current mine permit area, depending on the species.

Background information on wildlife in the West Antelope II general analysis area and surrounding lands was obtained from several sources, including the South PRB Coal FEIS (BLM 2003a), records from the WGFD, BLM, USFWS, USDA-FS, and personal contact with biologists from those four agencies. Site-specific data for the West Antelope II general analysis area were obtained from several sources, including WDEQ/LQD mine permit applications and annual wildlife monitoring reports for the applicant and nearby coal mines.

Surveys conducted during annual monitoring for existing permitted areas at the Antelope Mine include the permit area and a one-mile perimeter. A two-mile perimeter is used for big game and wildlife baseline studies. Due to the proximity of the proposed lease area to the existing mine permit area, all but the northern third of the West Antelope II general analysis area has been included in multiple

baseline studies and annual wildlife monitoring efforts associated with the Antelope Mine since the early 1980s. Additional acreage within that area was included in annual monitoring since 1994, with yearly coverage over the entire general analysis area beginning in 1998.

The Antelope Mine initiated baseline investigations in 2006 expressly for the West Antelope II LBA tract. As noted above, those surveys included the general analysis area plus a two-mile perimeter. Again, because the proposed LBA tract is adjacent to the existing Antelope Mine, much of the baseline two-mile perimeter had coincidentally been covered during previous annual or baseline monitoring studies for Antelope or the neighboring North Antelope Rochelle Mine over the last 25 years. Annual wildlife surveys associated with unrelated CBNG projects in the same area have also included the northern portions of the baseline two-mile perimeter since 2004. A full description of the extent and timing of coverage during mine-related surveys is provided in Appendix H of this EIS document. Site-specific surveys for the entire leased area and appropriate perimeters would be part of the mine permitting process if the tract is leased.

The West Antelope II LBA tract is dominated by rolling topography, with a few small areas of steeper and more heavily dissected terrain. The area surrounding the expansion is also characterized primarily by broken rolling hills and uplands, along with some prominent ridgelines and more level terrain along the terraces of Antelope and Spring Creeks. Surface mine lands, both active and reclaimed, dominate the landscape east and northeast of the southern portion of the tract. Elevations range from approximately 4,500 to 5,100 feet above sea level.

In an undisturbed condition, the major vegetation types in the general analysis area would provide habitat for many species. Vegetation types occur in a broad mosaic across the landscape; therefore, many wildlife species can be expected to utilize more than one habitat type. Predominant wildlife habitat types classified on the LBA tract and adjacent area correspond with the major plant communities defined during the vegetation baseline survey; they consist primarily (approximately 67 percent) of various upland grasslands (Section 3.9, Table 3-11). Included within those grasslands are black-tailed prairie dog (*Cynomys ludovicianus*) colonies, roughlands and coulees, and treated grazing lands. Smaller proportions (less than 1 to approximately 17 percent) of other habitat types are also present, including big sagebrush, birdsfoot sagebrush, grassy bottomland, disturbed land, water, silver sagebrush lowland, and greasewood lowland.

Mesic habitats include riparian corridors with limited trees, and are restricted to narrow bands along primary drainages of Antelope Creek, Spring Creek, and Horse Creek as they pass through or adjacent to the LBA tract. Cheatgrass and crested wheatgrass have invaded some areas, and a growing network of road and well-pad disturbance areas occur in the grassland and sagebrush grassland vegetation areas, especially in the north. A few oil tank batteries and increasing numbers of natural gas pipelines and facilities are also present, with pipeline

disturbance corridors in varying degrees of recovering vegetative cover. No designated critical, crucial, or unique habitats are present.

Antelope Creek and Spring Creek (a primary tributary of Antelope Creek) flow generally west to east across the narrow band of the West Antelope II study area that connects the north and south blocks. Horse Creek, another primary tributary of Antelope Creek, flows north to south through the northern-most extent of the LBA tract. All three drainages are intermittent or ephemeral streams. Limited portions of the drainages may receive recharge from bank storage, making them locally intermittent.

Historically, water was often present in the main creeks as small, shallow, isolated pools within the deeper channels. However, water levels have increased within some drainages over the last year due to the influx of discharged flows associated with CBNG development in the area, and those areas are seldom completely dry anymore. That water appears to be affecting the chemical balance of soils along some portions of Spring Creek, with obvious sodic soils where standing water has accumulated.

Despite this recent influx of water into the general analysis area, many channels are still reduced to isolated, shallow pools in the summer. Numerous named and unnamed ephemeral tributaries of these creeks also drain portions of the LBA tract. Several stock reservoirs are scattered throughout those drainages, and all are constructed with earthen berms or dams. Those water bodies provide short-term habitat for migrating waterfowl, shorebirds, and other aquatic species (birds, fish, herptiles) during spring but are often dry during other seasons.

3.10.1.2 Environmental Consequences

3.10.1.2.1 Proposed Action and Alternatives 1 and 2

If the West Antelope II LBA tract is leased under the Proposed Action, or Alternatives 1 or 2, coal mining operations at the Antelope Mine would be extended by up to 13 years. Impacts to wildlife that would be caused by mining the LBA tract would be addressed as part of the review of the mine permit application by the WGFD, USFWS, and the WDEQ/LQD when the mining and reclamation permit is revised to include the LBA tract.

Mining directly and indirectly impacts local wildlife populations. These impacts are both short-term (until successful reclamation is achieved) and long-term (persisting beyond successful completion of reclamation). The direct impacts of surface coal mining on wildlife occur during mining and are therefore short-term. They include injury and mortalities caused by collisions with mine-related traffic or mortalities due to loss of habitat (especially for species with limited mobility such as fish and some herptiles); restrictions on wildlife movement due to construction of fences, spoil piles, and excavation of pits; and displacement of wildlife from active mining areas. Displaced animals may find suitable habitat

that is not occupied by other animals, occupy suitable habitat that is already being used by other individuals, or occupy poorer quality habitat than that from which they were displaced. In the latter two situations, the animals may suffer from increased competition with other animals and are less likely to survive and reproduce. If the West Antelope II LBA tract is leased and mined, the direct impacts related to mine traffic and mine operations would be extended within the general analysis area by up to 13 years.

The indirect impacts are longer term than the direct impacts. Results from long-term surveys conducted at the Antelope Mine, and from those completed in both native and reclaimed habitats at other surface mines in the region, demonstrated that some reclaimed habitat types can support levels of species diversity and abundance equal to or greater than their native counterparts. However, wildlife species composition can be quite different between pre- and post-mining habitats, depending on the structure and composition of native habitats prior to disturbance.

After the LBA tract is leased, mined, and reclaimed, alterations in the topography and vegetative communities would likely result in such changes in species composition from pre-mine conditions. Some vegetative communities currently present in the tract, such as low-growth species (e.g., blue grama, and birdsfoot sagebrush) and big sagebrush, are often difficult to reestablish through artificial plantings. Wildlife species associated with pre-mining vegetative communities would be replaced by species that are typically associated with the taller and/or denser vegetation that is often present in reclaimed areas, especially until reclamation matures to its target mix.

Topographic changes would be permanent, and microhabitats may be reduced on reclaimed land due to flatter topography, less diverse vegetative cover, and reduction in sagebrush density. Changes in the composition between pre- and post-mining vegetation and wildlife species may be reduced if special efforts are made to reestablish low-growth and shrub habitat types. In the past, Antelope Mine has addressed low-growth specialized habitat needs with reclamation by creating new prairie dog colonies in reclaimed areas through translocation efforts, thus reestablishing the short-grass community present prior to disturbance. Such efforts have been curtailed by recent regulatory restrictions.

3.10.1.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the impacts to wildlife and wildlife habitat associated with coal removal described above would not occur on the West Antelope II LBA tract. Wildlife habitat on from 4,314 to 6,625 additional acres (under the Proposed Action, or Alternatives 1 and 2) would not be disturbed. Mining operations and associated impacts to wildlife and wildlife habitat would continue as currently permitted on the existing Antelope Mine coal leases but would not be extended onto portions of the LBA tract that will not be affected under the current mining

and reclamation plan. Impacts to wildlife and wildlife habitat associated with CBNG development would continue where those activities overlap with the West Antelope II LBA tract.

3.10.2 Big Game

3.10.2.1 Affected Environment

The two big game species that are common in suitable habitat throughout the general analysis area are pronghorn (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*), though pronghorn are more abundant. White-tailed deer (*Odocoileus virginianus*) are occasionally observed along the cottonwood corridor bordering Antelope Creek. The nearest elk (*Cervis elaphus*) population is the Rochelle Hills Herd, approximately 13 miles east of the study area; elk are rarely recorded within the general analysis area.

Pronghorn are the most common big game species in the general analysis area. However, pronghorn density within two miles of the LBA tract has consistently been lower than that of a larger multi-mine survey area over time. The differences are probably due primarily to the vegetative characteristics of the general analysis area. The majority of the West Antelope II LBA tract is comprised of grassland habitats, which are not preferred by wintering pronghorn (Sundstrom et al. 1973). The same is true for the current Antelope Mine annual wildlife monitoring survey area (current permit boundary plus a one-mile perimeter), which regularly supports fewer wintering pronghorn than other portions of the multi-mine survey block. Similarly, only small groups of pronghorn are regularly present in reclaimed habitats, which are currently dominated by grass species with only a modest shrub component. The home range for pronghorn can vary between 400 to 5,600 acres depending on several factors, including season, habitat quantity and quality, population characteristics, and local livestock occurrence. In northeast Wyoming, daily movement typically does not exceed six miles. Pronghorn may make seasonal migrations between summer and winter habitats, but migrations are often triggered by availability of specific plants and not local weather conditions (Fitzgerald et al. 1994).

The WGFD has classified the general analysis area as primarily yearlong pronghorn range, which means that a population or a portion of a population of animals makes general use of this habitat on a year-round basis. Within the LBA as-applied-for area, the SE ¼ of Section 10, T.40N., R.71W. encompasses severe winter relief habitat for antelope, as classified by the WGFD. Severe winter relief habitat is defined as "a documented survival range which may or may not be considered a crucial range area…it may lack habitat characteristics which would make it attractive or capable of supporting major portions of the population during normal years but is used by and allows at least a significant portion of the population to survive the occasional extremely severe winter" (TWS Wyoming Chapter 1990). The Cheyenne River Pronghorn Herd Unit encompasses the entire general analysis area. The WGFD estimated the 2006 post-season pronghorn

population to be approximately 39,621 animals; the herd objective is 38,000 (WGFD 2006).

Mule deer use nearly all habitats, but prefer sagebrush grassland, rough breaks, and riparian bottomland. Browse is an important component of the mule deer's diet throughout the year, comprising as much as 60 percent of total intake during autumn, while forbs and grasses typically make up the rest of their diet (Fitzgerald et al. 1994). Mule deer are not abundant in the general analysis area, with most individuals recorded in eroded draws, riparian corridors, and reclaimed lands in that vicinity. In certain areas of the state, this species tends to be more migratory than white-tailed deer, traveling from higher elevations in the summer to winter ranges that provide more food and cover. However, monitoring indicates that mule deer are not very migratory in the vicinity of the West Antelope II LBA tract. The WGFD has classified the general analysis area as yearlong mule deer range, with the extreme southeastern portion as winter/yearlong. The entire area is located within the Thunder Basin Herd Unit. The WGFD estimated the 2006 post-season mule deer population to be approximately 22,036 animals, whereas the herd objective was 20,000 (WGFD 2006). No crucial or critical mule deer ranges or migration corridors occur on or within several miles of the West Antelope II LBA tract.

White-tailed deer and elk are generally managed separately by the WGFD. White-tailed deer prefer riparian habitats, whereas elk are typically observed in and near rough breaks and pine stands. Those habitat types are not common within the general analysis area, which accounts for the rare sightings of white-tailed deer and elk in that region. The WGFD classifies the entire area as out of the normal white-tailed deer and elk use range, with the exception of a narrow corridor along Antelope Creek which is classified as yearlong range. The majority of white-tailed deer sightings were confined to the Antelope Creek riparian corridor. Elk observations were limited to rare records in the extreme southeastern corner of the winter big game survey perimeter.

3.10.2.2 Environmental Consequences

3.10.2.2.1 Proposed Action and Alternatives 1 and 2

Under the Proposed Action, and Alternatives 1 and 2, big game would be displaced from portions of the West Antelope II LBA tract to adjacent ranges during mining. Pronghorn would be most affected; however, no areas classified as crucial pronghorn habitat occur on or within two miles of the LBA tract, and this species is not as prevalent in the general analysis area as elsewhere within the region. Mule deer would not be substantially impacted, given their infrequent use of these lands and the availability of suitable habitat in adjacent areas. The WGFD does not consider the general analysis area to be within either white-tailed deer or elk use range, and sightings of those species in that vicinity are uncommon or rare, respectively.

Big game displacement would be incremental, occurring over several years and allowing for gradual changes in distribution patterns. Big game residing in the adjacent areas could be impacted by increased competition with displaced animals. Noise, dust, and associated human presence would cause some localized avoidance of foraging areas adjacent to mining activities. On the existing coal leases, however, big game have continued to occupy areas next to and within active mining operations, suggesting that some animals may become habituated to such disturbances.

Big game animals are highly mobile and can potentially move to undisturbed areas. But if the tract is leased, once surface disturbance begins, big game movement would be restricted on or through the tract due to the construction of fences, spoil piles, and pits related to mining. During winter storms or other stressful weather events, pronghorn may not be able to negotiate these barriers. WDEQ guidelines require fencing to be designed to permit pronghorn passage to the extent possible. Following reclamation, topographic moderation and changes in vegetation may result in long-term effects on big game carrying capacity.

3.10.2.2.2 No Action Alternative

The impacts to big game under the No Action Alternative would be similar to the impacts previously described in Section 3.10.1.2.2.

3.10.3 Other Mammals

3.10.3.1 Affected Environment

A variety of small and medium-sized mammal species occur in the vicinity of the general analysis area, although not all have been observed on the LBA tract. These include predators and furbearers such as the coyote (*Canis latrans*), red fox (*Vulpes vulpes*), swift fox (*Vulpes velox*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis*), weasels (*Mustela* spp.), badger (*Taxidea taxus*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), and beaver (*Castor canadensis*). Prey species include various rodents [including mice, rats, voles, gophers, ground squirrels, chipmunks, and black-tailed prairie dogs (*Cynomys ludovicianas*)) and lagomorphs [jackrabbits (*Lepus* spp.) and cottontails (*Sylvilagus* spp.)]. These prey species are cyclically common, widespread throughout the region, and are important for raptors and other predators. Porcupines (*Erethizon dorsatum*) and bats [such as hoary (*Lasiurus cinereus*), big brown (*Eptesicus fuscus*), and Townsend's big-eared (*Corynorhinus townsenii*)] have not been documented in the general analysis area, and have limited potential habitat in the vicinity.

The black-tailed prairie dog was added to the list of candidate species for federal listing on February 4, 2000 (USFWS 2000a). The USFWS has since removed the black-tailed prairie dog from the list of candidate species (USFWS 2002a), but continues to encourage the protection of prairie dog colonies for their value to the prairie ecosystem and the myriad of species that rely on them (USFWS 2004a).

The black-tailed prairie dog is a BLM Sensitive Species and a USDA-Forest Service Sensitive species (see Appendix H).

The black-tailed prairie dog is a highly social, diurnally active, burrowing mammal. Aggregations of individual burrows, known as colonies, form the basic unit of prairie dog populations. Found throughout the Great Plains in short-grass and mixed-grass prairie areas (Fitzgerald et al. 1994), the black-tailed prairie dog has declined in population numbers and extent of colonies in recent years. The three major impacts that have influenced black-tailed prairie dog populations are the initial conversion of prairie grasslands to cropland in the eastern portion of its range from approximately the 1880s through the 1920s; large-scale control efforts conducted from approximately 1918 until 1972 when an Executive Order was issued banning the use of compound 1080 (a predacide and rodenticide); and the introduction of sylvatic plague into North American ecosystems in 1908 (USFWS 2000b).

Currently, this species is primarily found in isolated populations in the eastern half of Wyoming (Clark and Stromberg 1987). Prairie dogs are considered a common resident in eastern Wyoming, utilizing short-grass and mid-grass habitats (Cerovski et al. 2004). The USFWS recently estimated that about 125,000 acres of occupied black-tailed prairie dog habitat exists in Wyoming (USFWS 2004b). Prairie dogs construct extensive burrow systems in fine- to medium-textured upland soil types. Many other wildlife species, such as the black-footed ferret (*Mustela nigripes*), swift fox, mountain plover (*Montanus charadrius*), ferruginous hawk (*Buteo regalis*), and burrowing owl (*Athene cunicularia*) may be dependent on the black-tailed prairie dog for some portion of their life cycle (USFWS 2000b).

According to USDA-FS observations on the TBNG, the largest concentrations of prairie dog colonies in the vicinity of the surface coal mines are found east of the coal burnline, which is east and beyond the area of surface coal mining (Tim Byer, personal communication 9/11/2003). The large prairie dog complexes in the area east of the coal burnline have been drastically impacted by outbreaks of plague in recent years. The colonies west of the burnline, including those within and near the West Antelope II LBA tract, are generally smaller and less densely concentrated. Nevertheless, some of those colonies have also been impacted by plague within the last three years (refer to Antelope Mine Annual Wildlife Reports, on file with WDEQ/LQD).

Surveys have been conducted to locate prairie dog colonies on and within two miles of the LBA tract as applied for under the Proposed Action and Alternatives 1 and 2 (BLM study area). The two-mile perimeter encompasses the general analysis area. Sixteen prairie dog colonies were found within this survey area, with 4 colonies (approximately 188 acres) within the LBA general analysis area (Figures 3-16 and 3-17). Additional discussion of prairie dog colonies identified in the vicinity of the West Antelope II area is included in the Biological Assessment (Appendix I) of this EIS.

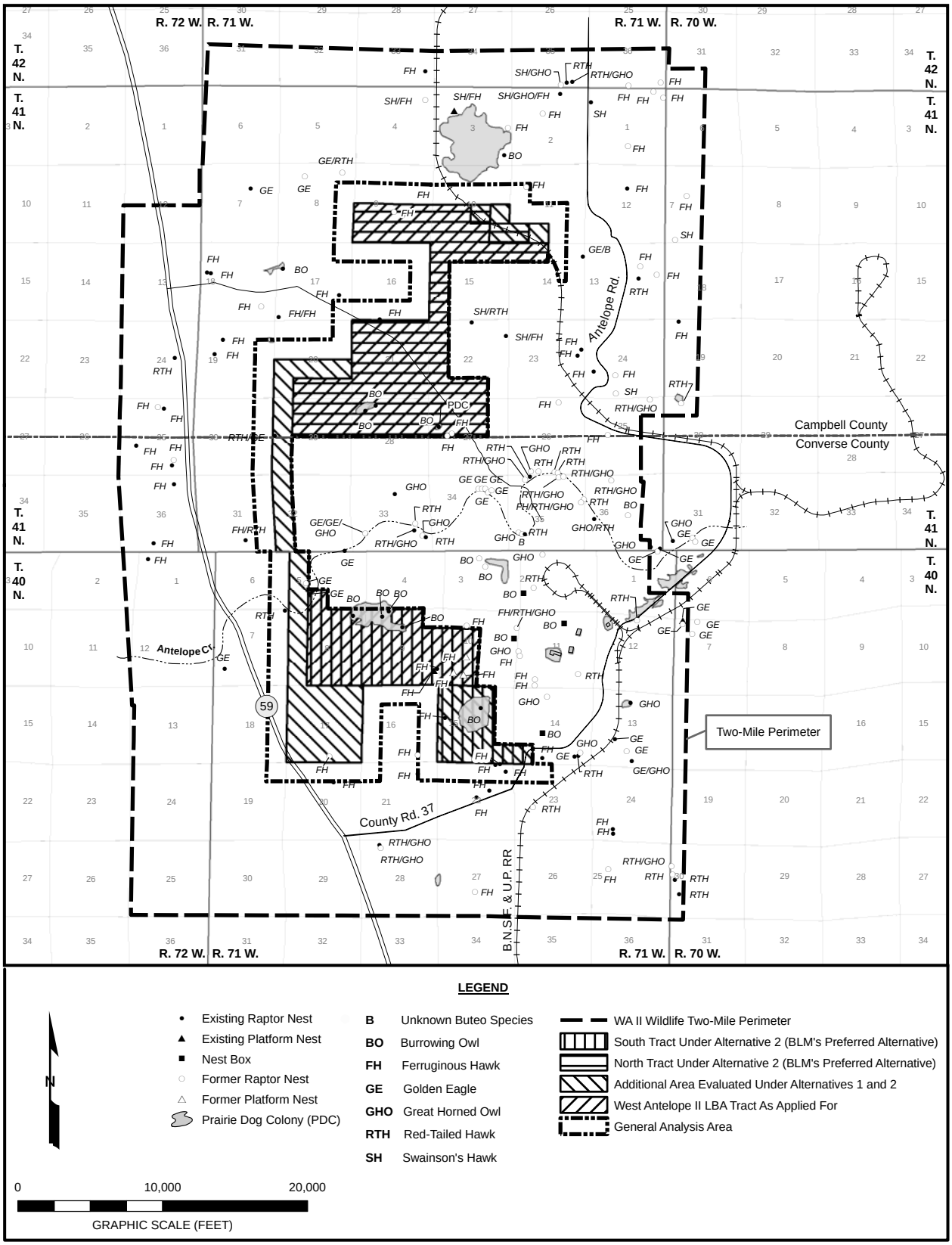


Figure 3-16. Raptor Nest Sites and Prairie Dog Colonies Within the West Antelope II Wildlife Two-Mile Perimeter Area.

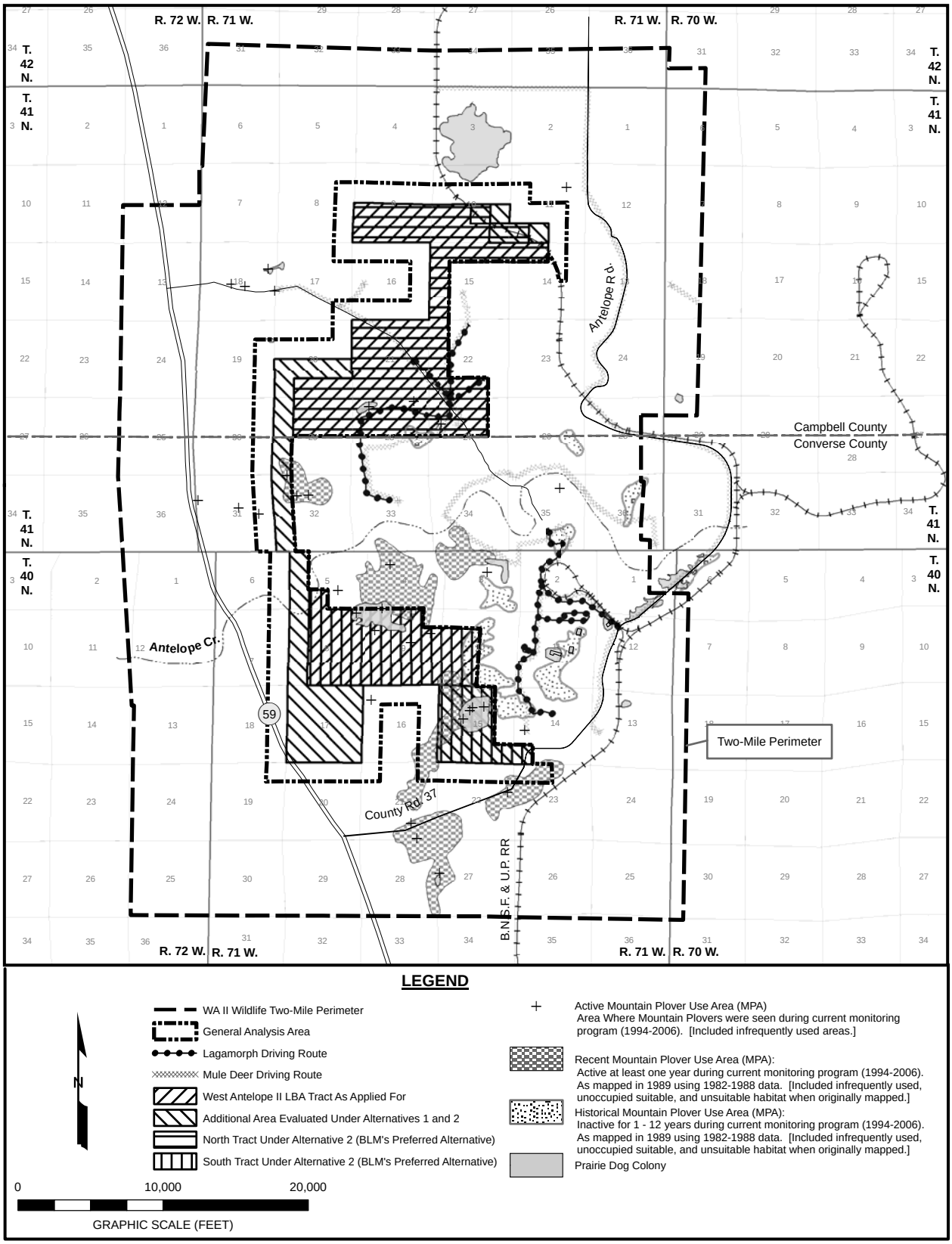


Figure 3-17. Wildlife Features and Survey Routes Within the West Antelope II Wildlife Two-Mile Perimeter Area.

3.10.3.2 Environmental Consequences

3.10.3.2.1 Proposed Action and Alternatives 1 and 2

Medium-sized mammals (such as lagomorphs, coyotes, and foxes) would be temporarily displaced to other habitats by mining, potentially resulting in increased competition and mortality. However, these animals would rebound as forage is developed or small mammal prey species recolonize the reclaimed areas. Direct losses of small mammals would be higher than for other wildlife, since the mobility of small mammals is limited and many would retreat into burrows when disturbed. Therefore, local populations of such prey species as voles, ground squirrels, and mice would decline during mining. However, these animals have a high reproductive potential and tend to re-occupy and adapt to reclaimed areas quickly. A research project on habitat reclamation on mined lands within the PRB for small mammals and birds concluded that objectives to encourage recolonization of reclamation by small mammal communities are being achieved (Shelley 1992). That study evaluated sites at five separate mines.

All or portions of four prairie dog colonies occur in the general analysis area and would be affected by leasing and mining the area described in the Proposed Action, or Alternatives 1 or 2. However, 74 percent of the total acreage (12 additional colonies) within the two-mile perimeter would be either only partially disturbed or not disturbed at all by mining under those options. Refer to the Biological Assessment (Appendix I) of this EIS for further discussion of impacts to prairie dog colonies in the general analysis area.

3.10.3.2.2 No Action Alternative

Impacts to small mammals under the No Action Alternative would be similar to the impacts described in Section 3.10.1.2.2, above.

3.10.4 Raptors

3.10.4.1 Affected Environment

The raptor species known or expected to occur in suitable habitats in the general analysis area include the golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), rough-legged hawks (*Buteo lagopus*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), prairie falcon (*Falco mexicanus*), great horned owl (*Bubo virginianus*), burrowing owl, and short-eared owl (*Asio flammeus*). Many of these species are USDA-FS and BLM Sensitive Species (see Appendix H).

The bald eagle (*Haliaeetus leucocephalus*) is a migrant and common winter resident of the Wyoming Powder River Basin region. On July 9, 2007, the USFWS published a Federal Register notice (72 FR 37346) announcing that the bald eagle would be removed from the list of threatened and endangered species under the

Endangered Species Act of 1973, as amended (16 U.S.C 1531 *et* seq.) on August 8, 2007. However, the protections provided to the bald eagle under the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668, and the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703, will remain in place. The bald eagle is now recognized as a Sensitive Species and is further discussed in the Sensitive Species Evaluation (Appendix H) of this EIS.

Raptors that commonly nest in the general analysis area are the golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, American kestrel, great horned owl, and burrowing owl. No nest sites have been documented in the general analysis area for northern harriers or short-eared owls, though occasional sightings of recently fledged young indicate that such activities do occur there for one or both of those species. Habitat is limited for those species that nest exclusively in trees or on cliffs, but several species are adapted to nesting on the ground, creek banks, buttes, or rock outcrops. Rough-legged hawks are winter residents in northeast Wyoming, and breed in the arctic regions.

Figure 3-16 shows the locations of raptor nests identified within the West Antelope II general analysis area. The two-mile wildlife perimeter is also shown. Since 1982, raptors have been monitored every year within this two-mile perimeter. Specific details regarding those nests, including their historical use by nesting raptors, will be provided in a future wildlife baseline report for that area. Previous information is available in the annual wildlife reports for the Antelope Mine. Over time, natural forces have destroyed many nests, while others have been relocated for mitigation or have been removed by mining activities. In some cases, nests have been created to mitigate other nest sites that were impacted by operations at the Antelope Mine.

During surveys completed in 2006 by Thunderbird-Jones & Stokes (J&S, formerly Thunderbird Wildlife Consulting), a total of six raptor species (golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, great horned owl, and burrowing owl) nested within the West Antelope II wildlife two-mile perimeter area (see Figure 3-16). Five of those six species have regularly nested within this area since annual monitoring began in 1982. Swainson's hawks began nesting in the area more recently, with the first nest documented within the survey area in 1998. Based on sightings of young, it is likely that at least one pair of American kestrels nested in one of the many small cavities present in the snags along Antelope Creek. Eighty-three raptor nests were intact within the entire wildlife two-mile perimeter area during the 2006 breeding season; one nest was removed prior to mining in the autumn.

In 2006, thirteen intact nests were on the LBA tract as applied for, including 1 golden eagle nest, 5 ferruginous hawk nests (four territories), and 7 burrowing owl nest sites (four territories). One ferruginous hawk nest was removed during autumn, 2006, due to encroaching mine operations. Three additional raptor nests were present on lands added under Alternatives 1 and 2: a ferruginous hawk nest in one of the above territories, one burrowing owl nest site, and one nest used

historically by red-tailed hawks and golden eagles (used solely by golden eagles since at least 1997). The remaining 67 intact nests were within two miles of the LBA tract. Only 5 of the 16 intact nests encompassed by the West Antelope II LBA tract or added lands were active during 2006: four on the tract itself and one on lands included with Alternative 1 and Alternative 2.

3.10.4.2 Environmental Consequences

3.10.4.2.1 Proposed Action and Alternatives 1 and 2

Mining the LBA tract would not impact overall regional raptor populations, however, individual birds or pairs may be impacted. Mining activity could cause raptors to abandon nests proximate to disturbance, particularly if mining encroaches on active nests during a given breeding season. USFWS recommends a one-mile buffer around all ferruginous hawk nests. In 2006, 11 ferruginous hawk nests in four territories were present within the West Antelope II general analysis area, with 5 nests in the BLM study area itself (LBA tract as applied for under the Proposed Action plus additional lands added by BLM under Alternative 1 and 2). A sixth nest was removed after that breeding season. Ferruginous hawks have actively nested (laid eggs) at only one of those sites in recent years, and that nest was last active in 2003.

For the last 15 years, monitoring data has indicated that the majority of nests within the general analysis area (the tract as applied for plus the additional area evaluated under Alternative 1 and 2, plus a one-quarter mile buffer) have served as alternate nesting sites for other active nests elsewhere within raptors' respective territories beyond that area. Nests of most other raptor species (including all of the others present on the LBA tract) are typically buffered by a one-quarter- or one-half-mile radius.

USFWS and WDEQ/LQD approval would be required before mining would occur within buffer zones for active raptor nests. The Antelope Mine annually monitors territorial occupancy and nest productivity on and around their existing leases. Several raptor pairs from multiple species have successfully nested within 200-1,000 feet of active mining at Antelope, including golden eagles, red-tailed hawks, and great horned owls. All five species represented on the LBA tract have successfully nested near active mining and construction areas throughout the PRB of northeast Wyoming. Those efforts have succeeded due to a combination of two things: 1) raptors becoming acclimated to the gradual encroachment of mine operations, and 2) successfully implemented progressive mitigation techniques to maintain viable raptor territories and protect nest productivity. Details documenting raptor nesting efforts and success near mine operations are available in the Antelope Mine Annual Wildlife Reports, on file with the WDEQ/LQD in Cheyenne, Wyoming.

Mining within or near raptor territories would impact availability of foraging habitat for nesting birds. However, increased acreage of reclamation within the

permit area would offset new habitat loss as mining progresses. Equipment yards associated with mining provide additional habitat for prey species such as cottontails, and several raptor pairs voluntarily nest near those areas. As at other surface mines throughout the region, raptor nesting efforts at Antelope Mine have typically been influenced primarily by natural factors such as prey abundance and availability of nesting substrates. Due to the lack of woody vegetation, raptors that nest in trees or on cliffs are not as abundant as those that either nest on the ground or are adaptable to nesting on mine facilities or other man-made structures (platform nests, etc.). During mining, new nesting habitat can be created through enhancement efforts like nest platforms, nest boxes, and tree plantings.

3.10.4.2.2 No Action Alternative

Impacts to raptor species under the No Action Alternative would be similar to the impacts described in Section 3.10.1.2.2, above.

3.10.5 Upland Game Birds

3.10.5.1 Affected Environment

Four upland game bird species have historically been documented within the West Antelope II general analysis area. These species are the mourning dove (*Zenaida macroura*), wild turkey (*Meleagris gallopavo*), gray (or Hungarian) partridge (*Perdix perdix*), and Greater sage-grouse (*Centrocercus urophasianus)*. However, the mourning dove is the most prevalent upland game bird in the general analysis area, and the only species known to occur with any regularity.

The mourning dove is a relatively common breeder in Campbell and Converse Counties. Doves are often seen in the area during migration, with fewer observations during the nesting season. Most sightings occurred near sites with water sources and trees, though they have occasionally been recorded in sagebrush or greasewood stands.

Wild turkeys have been seen infrequently over time, with spans of several years between observations. All observations occurred during spring, when males were gobbling. This species has been recorded along Antelope Creek, generally east of the LBA tract. However, they have also been seen on the tract itself, or along the creek channel west of the tract.

The gray partridge is an introduced species, and has also been occasionally documented in the general analysis area. Individual birds were observed in the vicinity of the study area in December 1984 and again in March 1985. No other sightings were recorded until December 1999, when snow tracks were seen within the current Antelope permit area, approximately one mile northeast of the southern block of the LBA tract, as applied for. No gray partridge have been observed in the general analysis area since then.

The Greater sage-grouse, hereafter referred to as sage-grouse, is a species of concern throughout the West, and is considered a "landscape species" which means that large expanses of unfragmented land are required in order to provide all the habitat components for their annual life cycle. Relying on sagebrush for food, cover, and shelter, sage-grouse require sagebrush habitat year-round and for every phase of their life cycle.

Sage-grouse breeding occurs on strutting grounds (leks) during late March and April. Leks are generally established in open areas surrounded by Wyoming big sagebrush which is used for escape and protection from predators. Generally, sage-grouse exhibit high fidelity to lek sites and return to the same liks year after year for breeding. Leks are considered to be the center of year-round activity for resident sage-grouse populations. On average, the majority of sage-grouse hens nest within 4 miles (6.2 km) of the lek. New spring plant growth, residual cover, and understory are important habitat components for nesting sage-grouse hens.

Areas near the nest are used for several weeks by hens for brood rearing. The habitats used during the first few weeks after hatching must provide good cover to conceal the chicks and must provide essential nutritional requirements during this period of rapid development. Brood-rearing habitats that have a wide diversity of plant species tend to provide a variety of insects that are important chick foods.

Summer habitat consists of sagebrush mixed with areas of wet meadows, riparian, or irrigated agricultural fields. As summer progresses and forbs mature and dry up, sage-grouse broods move to more mesic wet meadows where succulent plants and insects are still available. This can be especially important in drier years and during long drought periods. As fall nears, sage-grouse form flocks as brood groups break up. As fall progresses, sage-grouse move toward their winter ranges.

During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires sagebrush above snow. It is crucial that sagebrush be exposed at least 10 to 12 inches above snow level as this provides food and cover for wintering sage-grouse. Population and habitat analyses suggest that wintering habitat can be as limiting as breeding habitats. These seasonal movements are related to severity of winter weather, topography, and vegetative cover.

Since 1999, the USFWS has received eight petitions requesting that Greater sage-grouse be listed as threatened or endangered. Three of the petitions requested that Greater sage-grouse be listed as endangered across its entire range. On January 12, 2005, following a 12-month status review on the species, the USFWS concluded that listing was not warranted at that time. On December 4, 2007, U.S. District Court, District of Idaho, ruled that the USFWS 12-month petition finding on sage-grouse was in error and remanded the case back to the Service for further reconsideration. On February 26, 2008, the USFWS announced the initiation of another status review for the Greater sage-grouse.

USFWS has indicated the need for continued efforts to conserve sage-grouse and sagebrush habitat on a long-term basis, and has encouraged continued development and implementation of conservation strategies throughout the species' range. The sage-grouse is also a USDA-FS Region 2 Sensitive species and Management Indicator Species (see Appendix H).

In 2007, the Governor of Wyoming commissioned a Statewide Sage-grouse Implementation Team. On March 17, 2008, the team preliminarily identified and mapped recommended sage-grouse core breeding areas in Wyoming in an effort to better understand what types of habitat grouse prefer and what areas should be protected. The West Antelope II general analysis area is not located within the mapped core breeding areas.

On September 11, 2003, the Wyoming Game and Fish Commission announced that the 2003 hunting season for sage-grouse in Johnson, Sheridan, and Campbell Counties would be closed, following the deaths of 11 sage-grouse in northeastern Wyoming from West Nile Virus in August and early September of that year. According to a press release, the commission took this action because the incidence of infection was much higher in northeastern Wyoming than the rest of the state and the area is on the fringe of sage-grouse range with marginal, fragmented habitat (WGFD September 11, 2003 press release). Recent lek, or strutting ground, count data indicate that Wyoming's sage-grouse populations increased slightly from 2004 through 2007. Lower incidences of West Nile Virus mortalities were also documented in those years, primarily the result of cooler temperatures that reduced mosquito populations. Sage-grouse hunting seasons were consequently reopened in 2004 (Christiansen 2004).

The Antelope Mine has conducted annual searches for sage-grouse leks within the existing permit area and one-mile perimeter as part of its wildlife monitoring program since 1982. Baseline inventories that encompassed a two-mile perimeter around the permit area were conducted in the late 1970s, 1998, and 2003. Most of the surveys conducted since the early 1980s have included the eastern two-thirds of the West Antelope II general analysis area and its two-mile perimeter, with more complete coverage (up to 80%) in recent years. The entire general analysis area and most of its two-mile perimeter were surveyed in spring 2003 as part of annual monitoring or baseline studies for the Antelope Mine and its West Antelope expansion, respectively. Those surveys included the limited sagebrush stands in the general analysis area. At least 80% of the LBA general analysis area has been surveyed annually since then as part of annual monitoring efforts for the Antelope Mine. In May 2002, the USFWS office in Cheyenne, Wyoming, released a list entitled *Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming*, which replaced the previous *Migratory Birds of High Federal Interest List*. The Greater sage-grouse is included on the updated list, giving further impetus to ongoing annual survey efforts.

The sage-grouse is a year-round resident throughout much of the PRB, but is rare in the vicinity of the West Antelope II general analysis area and the adjacent

Antelope Mine. Sage-grouse require vast expanses of sagebrush-steppe communities with extensive mosaics of sagebrush of varying densities and heights. There are no large expanses of contiguous sagebrush in the West Antelope II general analysis area. The lack of use of that region by sage-grouse has been well documented from the late 1970s through 2006. The most recent evidence of sage-grouse in the vicinity occurred in early July 2006, when grouse droppings and feathers were seen in a sage draw approximately 1.5 miles southeast of the general analysis area. The prevalence of sign in that area indicated that multiple grouse had recently foraged in that drainage. The last grouse sighting prior to that occurred in a draw approximately 1.25 miles southwest of the general analysis area in the early 1990s.

As discussed in Section 3.9, sagebrush is a component of the Wyoming big sagebrush upland, birdsfoot sagebrush upland, and silver sagebrush upland vegetation types, which account for approximately 30 percent of the general analysis area. Potential sage-grouse habitat is limited to relatively small scattered sagebrush stands with no large expanses of contiguous sagebrush within several miles of the area. Consequently, few sage-grouse have ever been documented in the area, and no grouse leks, nests, or broods have ever been discovered on or within 2.0 miles of the West Antelope II general analysis area. Due to the ephemeral nature of the drainages in that area, little potential brood-rearing habitat is present. The nearest known sage-grouse lek is the Steckley Road Complex, approximately three miles away in T40N R70W, SE NW Section 29. A thorough history of sage-grouse survey efforts and observations within two miles of the LBA tract is presented in Appendix H of this EIS document.

3.10.5.2 Environmental Consequences

3.10.5.2.1 Proposed Action and Alternatives 1 and 2

Leasing and mining the West Antelope II LBA tract would affect some potential habitat for mourning doves, wild turkeys, and gray partridge. A portion of the best habitat (cottonwood corridor) along Antelope Creek is within the 100-foot non-disturbance zone on either side of the channel. Even though the corridor is protected by a 100-foot non-disturbance zone, as mining moves adjacent to the corridor the habitat will likely be less attractive and less accessible to upland game birds and other wildlife. While woody corridors are not abundant in the general analysis area, they also are not unique to the LBA tract. Similar habitat is present immediately west of the tract, where mining is not projected to occur in the near future. Additionally, sightings of turkeys and partridge are infrequent in the area, and doves are not restricted to treed habitats.

Overall, the sage-grouse population has been steadily declining in Wyoming and across the rest of the West. A study prepared by the Western Association of Fish and Wildlife Agencies estimated that sage-grouse populations in western North America declined at an overall rate of 2.0 percent per year from 1965 to 2003 (Connelly et al. 2004). The decline rate was larger from 1965 to 1985, with

populations stabilizing and some increasing from 1986 to 2003. For Wyoming, this study estimated that sage-grouse populations declined at an average rate of 9.66 percent from 1968 to 1986, and at an average rate of 0.33 percent per year from 1987 to 2003. Population lows were reached in the mid-1990s and there has been some gradual increase in numbers since that time (Connelly et al. 2004).

The West Antelope II LBA tract is within the Northeast Wyoming Local Sage-Grouse Working Group (NWLSWG) Area. It includes portions of the WGFD Sheridan and Casper regions and the USDA-Forest Service Thunder Basin National Grassland. Sage-grouse monitoring has occurred within the NWLSWG Area since 1967. Within this area, sage-grouse population trends have exhibited a cyclical pattern, with each successive peak of a cycle being lower than the preceding peak. This suggests a long term population decline since at least 1967 (Figure 3-18).

Population trends within the NWLSWG Area appear to be mirroring statewide trends in Wyoming, although the average number of males per lek in the NWLSWG Area, including in the Thunder Basin National Grassland, has typically been lower than those observed statewide (Figure 3-19). Since 1996, sage-grouse populations within the state and in northeast Wyoming have fluctuated but exhibited an overall increase, with a recent peak in male lek attendance occurring in 2000 or 2001.

The causes of the range-wide decline in sage-grouse population levels are not fully understood, but they may be influenced by local conditions. However, habitat loss due to disturbance of leks, nesting and brood-rearing areas as a result of increasing development, drought, and the potential for West Nile virus, as well as loss of population connectivity are key threats to this species (Braun 1998, Wisdom et al. 2002, Naugle et al. 2004).

Some potential impacts of mineral development (including coal mining and oil and gas development) on sage-grouse include: (1) direct habitat loss and fragmentation from mine, well, road, pipeline, transmission and power line construction, (2) alteration of plant and animal communities, (3) increased human activity which could cause animals to avoid the area, (4) increased noise, which could cause animals to avoid an area or reduce their breeding efficiency, (5) increased motorized access by the public leading to legal and illegal harvest, (6) direct mortality associated with water evaporation ponds and production pits, and (7) reduced water tables resulting in the loss of herbaceous vegetation. Some of these impacts are short-term and related to specific periods of activity. In some cases, mineral development may result in positive effects, which may include increased forb production, habitat diversity, and additional water sources. Some impacts may be long-term (30 years or more), and rehabilitation of impacted habitats may take many years to complete (WGFD 2003).

Areas of suitable habitat for nesting and strutting grounds are needed to sustain sage-grouse populations. One recent study suggests that availability of winter

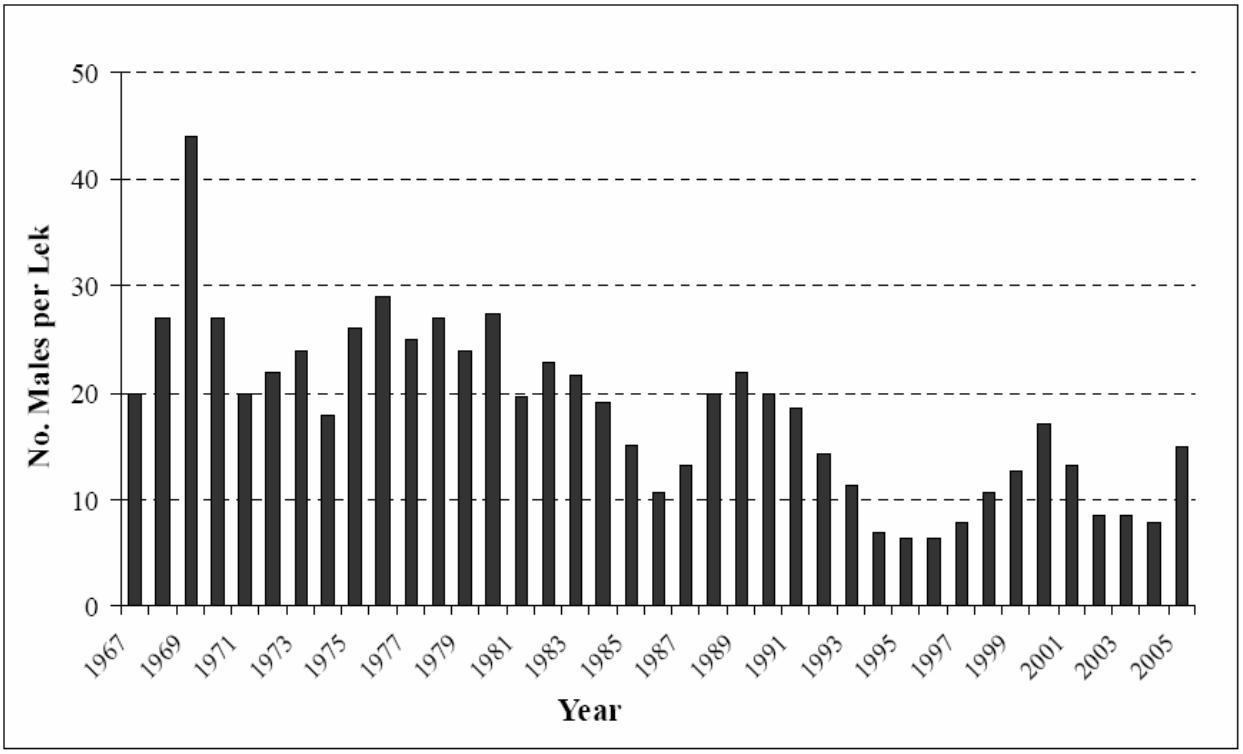


Figure 3-18. Average Male Sage-Grouse Lek Attendance Within the Northeast Wyoming Local Working Group Area (1967-2005).

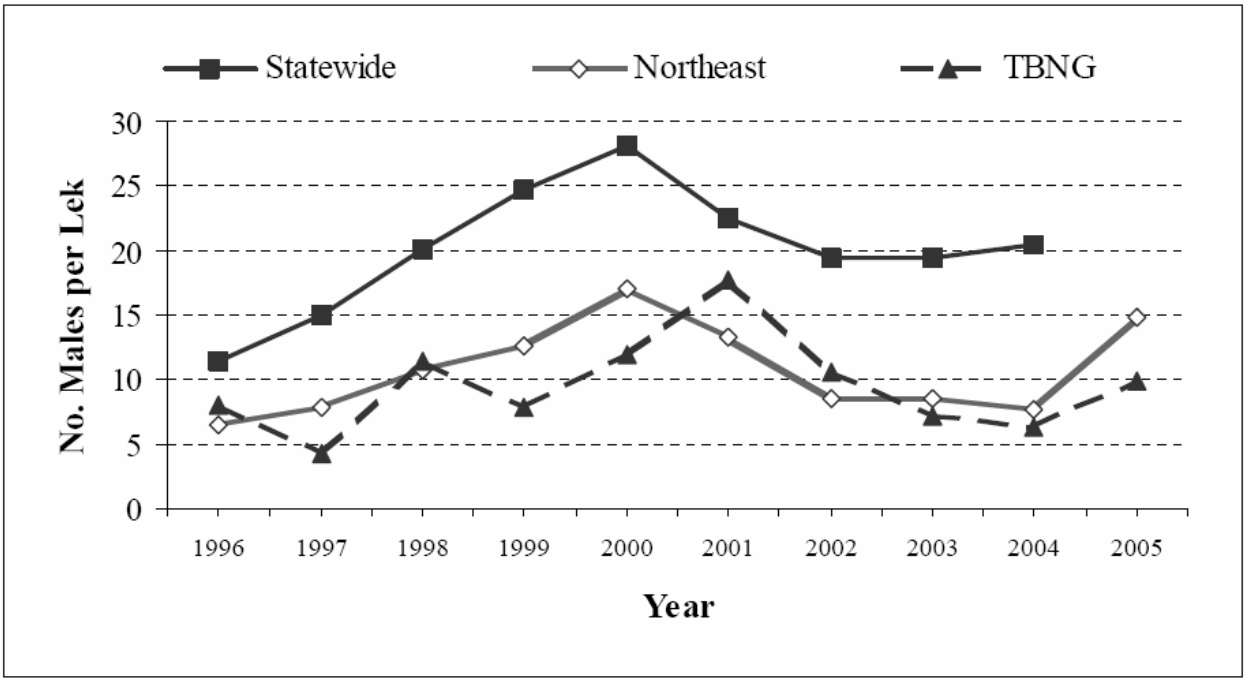


Figure 3-19. Average Male Sage-grouse Lek Attendance Statewide, Within the Northeast Wyoming Local Sage-Grouse Working Group Area, and Within the Thunder Basin National Grasslands (1996-2005).

habitat may also affect sage-grouse populations (Naugle et al. 2006). When mining occurs in potential sage-grouse habitat, there is a short-term loss of potential nesting habitat and potential disturbance to breeding activities especially when mining operations occur in proximity to sage-grouse leks. Following reclamation, there may be a long term loss of nesting and winter habitat, depending on the amount of sagebrush that is restored relative to the amount of sagebrush that was present before mining. Should the BLM study area be leased, mined, and reclaimed, alterations in the topography and vegetative communities would likely result in such changes in species composition from pre-mine conditions. Some vegetative communities currently present in the tract, such as low-growth species (e.g., blue grama, and birdsfoot sagebrush) and big sagebrush, are often difficult to reestablish through artificial plantings. Until sagebrush returns to its premining density levels, there would be a reduction in potential habitat for wildlife species associated with this habitat in the West Antelope II general analysis area. However, given the limited presence of sage stands in the area, it is not likely that many sagebrush obligates would be affected.

If mining activities disturbed a lek, sage-grouse would have to use an alternative lek or establish a new lek site for breeding activities. Fidelity to lek sites has been well documented (WGFD 2003), but monitoring of sage-grouse activities has indicated that the birds may change lek sites.

Baseline (1978-1979, 1998, 2003) and annual monitoring studies (1982-2006) have repeatedly demonstrated that sage-grouse do not inhabit the Antelope Mine area, although some small areas with marginal potential habitat are present. As described previously, those surveys encompassed most of the West Antelope II general analysis area and its two-mile perimeter for much of that period. No sage-grouse leks, nests, or broods were observed in that region during any survey year. Given the limited sightings of sage-grouse observations in the area, and the minimal quantity and marginal quality of potential sage-grouse habitat, implementation of the Proposed Action or either Alternative 1 or 2 is not likely to negatively impact any existing or potential sage-grouse leks, and will not impact prevalent sage-grouse habitats (expanses of sagebrush). Refer to Appendix H of this EIS document for more details regarding sage-grouse in the general analysis area.

3.10.5.2.2 No Action Alternative

Impacts to upland game birds under the No Action Alternative would be similar to the impacts described in Section 3.10.1.2.2, above.

3.10.6 Other Birds

3.10.6.1 Affected Environment

USFWS uses a list entitled *Migratory Bird Species of Management Concern in Wyoming,* specifically the *Coal Mine List of 40 Migratory Bird Species of*

Management Concern in Wyoming, for reviews related to existing and proposed coal mine leased land (USFWS 2002b). This list was taken directly from the Wyoming Bird Conservation Plan (Cerovski et al. 2001). The *Migratory Bird Species of Management Concern in Wyoming* replaced the *Migratory Birds of High Federal Interest* (MBHFI) list. The Antelope Mine has conducted annual surveys for avian species of concern since at least 1994, incorporating new lists and survey protocols as they are issued. Surveys occur in spring and summer to document migrating and breeding birds, and include the permit area and one-half-mile perimeter.

Results from surveys for migratory birds at the Antelope Mine are available in baseline and annual wildlife reports, on file with the WDEQ/LQD in Cheyenne, Wyoming. Those reports include a tabulation of the regional status, expected occurrence, historical observations, and breeding records for each species on the current list of avian species of concern for a given report year, as well as two or more preceding years. Additional information for each species observed within the given year is provided in the text of those reports.

Non-raptor avian species that have been documented within the Powder River Basin and are included on both the *Coal Mine list of Migratory Bird Species of Management Concern* and at least one more list of special status species include the mountain plover (*Charadrius montanus*), long-billed curlew (*Numenius americanus*), yellow-billed cuckoo (*Coccyzus americanus*), sage thrasher (*Oreoscoptes montanus*), loggerhead shrike (*Lanius ludovicianus*), Baird's sparrow (*Ammodramus bairdii*), sage sparrow (*Amphispiza belli*), Brewer's sparrow (*Spizella breweri*), and Greater sage-grouse. Of those species, the mountain plover, long-billed curlew, loggerhead shrike, Brewer's sparrow, and sage-grouse have been recorded within the general analysis area for the West Antelope II LBA tract; only the mountain plover, loggerhead shrike, and Brewer's sparrow are known or suspected to nest in that vicinity.

Raptor species that have been documented in the Powder River Basin and are on the *Coal Mine list of Migratory Bird Species of Management Concern* and on at least one other list of special status species include the bald eagle, ferruginous hawk, burrowing owl, and short-eared owl. Each of those species has been documented in the general analysis area, with all but the bald eagle known or suspected to nest there. Those species are discussed at length in Appendix H of this EIS.

In sum, nineteen of the 40 species on the current list have historically been observed at least once within the general analysis area. Species that have been recorded nesting in the area include the mountain plover, ferruginous hawk, Swainson's hawk, burrowing owl, and loggerhead shrike. Species that are presumed to nest in the area, based on their presence and behavior during the breeding season, include the McCown's longspur (*Calcarius mccownii*), Brewer's sparrow (*Spizella breweri*), lark bunting (*Calamospiza melanocorys*), chestnut-collared longspur (*Calcarius ornatus*), vesper sparrow (*Pooecetes gramineus*), and lark sparrow (*Chondestes grammacus*). Based on habitat requirements and

infrequent sightings, long-billed curlews, short-eared owls, upland sandpipers (*Bartramia longicauda*), and grasshopper sparrows (*Ammodramus savannarum*) could potentially nest in the area, but have not been documented doing so. Most observations of those species were limited to spring, so they were presumed to be migrants. The remaining four species historically documented in the area have been restricted to specific seasons (bald eagle-winter), rarely observed (sage-grouse), or recorded only once each (red-headed woodpecker [*Melanerpes erthrocephalus*] and barn owl [*Tyto alba*]). The ferruginous hawk, burrowing owl, loggerhead shrike, both longspurs, Brewer's sparrow, long-billed curlew, and Greater sage-grouse are all discussed in detail in Appendix H of this EIS document.

The mountain plover is included on the list of *Migratory Bird Species of Management Concern in Wyoming*. The mountain plover was designated as a proposed threatened species by the USFWS in October, 2001 (USFWS 2001). USFWS subsequently published a withdrawal of the proposed rule to list the mountain plover as threatened on September 9, 2003 (USFWS 2003). The USFWS continues to encourage provisions that would provide protection for this species, as it continues to be protected under the Migratory Bird Treaty Act, and as a sensitive species under BLM policy (Bureau Manual 6840.06 E. Sensitive Species).

The history of mountain plovers at the Antelope Mine and surrounding area is well documented. Mountain plovers were first recorded in the general analysis area during baseline studies for the mine in 1978 and 1979. Annual monitoring for this species began in 1982 and continued through 2006, and coincidentally included much of the West Antelope II general analysis area. Because mountain plovers are known to nest in the general analysis area, the Antelope Mine specifically addressed this species in its Avian Monitoring and Mitigation Plan, which was approved by USFWS. The mine also incorporated species-specific protective measures into its state mining permit, providing additional guidance and mitigation options regarding mountain plovers. Further details regarding the occurrence of this species within and near the LBA tract are provided in Appendix H of this EIS document.

The bald eagle, a USDA-FS and BLM Sensitive Species, is seasonally common and is most frequently observed during the winter months. Bald eagles are relatively common winter residents and migrants in northeastern Wyoming's PRB, but only rarely nest in that region. No bald eagle nests or winter roosts have been documented within one mile of the West Antelope II general analysis area during either baseline or annual monitoring studies since they began in 1978 and 1982, respectively.

The general analysis area includes only limited bald eagle nesting and roosting potential habitat in the form of scattered, decaying cottonwoods along Antelope Creek and isolated trees or small (five trees or less) stands of cottonwoods along Antelope or Spring Creeks, and their primary tributary draws. In general, the area does not contain consistent yearly, concentrated prey or carrion sources (e.g.,

fisheries, large groups of big game, waterfowl, sheep, etc.) that would be expected to attract bald eagles. This species is typically seen infrequently in the general vicinity of the West Antelope II LBA tract, and only during winter. Additional information about the observed occurrence of the bald eagle on the LBA tract can be found in the Sensitive Species Evaluation (Appendix H) of this EIS document.

Swainson's hawks have nested in the general vicinity of the Antelope Mine for the last few years. However, it wasn't until 1998 that this species nested within the raptor survey area for the LBA tract. Since then, five separate territories have been identified, though only one or two have been active within a given year. Because of the limited number of trees in the area and the fact that Swainson's hawks return to the region relatively late (mid-April) in the spring after most other raptor species have initiated nesting, few Swainson's hawks nests have been established in the area.

Burrowing owls were first recorded nesting in the Antelope Mine two-mile perimeter wildlife survey area in 1991, and owls have nested in that general vicinity during 14 of the last 16 years. All known burrowing owl nest sites throughout the entire West Antelope II general analysis area were in prairie dog burrows, and are therefore considered intact. Four additional artificial nest boxes have been constructed in the two-mile perimeter wildlife survey area for mitigation purposes since 1994, but no owls have ever been observed at or near them. Five pairs of burrowing owls have nested in the general analysis area, with all five pairs within the BLM study area itself (LBA tract as applied for plus added lands). Four of the five pairs have been active at least once in the last five years.

Lark buntings and vesper sparrows have been recorded in the general analysis area during each of the last 13 years (1994-2006). Lark buntings generally return to the area from migration in early May, while vesper sparrows are typically present in April. Results from general surveys and breeding bird point counts over time indicate that the lark bunting is the most abundant breeding bird of management concern in the area. The vesper sparrow is also quite common in most years. Both species are typically observed in all habitats in the general analysis area throughout spring and summer, and are presumed to nest in the vicinity.

Lark sparrows have also been recorded with some regularity in the general analysis area over the years. Lark sparrows inhabit a wide variety of habitats (Rising 1997), but were most often observed in relatively rugged terrain. It may be that some features associated with this species' breeding habitat, such as open areas of low scrub or scattered trees (Harrison 1984, Peterson 1990), are more prevalent in the breaks, thus the higher number of sightings there. Grasshopper sparrows have occasionally been recorded in the general analysis area, but most sightings have been in the relatively mature stands of reclaimed grassland associated with the Antelope Mine, approximately one mile east of the LBA tract. In the Great Plains region, including the PRB, grasshopper sparrows are typically associated with taller grassland vegetation, such as that found in mature

reclamation areas (Vickery 1996).

Short-eared owls and upland sandpipers have occasionally been recorded in the general analysis area. Most observations of these species consisted of migrants and non-breeding adults. Although potential nesting habitat is present, neither species has been known to nest in the area. The barn owl and red-headed woodpecker each were recorded in the general analysis area once since wildlife surveys were initiated in 1978. A single adult barn owl was seen perched on the bank of a draw near Antelope Creek in NW¼ Section 34, T.41N., R.71W., approximately 1.0 mile from the West Antelope II LBA tract, during lagomorph surveys in fall 2001. The first and only sighting of a red-headed woodpecker occurred in the cottonwood corridor along Antelope Creek in NE¼ SW¼ Section 33, T.41N., R.71W. during breeding bird surveys for the West Antelope baseline studies in mid-June, 2003. That observation occurred approximately 1.25 miles from the nearest edge of the LBA tract.

The remaining 21 migratory bird species of management concern have never been recorded in the general analysis area. Suitable habitat that would support these species like coniferous woodlands, large expanses of native prairie, lush riparian corridors, and large persistent bodies of water are scarce if not absent in the general analysis area.

Under natural conditions, the West Antelope II LBA tract provides extremely limited and marginal habitat for waterfowl and shorebirds. The natural aquatic habitat, prior to CBNG development in the general analysis area, was mainly available during spring migration as ponds (primarily stock reservoirs) and ephemeral streams. Many of these water features generally were reduced to small, isolated pools or were completely dry during summer. However, the recent development of CBNG resources on and upstream of the general analysis area has enhanced the water resources available in the area in the last two years, resulting in somewhat improved habitat for waterfowl and shorebirds. Waterfowl and shorebird observations have primarily consisted of relatively low numbers of common species, often restricted to spring migration. Few broods have been recorded in the area during baseline or annual monitoring studies due to limited and unreliable water resources in the area. Avian species typically associated with aquatic habitats in the general analysis area include, but are not limited to, the mallard duck (*Anas platyrhynchos*), killdeer (*Charadrius vociferus*), and red-winged blackbird (*Agelaius phoeniceus*).

3.10.6.2 Environmental Consequences

3.10.6.2.1 Proposed Action and Alternatives 1 and 2

Of the 19 Migratory Bird Species of Management Concern in Wyoming that have historically been observed in the general analysis area at least once, 11 species are classified as Level I (those identified as needing conservation action). Six of those 11 species are known or presumed to nest in and near the West Antelope II

general analysis area: the mountain plover, McCown's longspur, ferruginous hawk, burrowing owl, Brewer's sparrow, and Swainson's hawk. The first three species have regularly nested in the area over the last two decades of annual monitoring. In contrast, the latter three species nested less frequently, in part due to more limited nesting habitat (prairie dog colonies, small stands of sagebrush, isolated mature trees, respectively) present within the general analysis area. Bald eagles are seasonally present, and have been observed perched or foraging in the area in many years during winter. No bald eagle nests have ever been documented within several miles of the LBA general analysis. Other Level I species historically recorded in the area included the Greater sage-grouse, long-billed curlew, short-eared owl, and upland sandpiper. None of those species have ever been documented to display breeding behaviors or nest in the general analysis area.

When the West Antelope II tract is mined, current existing habitat within and near the tract for these 11 Level I species would be destroyed during mining. The habitat loss would be relatively short-term for some grassland species, but would last much longer for shrub-dependent species and other species requiring more specialized habitats. The current reclamation plan and practices for the Antelope Mine are designed to provide a mosaic of upland grass and sagebrush habitats that would potentially host most of these species.

Natural regrowth of some habitats (e.g., birdsfoot sagebrush) and recolonization of others (prairie dog colonies) would contribute to those reclamation efforts. Trees within the general analysis area are limited to two isolated stretches along Spring Creek and Antelope Creek. No trees would be removed from the Antelope Creek corridor due to the required buffer zone along that channel. Approximately 15 trees would be removed from the Spring Creek drainage. Some of the latter trees will be placed as snags in reclamation; all of those trees will be replaced with new trees along the drainage during reclamation.

Prairie dog translocations are no longer authorized in the area, but natural recolonization would also enhance reclamation efforts for those species with more specialized habitat needs, such as mountain plovers and burrowing owls. Both species nest in prairie dog colonies within the general analysis area. Periodic breeding bird surveys at other surface mines with similar habitats in the region since the mid-1980s have demonstrated that species richness and abundance in reclaimed habitats are equal to or greater than in their native counterparts, though species composition may not be the same due to differences between pre- and post-mining vegetation. Antelope Mine survey methods and results are available in annual wildlife monitoring reports on file with the WDEQ/LQD in Sheridan, Wyoming.

Specific impacts to and mitigation measures for avian species of management concern such as mountain plovers, bald eagles, sage-grouse, ferruginous hawks, and others are included in the preceding discussions or in Appendix H of this EIS document. In addition to those efforts, the availability of existing suitable habitat

beyond the general analysis area may provide off-site options for displaced species and individuals, provided that those areas are not already at carrying capacity for the various species.

Mining the LBA tract would have a negligible effect on migrating and breeding waterfowl and shorebirds. Sedimentation ponds created during mining would provide interim habitat for these fauna; such ponds are readily used by these species at other coal mines in the region. Antelope Creek would not be physically disturbed, but active mining on one or both sides could inhibit use by aquatic avian species. Any diverted creek channels would not provide the same habitat as the natural stream channel, though natural stream flow and the presence of CBNG discharge water in some areas would not be affected.

The current reclamation plan for the Antelope Mine requires that any portion of a stream channel affected by currently permitted mining be reclaimed to restore its pre-mining functions and aquatic habitats (special provisions are in place for Horse Creek and Spring Creek AVF areas). If the West Antelope II tract is leased and mined, these reclamation efforts would be extended onto the portion of the stream affected by mining the new tract. Replacement of all impacted jurisdictional wetlands would be required in accordance with Section 404 of the CWA (Section 3.7). If the replaced wetlands on the tract do not duplicate the exact function and/or landscape features of the pre-mine wetlands, waterfowl and shorebirds could potentially be positively or adversely affected as a result.

3.10.6.2.2 No Action Alternative

Impacts to migratory bird species, waterfowl, and shorebirds under the No Action Alternative would be similar to the impacts described in Section 3.10.1.2.2, above.

3.10.7 Amphibians, Reptiles, and Aquatic Species

3.10.7.1 Affected Environment

Wildlife surveys completed specifically for the applicant and other mines in the area, as well as biological research projects in the eastern PRB, have documented numerous other wildlife species that inhabit the region, including various amphibians, reptiles, and aquatic species. All of these species are locally common inhabitants of the area, depending on the quantity and quality of aquatic habitats present.

Under natural conditions, aquatic habitat in the general analysis area is limited by the intermittent and ephemeral nature of surface waters. The lack of deep-water habitat and extensive and persistent water sources limits the presence and diversity of fish and other aquatic species. As discussed above, water discharged from CBNG wells has enhanced the water supply within some drainages in the general analysis area, including Spring Creek, which has increased potential habitat for some aquatic species. However, those enhanced areas are still

relatively limited and/or isolated in nature, and no perennial drainages are present in the general analysis area.

Baseline aquatic studies were completed for the Antelope Mine during the original baseline surveys and covered Antelope Creek at, and downstream from, the confluence with Spring Creek (Commonwealth Associates 1980). Several common fish species were found on the upper Antelope Creek sampling station (located at the Spring Creek confluence, east of the LBA tract) during those efforts: the plains minnow (*Hybognathus placitus*), green sunfish (*Lepomis cyanellus*), and plains killifish (*Fundulus zebrinus*). Those species are either tolerant of intermittency or are adapted to shallow, sandy bottom streams. Horse Creek, which crosses the northern extent of the general analysis area, was sampled in June 1998 during baseline studies; the green sunfish was the only fish species caught (PRES 1999). Spring Creek has not historically exhibited flow persistent enough to warrant aquatic sampling. Specific sampling was also not conducted during the West Antelope baseline, but no fish were observed in that tract during incidental observations during other wildlife surveys along Antelope and Spring Creeks.

Few reptiles and amphibians have been recorded during wildlife surveys conducted in the general analysis area over the years. The relatively low quantity and quality of aquatic habitat in the area reduces its potential to attract these species, particularly amphibians and turtles. The boreal chorus frog (*Pseudacris triseriata*) has been the most common herptile observed in the area during baseline and annual monitoring surveys over the last two decades. These frogs have been heard in all three primary creeks in the area during spring. Other less common species recorded on or near the general analysis area over time included the Woodhouse's toad (*Bufo woodhousei*), northern leopard frog (*Rana pipiens*), and tiger salamander (*Ambystoma tigrinum*). Prairie rattlesnakes (*Crotalus viridis*) have been observed in a prairie dog colony approximately one mile northeast of the southern portion of the tract. Other dry land species, such as the eastern shorthorned lizard (*Phrynosoma douglassi*) and bullsnake (*Pituophis melanoleucas*), are likely to occur in the general analysis area. Many of these fish, amphibian, and aquatic species are also USDA-FS Sensitive species (see Appendix H).

3.10.7.2 Environmental Consequences

3.10.7.2.1 Proposed Action and Alternatives 1 and 2

Mining activities in the general analysis area would remove intermittent and ephemeral habitat for amphibians, reptiles, and other aquatic species in portions of Spring Creek and Horse Creek during active mining; Antelope Creek would not be physically disturbed. Under natural conditions, habitat for aquatic species is limited on the West Antelope II LBA tract as applied for, and few observations of those species have been recorded in the general analysis area over time. Additionally, primary channels and surface water flow affected during mining would be restored during reclamation. Aquatic species recorded in native and reclaimed channels at other mines in the PRB have been similar to those recorded

at the Antelope Mine.

Under jurisdiction of Antelope Mine's current WDEQ/LQD mine permit, portions of Horse Creek and Spring Creek have been, or will be, disturbed or diverted in order to recover coal from existing coal leases (Section 3.5.2.1). Antelope Creek will not be physically disturbed under the current WDEQ/LQD mine permit and would not be disturbed by mining operations in the general analysis area. Reclamation of the stream channel and restoration of surface water flow quantity and quality after mining to approximate pre-mining conditions would restore aquatic resources of those creeks.

3.10.7.2.2 No Action Alternative

Impacts to reptiles, amphibians, and other aquatic species under the No Action Alternative would be similar to the impacts described in Section 3.10.1.2.2, above.

3.10.8 Threatened, Endangered, Proposed, Candidate Species, BLM Sensitive Species, and USDA-FS Region 2 Sensitive Species and Management Indicator Species

Refer to Appendices H and I.

3.10.9 Regulatory Compliance, Mitigation and Monitoring

Regulatory guidelines and requirements designed to prevent or reduce surface coal mining impacts to wildlife include:

- fencing designed to permit pronghorn passage to the extent possible;
- development of a Monitoring and Mitigation Plan for raptors and other migratory bird species of management concern that must be approved by the USFWS, including the following provisions:
    - creation of raptor nests and nesting habitat through enhancement efforts (nest platforms, tree plantings) to mitigate other nest sites impacted by mining operations;
    - relocation of active and inactive raptor nests that would be impacted by mining in accordance with the approved raptor monitoring and mitigation plan;
    - obtaining permits for removal and mitigation of golden eagle and other raptor species' nests;
    - buffer zones for protection of raptor nests;

  - restriction of mine-related disturbances from encroaching within stipulated buffers of active raptor nests from egg-laying until fledging to prevent nest abandonment and injury to eggs or young;
  - reestablishment of the ground cover necessary to attract and sustain a suitable raptor prey base after mining; and
  - required use of raptor-safe construction for overhead power lines;

- development of a Migratory Bird Species of Management Concern for Coal Mines in Wyoming Monitoring and Mitigation Plan, which must be approved by USFWS;
- restoration of sage-grouse habitat after mining including reestablishment of sagebrush and other shrubs on reclaimed lands and grading of reclaimed lands to create swales and depressions for sagebrush obligates and their young;
- restoration of short-grass habitat for species that nest and forage in those habitat types;
- restoration of diverse landforms, direct topsoil replacement, and the construction of brush piles, snags, and rock piles to enhance habitat for wildlife;
- restoration of habitat provided by jurisdictional wetlands; and
- reclamation of the stream channels and restoration of surface water flow quantity and quality after mining to approximate pre-mining conditions.

Antelope Mine's current mine permit requires reconstruction of bed form features such as pools and runs in the stream channels of Spring Creek and Horse Creek. Those efforts should help restore the channels' natural form and function, as well as provide habitat. Restoration will be achieved by salvaging sufficient material from channel terrace alluvium to reconstruct naturally-occurring features. Current reclamation, as well as future reclamation of those creeks by the Antelope Mine, would incorporate alluvium salvaged from the original channels. Similar measures would be incorporated in the amended mining and reclamation plans, if the LBA tract was leased and permitted for mining.

Baseline wildlife surveys were conducted for the Antelope Mine before mining operations began. Annual wildlife monitoring has been ongoing since the early 1980s. These surveys are required by state and federal regulations. The wildlife monitoring surveys cover the lands within the approved mine permit area and a surrounding perimeter that varies in size according to the species being considered. As a result, a majority of the West Antelope II general analysis area has been encompassed during the required monitoring efforts for the Antelope Mine.

The required annual wildlife monitoring program currently consists of the following:

- early spring surveys for new and/or occupied raptor territories and/or nests, upland game bird lek locations, T&E species, and migratory birds on and around the existing leases;
- late spring surveys for migratory birds and raptor production at occupied nests, opportunistic observations of all wildlife species, and T&E species;
- summer surveys for raptor production at occupied nests, migratory birds, and lagomorph density.

Surface coal mines in the PRB were required to conduct seasonal surveys for big game species and brood surveys for upland game birds annually from 1994-1999. At the end of that period, the WGFD reviewed monitoring data and requirements for those species on mine properties. WGFD biologists concluded that the monitoring had demonstrated a lack of impacts to big game on existing mine sites, and that the brood surveys were not providing meaningful data. Additionally, no severe mine-related big game mortalities had occurred and no long-lasting impacts to big game had been documented on existing mine sites. The WGFD therefore recommended in late 1999 that big game monitoring and upland game bird brood surveys be discontinued on all existing mine sites. New mines will be required to conduct big game monitoring if located in crucial winter range or in significant migration corridors, neither of which are present within the West Antelope II general analysis area.

Although big game surveys are no longer required, the Antelope Mine voluntarily elected to continue winter aerial and ground counts in alternate years to enhance previous annual data for those species. Numerous other mines in the PRB also conduct these voluntary surveys on the same schedule as Antelope Mine.

The Antelope Mine operates under a current USFWS approved Monitoring and Mitigation Plan for raptors and other migratory bird species of management concern. The plan would be amended to include the West Antelope II LBA tract if it is leased and permitted for mining. The amended plan would be subject to review and approval by the USFWS before the amended mining plan is approved.

If the current *Coal Mine List of Migratory Bird Species of Management Concern in Wyoming* is updated, or if additional species are documented nesting or using the area regularly, the current Monitoring and Mitigation Plan would be amended to incorporate and protect those birds and their habitats.

3.10.10 Residual Impacts

Although the West Antelope II LBA tract would be reclaimed in accordance with the requirements of SMCRA and Wyoming statutes, there would still be some residual wildlife impacts. The topographic moderation would result in a

permanent loss of habitat diversity and a potential decrease in slope-dependent shrub communities. This would reduce the carrying capacity of the land for shrub-dependent species. Reclamation standards for bond release may also limit replacement of habitat for some species such as the mountain plover, which occupy somewhat specialized, low-growth form habitats. Those species may repopulate reclaimed areas, but populations may not attain pre-mining levels without special variances to accommodate those specific needs. For example, every effort would be made to preserve source populations of prairie dogs in the vicinity of development, as these animals can be valuable in restoring similar structural characteristics of pre-mine grassland species through regular clipping and harvesting of vegetation.

Limited riparian and sagebrush-grassland habitat is present in the general analysis area. Areas that currently support sagebrush would be altered to a grassland community, perhaps for decades, during the interim between sage plantings and maturity in reclamation. Such habitat transformations would likely result in a change in wildlife species composition until pre-mining habitats had been fully reestablished. Because state and federal regulations require reclamation of specific habitats, minimal residual impacts to T&E, Candidate, or Proposed plant and animal species are expected to occur.

3.11 Land Use and Recreation

3.11.1 Affected Environment

Within the West Antelope II LBA tract as applied for, surface ownership consists entirely of private lands. Federal land administered by the USDA-FS is included within the area added under Alternatives 1 and 2. The present land use of the general analysis area is primarily livestock grazing and wildlife habitat. Gas production and recreation are secondary land uses. Surface ownership for the West Antelope II LBA tract is shown in Table 3-12 and Figure 3-20.

Table 3-12. Distribution of Surface Ownership Within the West Antelope II LBA Tract as Applied for Under the Proposed Action and Additional Lands Added Under Alternatives 1 and 2.

	Federal Ownership		**Private Ownership**	
LBA Tract Configuration	**(Acres)**	**(Percent)** [1]	**(Acres)**	**(Percent)** [1]
Tract As Applied For	0	0	4108.6	65.1
Additional Lands Added Under Alternatives 1 and 2	237.2	3.8	1963.4	31.1
Total	**237.2**	**3.8**	**6072.0**	**96.2**

[1] Based on total acres (Proposed Action plus Alternatives 1 and 2).

As indicated in Table 3-12, approximately 240 acres of federal surface administered by the USDA-FS is included in the West Antelope LBA tract under

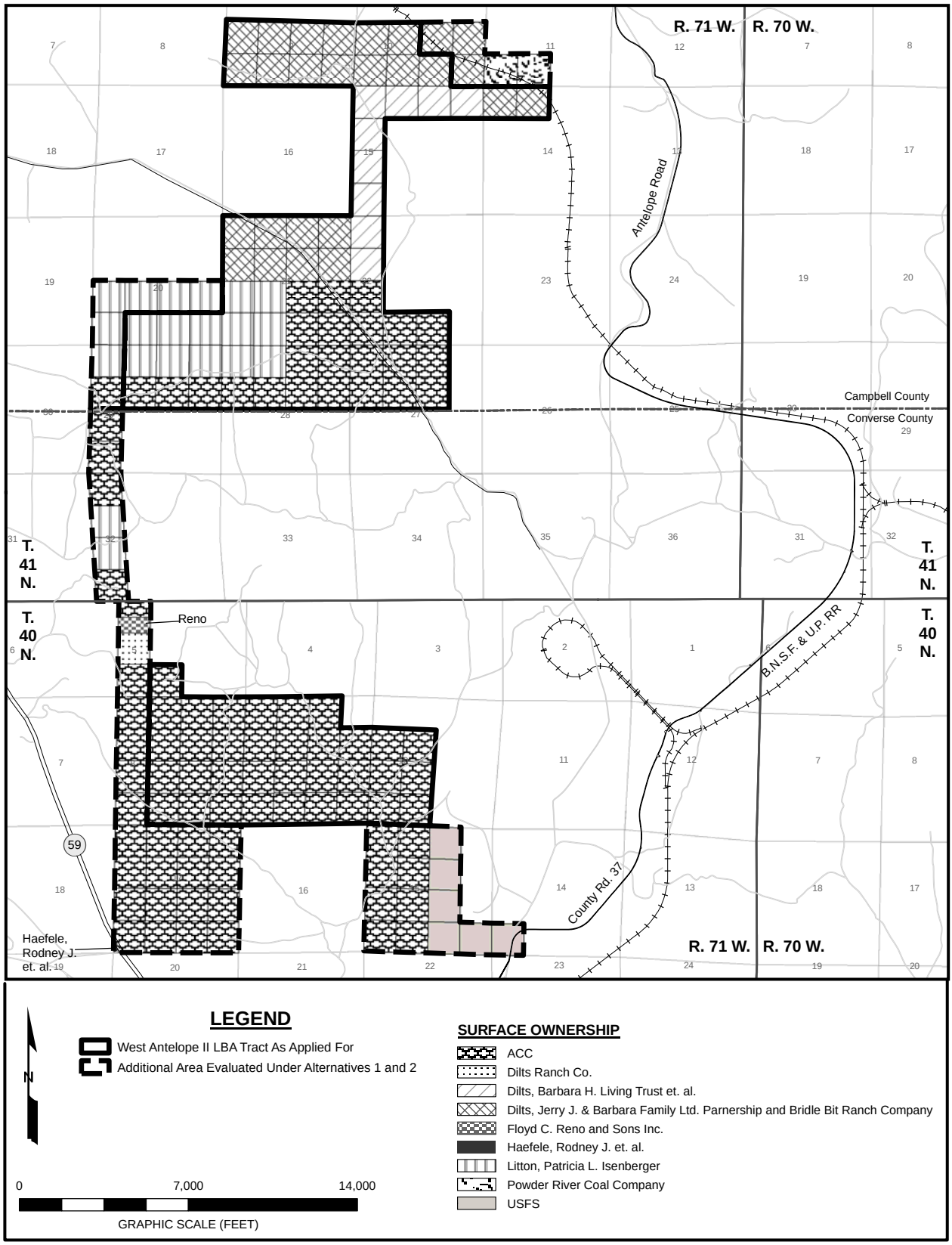


Figure 3-20. Surface Ownership Within the West Antelope II LBA Tract.

Alternatives 1 and 2. This federal land is within Grazing Allotment #213, currently held by Thunder Basin Grazing Association.

Areas of disturbance within and near the general analysis area include roads, oil and gas wells and associated production facilities, surface mine-related facilities, and activities associated with ranching. State Highway 59 is located west of the West Antelope II LBA tract as applied for. Highway 59 crosses the southwestern corner of the portion of the BLM study area that includes the south block of the tract under Alternatives 1 and 2. County roads that traverse and provide public and private access within and near the general analysis area include County Road 37 (Antelope Coal Mine Road) in Converse County and County Road 4 (Antelope Road) in Campbell County. County Road 37 crosses the southeastern corner of the portion of the BLM study area that includes the south block of the tract under Alternatives 1 and 2. The BNSF & UP railroad ROW crosses the northern block of the West Antelope II LBA tract (Figure 3-20). As discussed in Section 1.5 and Appendix B, the lands within the railroad ROW are considered to be unsuitable for mining under coal mining unsuitability Criterion 2 (43 CFR 3461.5 (c)(2)). The lands within the public road ROWs are considered to be unsuitable for mining under coal mining unsuitability Criterion 3 (43 CFR 3461.5 (c)(3)).

The oil and gas estate within the West Antelope II LBA tract is federally and privately owned (Figure 3-21); the majority (approximately 95 percent) is federally owned. Not all of the federally owned oil and gas estate is leased. The current (April 2007) federal oil and gas lessees for the LBA tract (Proposed Action and Alternatives 1 and 2) are listed in Table 3-13.

According to WOGCC records (WOGCC 2007c), two conventional oil wells were permitted and drilled on lands included in the BLM study area for the West Antelope II LBA tract (the tract as applied for and additional area evaluated under Alternatives 1 and 2, Figure 3-21). Both are permanently abandoned.

The Supreme Court has ruled that the CBNG belongs to the owner of the oil and gas estate (98-830). Therefore, the oil and gas lessees have the right to develop CBNG as well as conventional oil and gas on the LBA tract.There are 40 permitted CBNG wells on lands included in the BLM study area for the West Antelope II LBA tract (the tract as applied for and the additional area evaluated under Alternatives 1 and 2, Figure 3-21) (WOGCC 2007c). The status of these 40 well permits as of April 2007 was as follows: 20 producing, 3 flowing, 7 shut-in, 1 permanently abandoned, 1 denied or cancelled, 1 notice of intent to abandon, and 7 expired permits. CBNG wells capable of production on or in sections adjacent to the West Antelope II LBA tract are listed in Appendix E.

Additional information on the conventional oil and gas and CBNG development in the West Antelope II LBA tract and surrounding area is included in Section 3.3.2.

Certain ancillary facilities are needed to support oil and gas production. These support facilities may include well access roads; well pads; production equipment

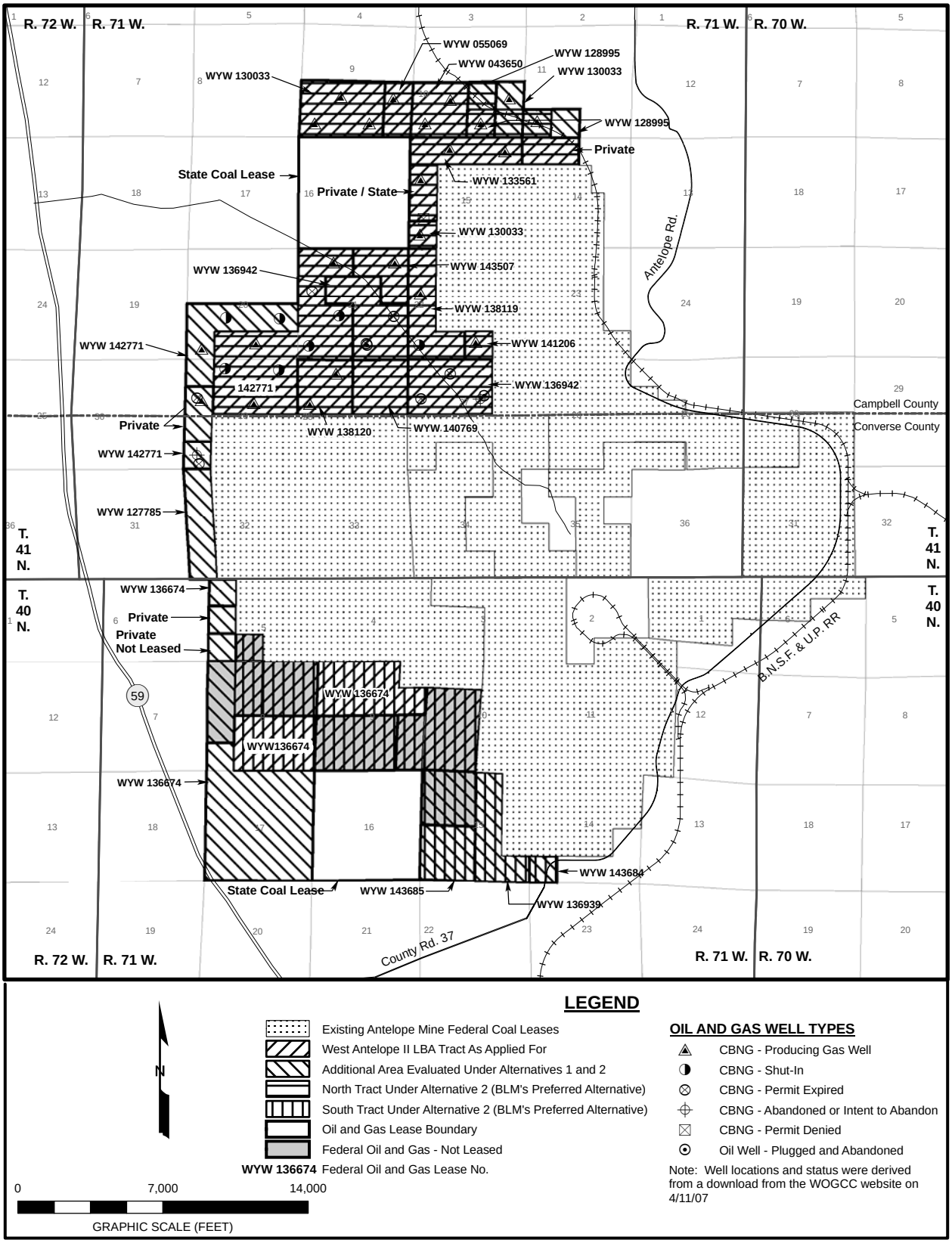


Figure 3-21. Oil and Gas Ownership on the West Antelope II LBA Tract.

Table 3-13. Current Federal Oil and Gas Leases on the West Antelope II LBA Tract.

For the following locations, both the oil and gas rights (including CBNG) and coal rights are owned by the federal government.

Lease Number	Location	Lessees of Record
	T.40N., R.71W.	
WYW 136674	Section 5; Lots 8, 9 Section 8; Lots 9-11, 13-16 Section 9; Lots 2-8 Section 17; Lots 1-16	Antelope Coal Co.
WYW 136939	Section 15; Lots 2, 7,10, 15, 16	Liberty Petroleum Corp.
WYW 143684	Section 14; Lot 13	Bill Barrett Prod. Co.
WYW 143685	Section 15; Lots 11-14	Petro Atlas Corp.
	T.41N., R.71W.	
WYW 043650	Section 10; Lots 11-14	ABO Petro Corp. Cienaga LLC Hay Canyon LLC Marico Expl. Inc. Myco Industries Inc. Sharbro Oil LTD Co. Tulipan LLC Willian G. Helis Est. Yates Drilling Do. Yates Petroleum Corp.
WYW 055069	Section 9; Lots 9, 16	Key Production Co. Inc. Lance O&G Co. Inc. Nance Petroleum Corp. Pathfinder Energy Wellstar Corp. Williams Prod. RMT Co.
WYW 127785	Section 32; Lots 4, 5, 12, 13	Fred L. Engle
WYW 128995	Section 10; Lots 10, 15 Section 11; Lots 13, 14	ABO Petro Corp. Lance O&G Co. Inc. Myco Industries Inc. Williams Prod. RMT Co. Yates Drilling Do. Yates Petroleum Corp.

Table 3-13. Current Federal Oil and Gas Leases on the West Antelope II LBA Tract - Continued.

Lease Number	Location	Lessees of Record
WYW 130033	Section 9; Lots 10-15 Section 10; Lots 9, 16 Section 15; Lot 13	ABO Petro Corp. Lance O&G Co. Inc. Myco Industries Inc. Sharbro Oil LTD Co. Williams Prod. RMT Co. Yates Drilling Do. Yates Petroleum Corp.
WYW 133561	Section 15; Lots 1-4	Barbara Starr Shillington
WYW 136942	Section 21; Lots 6, 7, 9, 10, 15, 16 Section 27; Lots 6-11	Gregor Klurfeld
WYW 138119	Section 22; Lots 7, 8, 14-16	Bowers O&G Inc. Spring Creek Ranch
WYW 138120	Section 28; Lots 3-6	Bowers O&G Inc. Spring Creek Ranch
WYW 140769	Section 28; Lots 1, 2, 7, 8	Lance O&G Co. Inc. Williams Prod. RMT Co.
WYW 141206	Section 22, Lot 2	Williams Prod. RMT. Co.
WYW 142771	Section 20; Lots 9-16 Section 21; Lots 3-5, 11-14 Section 29; Lots 1-4, 6-8, 13	Lance O&G Co. Inc. Williams Prod. RMT Co.
WYW 143507	Section 21; Lots 1, 2, 8	ABO Petro Corp. Myco Industries Inc. Yates Drilling Do. Yates Petroleum Corp.

at the wellhead (which may be located on the surface and/or underground); well production casing (which extends from the surface to the zone of production); underground pipelines (which gather the oil, gas, and/or water produced by the individual wells and carry it to a larger transmission pipeline or collection facility); facilities for treating, discharging, disposing of, containing, or injecting produced water; central metering facilities; electrical power utilities; gas compressor stations; and high-pressure transmission pipelines for delivering the gas to market. Currently, some of these oil and gas production facilities, particularly oil and gas pipelines, exist on the LBA tract, as discussed in Section 3.15 of this EIS.

Coal mining is a dominant land use to the north and east of the LBA tract. The Jacobs Ranch, Black Thunder, School Creek, North Antelope/Rochelle, and Antelope Mines form a group of contiguous surface coal mines located in Campbell and Converse Counties (Figure 1-1). Coal production from these mines increased by 65 percent between 1998 and 2006 (from approximately 155 million tons in 1998 to approximately 255 million tons in 2006). Of the 17 leases issued in the PRB since decertification of the federal coal region, 14 have been issued within this group of five mines (Table 1-1). The West Antelope II LBA tract being evaluated in this EIS is one of five currently pending lease applications in this group of mines (Table 1-2).

Campbell County does not have a county-wide land use plan, but is currently developing a comprehensive land use plan jointly with the City of Gillette (City of Gillette 1978 and Campbell County 2005). The *City of Gillette/Campbell County Comprehensive Planning Program* (City of Gillette 1978) provides general land use goals and policies for state and federal coal leases in the county. In August 1978, the Converse County Planning Commission completed a land use plan covering agriculture, recreation and minerals industries management (Converse County 1978). The Antelope Coal Field lies approximately 55 miles north of Douglas in an area zoned primarily for agricultural use, and secondarily for mineral extraction.

Big game hunting is the principal recreational land use within the general analysis area, with pronghorn, mule deer, and white-tailed deer present within the area (Section 3.10.2). On private lands, hunting is allowed only with landowner permission. Land ownership within the PRB is largely private (approximately 80 percent), with some private landowners permitting sportsmen to cross and/or hunt on their land. There has been a trend over the past two to three decades towards a substantial reduction in private lands that are open and reasonably available for hunting. Access fees continue to rise and many resident hunters feel these access fees are unreasonable. This trend has created problems for the WGFD in their attempt to distribute and control harvest at optimal levels, as well as for sportsmen who desire access to these animals (WGFD 2004).

In general, publicly owned lands (i.e., USDA-FS or BLM-administered federal lands and state school sections) are open to hunting if legal access is available. Due to safety concerns, however, public surface lands contained within an active mining area are generally closed to the public, further limiting recreational use. There are no BLM-administered public surface lands included in the West Antelope II LBA tract. About 240 acres of USDA-FS administered lands (TBNG) are included in the area added to the south block of the tract under Alternatives 1 and 2 (Figure 3-20). Approximately 100 acres of the TBNG land within the area added under Alternatives 1 and 2 are within the current Antelope Mine permit boundary and thus may be inaccessible to the public.

Specific information pertaining to WGFD big game herd management objectives within and near the general analysis area is contained in the 2006 Big Game Job Completion Reports for the Casper and Sheridan Regions (WGFD 2006). The

WGFD classifies most of the general analysis area as yearlong habitat for pronghorn. A small portion of the south tract is classified as severe winter range. No crucial or critical pronghorn habitat is recognized by the WGFD in this area. The general analysis area is within pronghorn Hunt Area 27, which is contained in the Cheyenne River Herd Unit. In post-season 2006, the population of the Cheyenne River Herd Unit was estimated to be approximately 39,621 animals; the WGFD population objective is 38,000.

Between 1995 and 2000, the Cheyenne River Herd Unit population was fairly stable at about 15 percent below the objective population. Pronghorn populations in this herd unit dropped in 2001, primarily because of lower productivity and survival caused by climatic factors. Population recovery began in the following years, with an increase of approximately 2,000 additional pronghorn each year between 2002 and 2005. The estimated population decreased slightly in 2006. Hunt Area 27 contains mostly privately owned surface lands with poor hunter access to limited publicly owned lands; therefore, the number of pronghorn is expected to steadily increase. If the population exceeds objective levels, more licenses will be needed and these may be difficult to sell in this mostly private land area. Nearly all landowners charge access fees for hunting and private land access is based on the desires and perceptions of the landowners. Increased harvest may be difficult to achieve because of the increased CBNG development, which is limiting rifle hunting on associated lands.

The WGFD has classified the general analysis area as winter-yearlong, yearlong, and "OUT" mule deer use range (the OUT areas do not contain enough animals to be important habitat, or the habitat is of limited importance to a species). Crucial or critical mule deer habitat does not occur on or within several miles of the general analysis area. The general analysis area is located within mule deer Hunt Area 10, part of the Thunder Basin Mule Deer Herd Unit. The Thunder Basin Herd Unit encompasses 3,642 square miles; of this, 71 percent is privately owned. Hunt Area 10, however, contains substantial blocks of public land. According to WGFD, there has been an increase in the number of landowners leasing to outfitters, which is increasing hunting pressure on public lands. In 2006, measures taken to address landowner and sportsmen concerns about low deer numbers in Hunt Area 10 included switching to general license, antlered only hunting and reducing the length of the hunting season. The 2006 post-season objective for this mule deer herd was 20,000. The 2006 post-season population was estimated at 22,036, an increase of 4,230 animals since 2005. Because of drought-related forage conditions, WGFD believes the herd should be reduced to below the objective population; however, limited sales and use of certain types of licenses and limited hunting on private land may hamper the ability to reduce the population through hunting.

White-tailed deer are now managed separately by WGFD. The herd occupying Hunt Area 10 is part of the Central White-tailed Deer Herd Unit. White-tailed deer are seldom observed within the general analysis area due to their preference for riparian woodlands and irrigated agricultural lands. WGFD classifies the entire

general analysis area, with the exception of a narrow corridor along Antelope Creek, as OUT white-tailed deer use range. The narrow corridor along Antelope Creek is classified as yearlong range. There is no population model for this herd.

The Rochelle Hills Elk Herd resides in the Rochelle Hills located approximately 13 miles east of the general analysis area. The general analysis area is within Elk Hunt Area 113 of the Rochelle Hills Herd Unit. Elk Hunt Area 113 contains crucial winter, parturition, winter-yearlong, yearlong, OUT, and undecided/unknown use ranges. In post-season 2006, the population of the Rochelle Hills Elk Herd was estimated to be approximately 650 animals; the WGFD population objective is 400. The herd favors the ponderosa pine/juniper woodlands, savanna, and steeper terrain habitat offered by the Rochelle Hills. However, recent data indicate the population is larger than previously expected, with this herd also occupying the public lands found in TBNG located within Hunt Area 113. As more lands are reclaimed from coal mining adjacent to the Rochelle Hills, elk are shifting their winter use to those sites. Such lands typically offer excellent winter grass supplies, especially during more severe winters when other sites are less accessible.

Under natural conditions, aquatic habitat is very limited by the ephemeral nature of surface waters in the general analysis area; therefore, public fishing opportunities are very limited. The lack of deep-water habitat and extensive and persistent water sources limits the presence and diversity of fish and other aquatic species. However, water discharged from CBNG wells has enhanced the water supply within some drainages in the general analysis area, including Spring Creek, which has increased potential habitat for some aquatic species. Those enhanced areas are still relatively limited and/or isolated in nature, and no perennial drainages are present in the general analysis area.

3.11.2 Environmental Consequences

3.11.2.1 Proposed Action and Alternatives 1 and 2

The major adverse environmental consequences of leasing and mining the West Antelope II LBA tract with respect to land use would be the loss of livestock grazing and wildlife habitat (particularly big game) and curtailment of oil and gas development during coal mining and surface reclamation. This would include removal of all existing oil and gas surface and downhole production and transportation equipment and facilities. Wildlife and livestock use would be displaced while the tract is being mined and reclaimed. Under Alternatives 1 and 2, access to approximately 240 acres of federal grazing leases would be suspended during mining operations. This federal land is within Grazing Allotment #213, currently held by Thunder Basin Grazing Association. Access for recreational and other (i.e., ranching, oil and gas development) activities would be restricted during mining operations. Estimated disturbance areas for the West Antelope II LBA tract and the tract configuration for Alternatives 1 and 2 are presented in Table 3-1.

Sections 3.3.2 and 3.11.1 and Appendix E of this document address producing, abandoned, and shut in oil and gas (conventional and CBNG) wells that presently exist on the LBA tract under the Proposed Action and Alternatives 1 and 2. Well location information, federal oil and gas ownership, and federal oil and gas lessee information are presented in Figure 3-21 and Table 3-13. BLM manages federal lands on a multiple use basis, in accordance with the regulations. In response to conflicts between oil and gas and coal lease holders, BLM policy advocates optimizing the recovery of both coal and CBNG resources to ensure that the public receives a reasonable return for these publicly owned resources. Optimal recovery of both coal and oil and gas resources requires negotiation and cooperation between the oil and gas lessees and the coal lessees. In the past, negotiations between some of the applicant mines and some of the existing oil and gas lessees have resulted in agreements that allowed development of both resources on portions of the LBA tract. Producing CBNG wells are present on the West Antelope II LBA tract. In the PRB, royalties have been and would be lost to both the state and federal governments if the federal CBNG is not recovered prior to mining or if federal coal is not recovered due to conflicts. State and federal governments can also lose bonus money when the costs of the agreements between the lessees are factored into the fair market value determinations.

As discussed above, BLM is evaluating including up to approximately 240 acres of USDA-FS-administered federal surface under Alternatives 1 or 2. Access to those lands would be limited if they are leased and mined. Approximately 100 of those acres are within the current Antelope Mine permit area and access to the public is currently limited on those lands as a result. The loss of access to federal lands is long term (during mining and reclamation), but is not permanent. Public access to federal lands would be restored after mining and reclamation are complete.

Hunting on the West Antelope II LBA tract, including the federal surface discussed above, would be eliminated during mining and reclamation. Pronghorn, white-tail deer, and mule deer occur on and adjacent to the LBA tract, as do mourning dove, waterfowl, rabbit, and coyote. The federal lands actually represent a relatively small portion of the currently accessible public surface lands for recreational opportunity within the respective animal hunt areas.

Following reclamation, the land would be suitable for grazing and wildlife uses, which are the historic land uses. The reclamation standards required by SMCRA and Wyoming State Law meet the standards and guidelines for healthy rangelands for public lands administered by the BLM in Wyoming. Following reclamation bond release, management of the privately owned surface would revert to the private surface owner and management of the federally owned surface would revert to the federal surface managing agency (USDA-FS).

3.11.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts would

not occur on from 4,314 up to 6,625 acres that would be disturbed under the Proposed Action or Alternatives 1 and 2, respectively. Currently approved mining operations would continue on the existing Antelope Mine leases. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.11.3 Regulatory Compliance, Mitigation and Monitoring

Mined areas would be reclaimed as specified in the approved mine plan to support the anticipated post-mining land uses of wildlife habitat and rangeland. The reclamation procedures would include stockpiling and replacing topsoil, using reclamation seed mixtures, which would be approved by WDEQ, and replacing stock reservoirs.

Steps to control invasion by weedy (invasive nonnative) plant species using chemical and mechanical methods would be included in the amended mine plan. Revegetation growth and diversity would be monitored until the final reclamation bond is released (a minimum of 10 years following seeding with the final seed mixture). Erosion would be monitored to determine if there is a need for corrective action during establishment of vegetation. Controlled grazing would be used during revegetation to determine the suitability of the reclaimed land for anticipated post-mining land uses.

See Section 3.3.2.3 for discussion of regulatory requirements, mitigation and monitoring related to oil and gas development.

3.11.4 Residual Impacts

No residual impacts to land use and recreation are expected.

3.12 Cultural Resources

3.12.1 Affected Environment

Cultural resources, protected under the National Historic Preservation Act of 1966, are nonrenewable remains of past human activity. The PRB, including the general analysis area, appears to have been inhabited by aboriginal hunting and gathering people for more than 13,000 years. Throughout the prehistoric past, the area was used by highly mobile hunters and gatherers who exploited a wide variety of resources. Several thousand cultural sites have been recorded within the PRB.

Several culture historic chronologies are pertinent to evaluating prehistoric occupations in Wyoming. Frison's (1978, 1991) chronology for the Northwestern Plains divides occupations from early to late into the Paleoindian, Early Plains Archaic, Middle Plains Archaic, Late Plains Archaic, Late Prehistoric, and Protohistoric periods. Frison's chronology is used here. The Plains designation within the Early, Middle, and Late Archaic periods has been omitted.

- Paleoindian period (13,000 to 7,000 years B.P.)
- Early Archaic period (7,000 to 5,000-4,500 years B.P.)
- Middle Archaic period (5,000-4,500 to 3,000 years B.P.)
- Late Archaic period (3,000 to 1,850 years B.P.)
- Late Prehistoric period (1,850 to 400 years B.P.)
- Protohistoric period (400 to 250 years B.P.)
- Historic period (250 to 120 years B.P.)

The Paleoindian period dates from about 13,000 to 7,000 years ago and includes various complexes (Frison 1978). Each of these complexes is correlated with a distinctive projectile point style derived from a general large lanceolate and/or stemmed point morphology. The Paleoindian period is traditionally thought to be synonymous with "big game hunters" who exploited megafauna such as bison and mammoth (plains Paleoindian groups), although evidence of the use of vegetal resources is noted at a few Paleoindian sites (foothill-mountain groups).

The Early Archaic period dates from about 7,000 to 5,000-4,500 years ago. Projectile point styles reflect the change from large lanceolate types that characterize the earlier Paleoindian complexes to large side- or corner-notched types. Subsistence patterns reflect exploitation of a broad spectrum of resources, with a much-diminished utilization of large mammals.

The onset of the Middle Archaic period (4,500 to 3,000 years B.P.) has been defined on the basis of the appearance of the McKean Complex as the predominant complex on the Northwestern Plains around 4,900 years B.P. (Frison 1978, 1991, 2001). McKean Complex projectile points are stemmed variants of the lanceolate point. These projectile point types continued until 3,100 years B.P. when they were replaced by a variety of large corner-notched points (i.e., Pelican Lake points) (Martin 1999). Sites dating to this period exhibit a new emphasis on plant procurement and processing.

The Late Archaic period (3,000 to 1,850 years B.P.) is generally defined by the appearance of corner-notched dart points. These projectile points dominate most assemblages until the introduction of the bow and arrow around 1,500 years B.P. (Frison 1991). The period witnessed a continual expansion of occupations into the interior grasslands and basins, as well as the foothills and mountains.

The Late Prehistoric period (1,850 to 400 years B.P.) is marked by a transition in projectile point technology around 1,500 years B.P. The large corner-notched dart points characteristic of the Late Archaic period are replaced by smaller corner-

and side-notched points for use with the bow and arrow. Ceramic technology also appears with the Late Prehistoric Period. Around approximately 1,000 years B.P., the entire Northwestern Plains appears to have suffered an abrupt collapse or shift in population (Frison 1991). This population shift appears to reflect a narrower subsistence base focused mainly on communal procurement of pronghorn and bison.

The Protohistoric period (400 to 250 years B.P.) witnesses the beginning of European influence on prehistoric cultures of the Northwestern Plains. Additions to the material culture include most notably the horse and European trade goods, including glass beads, metal, and firearms. Projectile points of this period include side-notched, tri-notched, and unnotched points, with the addition of metal points. The occupants appear to have practiced a highly mobile and unstable residential mobility strategy.

The historic period (250 to 120 years B.P.) is summarized from Schneider et al. (2000). The use of the Oregon Trail by emigrants migrating to the fertile lands of Oregon, California, and the Salt Lake Valley brought numerous pioneers through the state of Wyoming, but few stayed. It was not until the fertile land in the West became highly populated, along with the development of the cattle industry in the late 1860s, that the region currently comprising the state of Wyoming became attractive for settlement. The region offered cattlemen vast grazing land for the fattening of livestock, which could then be shipped across the country via the recently completed (1867-1868) transcontinental railroad in southern Wyoming.

The settling of the region surrounding Gillette, Wyoming began in the late 1800s, after a government treaty in 1876 placed the Sioux Indians on reservations outside the territory. Cattlemen were the first settlers to establish themselves in the area, with dryland farmers entering the area after 1900. The town of Gillette was established by the railroad in 1891 in an effort to promote the settling of undeveloped areas along the rail lines. The presence of the railroad allowed for the greater development of the cattle industry because it facilitated shipping cattle from the area. Several early ranches established in the region include the 4J Ranch (1875), Half Circle L Ranch (1880s), I Bar U Ranch (1888), and the T7 Ranch (1881).

The Dry Land Farming movement of the late 19th and early 20th centuries had a profound effect on the settlement of the PRB during the years around World War I. Although the principles of dry land farming were sound, success still required a certain amount of precipitation each year. Wyoming encouraged dry land settlement of its semi-arid lands through a Board of Immigration created in 1911. Newspapers extolled the virtues of dry land farming, and railroads conducted well-organized advertising campaigns on a nationwide basis to settle the regions through which they passed.

The most intensive period of homesteading activity in the Eastern PRB occurred in the late 1910s and early 1920s. Promotional efforts by the state and the railroads,

the prosperous war years for agriculture in 1917 and 1918, and the Stock Raising Act of 1916 with its increased acreage (but lack of mineral rights) all contributed to this boom period. A large amount of land filings consisted of existing farms and ranches expanding their holdings in an optimistic economic climate. However, an equally large number of homesteaders had been misled by promotional advertising and were not adequately prepared for the experiences that awaited them in the PRB. It soon became apparent to the would-be dry land farmer that he could not make a living by raising only crops. Some were initially successful in growing wheat, oats, barley and other small grains, along with hay, alfalfa, sweet clover and other grasses for the increased number of cattle.

A drought in 1919 was followed by a severe winter. The spring of 1920 saw market prices fall. Those homesteaders who were not ruined by the turn in events often became small livestock ranchers and limited their farming to the growing of forage crops and family garden plots. Some were able to obtain cheap land as it was foreclosed or sold for taxes. During the 1920s the size of homesteads in Wyoming nearly doubled and the number of homesteads decreased, indicating the shift to livestock raising (LeCompte and Anderson 1982).

With serious drought beginning in 1932, several Federal actions were taken. In April of 1932, Weston, Campbell and Converse counties were eligible for a drought relief program. The Northeast Wyoming Land Utilization Project began repurchasing the sub-marginal homestead lands and making the additional acres of government land available for lease. This helped the small operator to expand the usable grazing land. Cropland taken out of production could be reclaimed and then added to the grazing lease program. Grazing associations were formed to regulate the grazing permits. In1934, the Agricultural Adjustment Administration began studying portions of Converse, Campbell, Weston, Niobrara and Crook counties. In all, 2 million acres were included in the Thunder Basin Project (LA-WY-1) to alter land use and to relocate settlers onto viable farmland. Nationally, the program hoped to shift land use from farms to forest, parks, wildlife refuges or grazing districts. In marginal areas cash crops were to be replaced by forage crops, the kind and intensity of grazing would be changed and the size of operating units would be expanded (USDA-FS n.d.). Land purchase work on the Thunder Basin Project began late 1934 and the purchasing of units started in 1935.

During the development program to rehabilitate the range, impounding dams were erected, wells were repaired, springs developed, and homestead fences were obliterated while division fences were constructed for the new community pastures. Farmsteads were obliterated and the range reseeded. Remaining homesteaders and ranchers often purchased or scavenged materials from the repurchased farmsteads. Pits were dug on some homesteads and machinery and demolished buildings buried (many of these were dug up during the World War II scrap drives). Ironically, the rehabilitation project utilized a labor pool of former farmers who had spent years building what the government paid them to destroy. Their efforts were so successful that almost no trace remains of many homesteads.

While counties lost much of their population base as a result of the Resettlement Administration relocation program, they were strengthened financially: schools were closed, maintenance of rural roads was restricted to main arteries, and delinquent taxes were paid. The remaining subsidized ranches were significantly larger and provided a stabilizing effect on the local economies. Three grazing associations were formed: the Thunder Basin Grazing Association, the Spring Creek Association, and the Inyan Kara Grazing Association. These associations provided responsible management of the common rangeland.

Class III Cultural Resources Survey

A Class III cultural resources survey is an intensive and comprehensive inventory of a proposed project area conducted by professional archaeologists and consultants. The survey is designed to locate and identify all prehistoric and historic cultural properties 50 years and older that have exposed surface manifestations. The goal of the survey is to locate and evaluate for the NRHP all cultural resources within the project area. Cultural properties are recorded at a sufficient level to allow for evaluation for possible inclusion to the NRHP. Determinations of eligibility are made by the managing federal agency in consultation with the SHPO. Consultation with the SHPO must be completed prior to the approval of the mining plan.

After completion of a Class III cultural resources survey, additional investigations may be undertaken to complete an individual site record. If necessary, site-specific testing or limited excavation may be utilized to collect additional data which will: 1) determine the final evaluation status of a site; and/or 2) form the basis of additional work to be conducted during implementation of a treatment plan if the site is determined eligible for the NRHP. A treatment plan is then developed for those sites that are eligible for the NRHP and are within the area of potential effect. Treatment plans are implemented prior to mining and can include such mitigation measures as avoidance (if possible), large scale excavation, complete recording, Historical American Building Survey/Historic American Engineering Record documentation, archival research, and other acceptable scientific practices.

Data recovery plans are required for sites which cannot be avoided by project development and are recommended as eligible for the NRHP following testing and consultation with the SHPO. Until consultation has occurred and agreement regarding NRHP eligibility has been reached, all sites recommended as eligible or undetermined eligibility must be protected from disturbance. If the West Antelope II LBA tract is leased, full consultation with the SHPO would be completed prior to approval of the mining plans. Those sites determined to be unevaluated or eligible for the NRHP through consultation would receive further protection or treatment.

Numerous Class I (survey records review) and Class III cultural resource surveys associated with oil and gas field development, as well as with surface mining operations, have been conducted in the general area. The entire West Antelope II

general analysis area has been surveyed for cultural resources at a Class III level. Approximately 1,140 acres within the anticipated permit amendment study area (Figure 3-1) were surveyed in October 2008. Agency archaeologist are reviewing the results of that inventory, and site evaluations and assessment of potential effects and mitigation needs will be detailed in the Conditions of Approval accompanying the Record of Decision. Of the seven cultural sites documented by the recorder within the 1,140 acres, four were recommended as eligible for the NRHP.

Eighty-two cultural sites have been documented within the portion of the West Antelope II general analysis area that was surveyed prior to October 2008 (Table 3-14). Of these 82 sites, 48 are prehistoric activity areas ranging from open camps to cairns and other rock alignments, 22 are historic (homestead remains, trash scatters, etc), nine are multi-component (containing both historic and prehistoric components), and three are cairns of undetermined age and cultural affilitation.

Eight prehistoric sites (including one multiple component site) have been determined NRHP *eligible* under Criterion D, which applies to sites that have yielded, or may be likely to yield, information important in prehistory or history. These sites will require the implementation of approved mitigation plans prior to any disturbance, as their loss would be considered an adverse effect to cultural resources. Sites 48CA2892, 48CA4342, 48CA4343, 48CA4998, 48CA5800, 48CO0480, 48CO2832, and 48CO2834 will require planned avoidance unless an approved mitigation plan is implemented.

There are two prehistoric sites with undetermined or unresolved NRHP status within the West Antelope II survey area. Unresolved sites are treated under the law as if they were NRHP eligible, that is, disturbance is to be avoided until they have been evaluated for the NRHP. Site 48CA4718 is recommended eligible by the recording organization but has not been evaluated by any agency. Site 48CA3929 is recommended not eligible by the recorder, but is considered unevaluated by the SHPO. SHPO requested that additional testing be conducted at these sites because further information is required before a final evaluation can be made. Additionally, BLM has recommended that site 48CA3929 be submitted to Native American consultation to determine eligibility.

Three prehistoric sites (48CO2934, 48CO2996, and 48CO2997) were evaluated by the recorder as *not eligible* in the field. There is no SHPO concurrence, but BLM has concurred with the evaluation of not eligible. All three fail to meet criterion D due to minimal artifact assemblages and lack of soils deposition. However, rock alignments and stone circles are often of religious or spiritual importance and Native American consultation will need to be carried out on these sites. Two additional sites (48CA1547, 48CA3064) have been evaluated as not eligible under criterion D but will also require Native American consultation to determine whether these sites might be eligible under criterion A.

Table 3-14. Cultural Sites in the West Antelope II General Analysis Area.

Site Number	NRHP Status	Author(s) / Organization	Report / Project Name	Site Type
48CA0884	NE/D	Archaeological Services	Jumping Creek Fed-1 well	P
48CA0885	NE/D	Archaeological Services	Jumping Creek Fed-1 well	P
48CA1547	NE [1]	GCM Services	Fiddleback Ranch Land Exchange	H
		GCM Services	Horse Creek Archaeological Study	
		High Plains Consultants	Boundary Fed 1	
48CA2892	E (D)	GCM Services	Horse Creek Archaeological Study	P
		GCM Services	Antelope Coal Mine Drill Holes	
48CA2973	NE	GCM Services	Fiddleback Ranch Land Exchange	M
		Greer Services	Kane Fed. Proj. Dilts Lease CBM	
48CA3064	NE [1]	GCM Services	Horse Creek Archaeological Study	U
48CA3097	NE	GCM Services	Horse Creek Archaeological Study	P
48CA3574	NE	GCM Services	West Antelope II & Off Lease Drill	H
		GCM Services	Tract L Addendum	
		Quality Services	Rochelle Hills POD CBM	
		ACR Consultants, Inc.	Antelope Federal POD CBM	
		Pronghorn Archaeological Services	East Litton CBM POD	
48CA3925	NE	GCM Services	West Antelope LBA Area	H
48CA3926	NE	GCM Services	West Antelope LBA Area	H
48CA3927	NE	GCM Services	West Antelope LBA Area	H
48CA3928	NE	GCM Services	West Antelope LBA Area	H
48CA3929	UND [1]	GCM Services	West Antelope LBA Area	P
48CA3930	NE	GCM Services	West Antelope LBA Area	P
48CA3972	NE	GCM Services	West Antelope LBA Area	P
48CA4342	E (D)	Greer Services	Kane Fed. Proj. Dilts Lease CBM	P
48CA4343	E (D)	Greer Services	Kane Fed. Proj. Dilts Lease CBM	P
48CA4718	UND	WAS	Antelope II POD	P
		GCM Services	West Antelope II & Off Lease Drill	
48CA4719	NE	GCM Services	West Antelope II & Off Lease Drill	H
		Western Land Services	Antelope II POD	
48CA4720	NE	GCM Services	West Antelope II & Off Lease Drill	H
		Western Land Services	Antelope II POD	
48CA4783	NE	Western Land Services	Antelope II POD	H
48CA4998	E (D)	Quality Services	Rochelle Hills POD CBM	P
48CA4999	NE	Quality Services	Rochelle Hills POD CBM	H
48CA5000	NE	Quality Services	Rochelle Hills POD CBM	H
48CA5001	NE	Quality Services	Rochelle Hills POD CBM	H
48CA5002	NE	Quality Services	Rochelle Hills POD CBM	H
48CA5003	NE	Quality Services	Rochelle Hills POD CBM	M

Table 3-14. Cultural Sites in the West Antelope II General Analysis Area (Continued).

Site Number	NRHP Status	Author(s) / Organization	Report / Project Name	Site Type
48CA5011	NE	Quality Services	Rochelle Hills POD CBM	H
48CA5012	NE	GCM Services Quality Services	Tract L Addendum Rochelle Hills POD CBM	H
48CA5013	NE	GCM Services Quality Services	Tract L Addendum Rochelle Hills POD CBM	H
48CA5296	NE	ACR Consultants, Inc.	Tuit Draw POD	H
48CA5799	NE	GCM Services	West Antelope II & Off Lease Drill	U
48CA5800	E (D)	GCM Services	West Antelope II & Off Lease Drill	M
48CO0047	NE (CON)	OWSA	No Associated Report	P
48CO0144	NE	OWSA GCM Services	Antelope Coal Lease - Final Report West Antelope II & Off Lease Drill	H
48CO0154	NE (CON)	OWSA	Antelope Coal Lease - Final Report	P
48CO0158	NE/D	OWSA GCM Services	Antelope Coal Lease - Final Report West Antelope II & Off Lease Drill	M
48CO0159	NE (CON)	OWSA	Antelope Creek Lease Area	P
48CO0480	E (D)	WCRM	Antelope Mine Testing and Mitigation	P
48CO1709	NE	TRC/Mariah & Associates	WDOT Linear Survey	H
48CO1710	NE	TRC/Mariah & Associates	WDOT Linear Survey	H
48CO1716	NE	USFS	Antelope Creek Land Exchange	P
48CO1717	NE	USFS	Antelope Creek Land Exchange	P
48CO1718	NE	USFS	Antelope Creek Land Exchange	P
48CO1719	NE	USFS	Antelope Creek Land Exchange	P
48CO1720	NE	USFS	Antelope Creek Land Exchange	M
48CO1721	NE	USFS	Antelope Creek Land Exchange	M
48CO1722	NE	USFS	Antelope Creek Land Exchange	P
48CO1723	NE	USFS	Antelope Creek Land Exchange	M
48CO1724	NE (CON)	USFS GCM Services	Antelope Creek Land Exchange West Antelope Drilling Additions	P
48CO1725	NE	USFS	Antelope Creek Land Exchange	P
48CO2248	NE	AEC	Antelope Mines Fuel Pipeline	M
48CO2613	NE	AEC	Rochelle Hills CS#1 Well, Access	P
48CO2718	NE	GCM Services	West Antelope LBA Area	P
48CO2830	NE	GCM Services	West Antelope Drilling Additions	H
48CO2831	NE	GCM Services	West Antelope Drilling Additions	P
48CO2832	E (D)	GCM Services	West Antelope Drilling Additions	P

Table 3-14. Cultural Sites in the West Antelope II General Analysis Area.

Site Number	NRHP Status	Author(s) / Organization	Report / Project Name	Site Type
48CO2833	NE	GCM Services	West Antelope Drilling Additions	P
		GCM Services	West Antelope Site Evaluations	
48CO2834	E (D)	GCM Services	West Antelope Drilling Additions	P
		GCM Services	West Antelope Site Evaluations	
48CO2835	NE	GCM Services	West Antelope Drilling Additions	P
48CO2836	NE	GCM Services	West Antelope Drilling Additions	P
48CO2837	NE	GCM Services	West Antelope Drilling Additions	P
48CO2838	NE	GCM Services	West Antelope Drilling Additions	P
48CO2859	NE	Quality Services	Rochelle Hills POD CBM	H
48CO2860	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2861	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2862	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2863	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2864	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2867	NE	Quality Services	Rochelle Hills POD CBM	M
48CO2868	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2869	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2886	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2919	NE	GCM Services	West Antelope II & Off Lease Drill	P
48CO2920	NE	GCM Services	West Antelope II & Off Lease Drill	P
48CO2921	NE	GCM Services	West Antelope II & Off Lease Drill	P
48CO2922	NE	GCM Services	West Antelope II & Off Lease Drill	P
48CO2923	NE	GCM Services	West Antelope II & Off Lease Drill	P
48CO2924	NE	GCM Services	West Antelope II & Off Lease Drill	P
48CO2934	NE [1]	GCM Services	CA/CO Joint Pipeline Corridor	P
48CO2996	NE [1]	GCM Services	West Antelope EIS Additions	P
48CO2997	NE [1]	GCM Services	West Antelope EIS Additions	U

Site Type: P=Prehistoric; H=Historic; M=Multi-component; U=Unknown (i.e., rock cairn)

WCRM=Western Cultural Resource Management; OWSA=Office of the Wyoming State Archaeologist; USFS=United States Forest Service; AEC=Archaeological Energy Consulting; WAS=Western Archaeological Services
NRHP Status: E(D)=Eligible for the NRHP under Criterion D; NE=Not Eligible; NE(CON)=Not Eligible by Consultant; NE/D=Not Eligible/Destroyed; UND=Undetermined NRHP Status (No SHPO review or inusfficient information).

[1] Site requires Native American consultation

Four prehistoric sites (48CO0047, 48CO0154, 48CO0159, 48CO1724) were reported as *not eligible* by the recorder, with no other concurrence. Three of these sites (48CO0047, 48CO0154, and 48CO0159) were reported prior to 1980 and, according to BLM policy, must be reassessed. Site 48CO1724 was recorded in 1991, but because no other information is available it should be reexamined prior to final disposition. Available information for these four sites indicates that they will not be eligible for the NRHP under current standards.

The remaining 63 sites have been determined *not eligible* for the NRHP. No further protection is afforded these sites, as recordation has exhausted their archaeological potential. There is a standing stipulation that, should previously unknown cultural resources be discovered during any surface disturbing activity, all activity in that vicinity shall be halted until a qualified archaeologist can evaluate the find.

3.12.2 Environmental Consequences

3.12.2.1 Proposed Action and Alternatives 1 and 2

Data recovery plans are required for all sites recommended eligible to the National Register following testing and consultation with SHPO. Until consultation with SHPO has occurred and agreement regarding NRHP eligibility has been reached, all sites would be protected from disturbance.

Full consultation with SHPO must be completed prior to approval of a mining plan. At that time, those sites determined to be unevaluated or eligible for the NRHP through consultation would receive further protection or treatment. Impacts to eligible or unevaluated cultural resources cannot be permitted. If unevaluated sites cannot be avoided, they must be evaluated prior to disturbance. If eligible sites cannot be avoided, a data recovery plan must be implemented prior to disturbance. Ineligible cultural sites may be destroyed without further work.

The eligible sites on the West Antelope II LBA tract that cannot be avoided or that have not already been subjected to data recovery action would be carried forward in the mining and reclamation plan as requiring protective stipulations until a testing, mitigation, or data recovery plan is developed to address the impacts to the sites. The lead federal and state agencies would consult with Wyoming SHPO on the development of such plans and the manner in which they are carried out.

Cultural resources adjacent to the mine areas may be impacted as a result of increased access to the areas. There may be increased vandalism and unauthorized collecting associated with recreational activity and other pursuits outside of but adjacent to mine permit areas. Unintended or uninformed impacts related to increased off-road traffic during mine related activities are the most frequents impacts to cultural resources.

3.12.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts would not occur on from 4,314 up to 6,625 acres that would be disturbed under the Proposed Action or Alternatives 1 and 2, respectively. Currently approved mining operations would continue on the existing Antelope Mine leases. Cultural resources on the portions of the West Antelope II LBA tract adjacent to the

Antelope Mine would be affected as a result of disturbance that would occur during recovery of the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.12.3 Native American Consultation

Native American heritage sites can be classified as prehistoric or historic. Some may be presently in use as offering, fasting, or vision quest sites.

Other sites of cultural interest and importance may include rock art, stone circles, various rock features, fortifications or battle sites, burials, and locations that are sacred or part of the oral history and heritage but have no man-made features.

No Native American heritage, special interest, or sacred sites have been formally identified and recorded to date within the general analysis area. However, the geographic position of the general analysis area between mountains considered sacred by various Native American cultures (the Big Horn Mountains to the west, the Black Hills to the east, and Devils Tower to the north) creates the possibility that existing locations may have special religious or sacred significance to Native American groups. If such sites or localities are identified, appropriate action must be taken to address concerns related to those sites.

Tribes that have been identified as potentially having concerns about actions in the PRB include the Crow, Northern Cheyenne, Shoshone, Arapaho, Oglala Sioux, Rosebud Sioux, Crow Creek Sioux, Lower Brule Sioux, Standing Rock Sioux, Cheyenne River Sioux, Apache Tribe of Oklahoma, Comanche Tribe of Oklahoma, and Kiowa Tribe of Oklahoma. These tribal governments and representatives have been sent copies of the EIS. They are also being provided with more specific information about the known cultural sites on the tract in this analysis. Their help is being requested in identifying potentially significant religious or cultural sites in the general analysis area before a leasing decision is made on the West Antelope II LBA tract.

Native American tribes were consulted at a general level in 1995-1996 as part of an update to the BLM Buffalo RMP update (BLM 2001a) Some of the Sioux tribes were consulted by BLM on coal leasing and mining activity in the PRB at briefings held in Rapid City, South Dakota in March 2002.

3.12.4 Regulatory Compliance, Mitigation and Monitoring

Class I and III surveys are conducted to identify cultural properties on all lands affected by federal undertakings. Prior to mining, SHPO is consulted to evaluate the eligibility of the cultural properties for inclusion in the NRHP. Cultural properties that are determined to be eligible for the NRHP would be avoided or, if

avoidance is not possible, a recovery plan would be implemented prior to disturbance.

Mining activities are monitored during topsoil stripping operations. If a lease is issued for the West Antelope II LBA tract, BLM would attach a stipulation to the lease requiring the lessee to notify appropriate federal personnel if cultural materials are uncovered during mining operations (Appendix D).

3.12.5 Residual Impacts

Cultural sites that are determined to be eligible for the NRHP would be avoided if possible. Eligible sites that cannot be avoided would be destroyed by surface coal mining after data from those sites is recovered. Sites that are not eligible for the NRHP would be lost.

Cultural sites are permanently destroyed by surface coal mining operations but, as a result of the intensive pedestrian inventories, site evaluations and excavation and analysis of prehistoric cultural resources discussed above, there is a more informed understanding of what types of resources exist in the region and a better understanding of local prehistory.

3.13 Visual Resources

3.13.1 Affected Environment

Visual sensitivity levels are determined by people's concern for what they see and the frequency of travel through an area. Landscapes within the general analysis area include rolling sagebrush and short-grass prairie, which are common throughout the PRB. There are also areas of altered landscape, such as oil fields and surface coal mines. Existing surface mines form a nearly continuous band on the east side of Highway 59 from Gillette south for about 50 miles. Other man-made intrusions include ranching activities (fences, homesteads, and livestock), oil and gas development (pumpjacks, pipeline ROWs, CBNG well shelters, and CBNG compressor stations), transportation facilities (roads and railroads), environmental monitoring installations, road signage, and electrical power transmission lines. The natural scenic quality in and near the general analysis area is fairly low because of the industrial nature of the adjacent existing mining operations and oil and gas development.

The VRM system is the basic tool used by BLM to inventory and manage visual resources on public lands. Prior to 1986, the five VRM classes defined below were used to describe increasing levels of change within the characteristic landscape. The number of VRM classes was reduced from five to four in 1986 (BLM 2007), but the new resource management class objectives remain very similar to the original objectives of VRM Classes I through IV.

The pre-1986 VRM Classes are summarized as follows:

Class I: Natural ecologic changes and very limited management activity is allowed. Any contrast (activity) within this class must not attract attention.

Class II: Changes in any of the basic elements (form, line, color, texture) caused by an activity should not be evident in the landscape.

Class III: Contrasts to the basic elements caused by an activity are evident but should remain subordinate to the existing landscape.

Class IV: Activity attracts attention and is a dominant feature of the landscape in terms of scale.

Class V: This classification is applied to areas where the natural character of the landscape has been disturbed up to a point where rehabilitation is needed to bring it up to the level of one of the other four classifications.

The 2001 Buffalo RMP revision (BLM 2001a) covers the Campbell County portion of the West Antelope II general analysis area. It retained and carried forward the VRM inventory from the 1985 Buffalo RMP (BLM 1985a). Visual classifications for the Converse County portion of the West Antelope II LBA tract (the south block of the lease application area) were included in the Platte River Resource Area RMP (BLM1985b). The Proposed Resource Management Plan and Final Environmental Impact Statement for the Casper Field Office, which was released June 8, 2007 and will replace the 1985 Platte River RMP when it is completed, includes an updated VRM inventory (BLM 2007).

At this time, the lands included in the general analysis area in both Campbell and Converse Counties continue to be managed in accordance with the VRM classes established in 1981 and the predominant VRM class is Class IV. Portions of the general analysis area adjacent to State Highway 59 in Converse County are currently classified as Class III, but the amount of Class III land would be reduced by adoption of the preferred alternative (BLM 2007) for the Casper Field Office RMP. Use of the post-1986 VRM classes in the Casper Field Office RMP will not affect the general analysis area VRM classification because the general analysis area does not include any lands that were classified as VRM Class V in the 1985 Platte River RMP.

Approximately 240 acres of the surface of the general analysis area is part of the TBNG, which is administered by the USDA-FS. The USDA-FS has established visual quality objectives for the TBNG. In the general analysis area, facilities and landscape modifications may be visible but should be reasonably mitigated to blend and harmonize with natural features according to the revised Land and Resource Management Plan for the Thunder Basin National Grassland (USDA-FS 2001).

Currently, mine facilities and mining operations at the Antelope Mine are visible from various public-use roads in the general analysis area, including Antelope Road (County Road 37) and State Highway 59.

3.13.2 Environmental Consequences

3.13.2.1 Proposed Action and Alternatives 1 and 2

If the West Antelope II LBA tract is leased and mined, mining operations on the LBA tract would be visible from State Highway 59, which is approximately 0.75 to 2.5 miles west of the tract. The portions of the general analysis area that would be disturbed under the Proposed Action or Alternatives 1 or 2 would be considered as VRM Class IV prior to reclamation. After reclamation of the LBA tract and adjoining mines, the VRM Class IV conditions would be restored and the reclaimed land would resemble the surrounding undisturbed terrain. No visual resources that are unique to this area have been identified on or near the West Antelope II LBA tract.

Reclaimed terrain would be almost indistinguishable from the surrounding undisturbed terrain. Slopes might appear smoother (less intricately dissected) than undisturbed terrain and sagebrush would not be as abundant for several years; however, within a few years after reclamation, the mined land would not be distinguishable from the surrounding undisturbed terrain except by someone very familiar with landforms and vegetation.

3.13.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts would not occur on from 4,314 up to 6,625 acres that would be disturbed under the Proposed Action or Alternatives 1 and 2, respectively. The current VRM Class designations would not change for those lands. Currently approved mining operations would continue on the existing Antelope Mine leases. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.13.3 Regulatory Compliance, Mitigation and Monitoring

Landscape character would be restored during reclamation to approximate original contour and would be reseeded with an approved seed mixture, including native species.

See Section 3.2 and Section 3.9 for additional discussion of the regulatory requirements, mitigation, and monitoring for topography and vegetation.

3.13.4 Residual Impacts

No residual impacts to visual resources are expected.

3.14 Noise

3.14.1 Affected Environment

Existing noise sources in the general analysis area include coal mining activities, traffic on the access and county roads, rail traffic, wind, and CBNG compressor stations.

Noise originating from CBNG development equipment (e.g., drilling rigs and construction vehicles) is apparent locally over the short term (i.e., 30 to 60 days) where well drilling and associated construction activities are occurring. The amount of noise overlap between well sites is variable and depends on the timing of drilling activities on adjacent sites and the distance between the site locations. Studies of background noise levels at PRB mines indicate that ambient sound levels generally are low, owing to the isolated nature of the area. The unit of measure used to represent sound pressure levels (decibels) using the A-weighted scale is a dBA. It is a measure designed to simulate human hearing by placing less emphasis on lower frequency noise because the human ear does not perceive sounds at low frequency in the same manner as sounds at higher frequencies. Figure 3-22 presents noise levels associated with some commonly heard sounds.

No site-specific noise level data are available for the general analysis area. However, in 2004, Matheson Mining Consultants, Inc. conducted a noise survey at the two occupied locations closest to the existing Antelope operations. Measurements were taken at the Don Jacobs residence located directly west of the mine on State Highway 59 and at the Dyno Nobel West Region office located northeast of the mine on County Road 37. The maximum daily time weighted (L_{eq}) noise reading at the Don Jacobs residence was 51 dBA which is comparable to that of a normal office, 50 feet in the distance. The maximum measured L_{eq} at Dyno Nobel was 52.6 dB(A) which is equivalent to the noise level of an average office environment.

3.14.2 Environmental Consequences

3.14.2.1 Proposed Action and Alternatives 1 and 2

Noise levels on the LBA tract would be increased considerably by mining activities such as blasting, loading, hauling, and possibly in-pit crushing. Since the LBA tract would be mined as an extension of existing operations, no rail car loading would take place on the LBA tract. The Noise Control Act of 1972 indicates that a

24-hour equivalent level of less than 70 dBA prevents hearing loss and that a level below 55 dBA, in general, does not constitute an adverse impact.

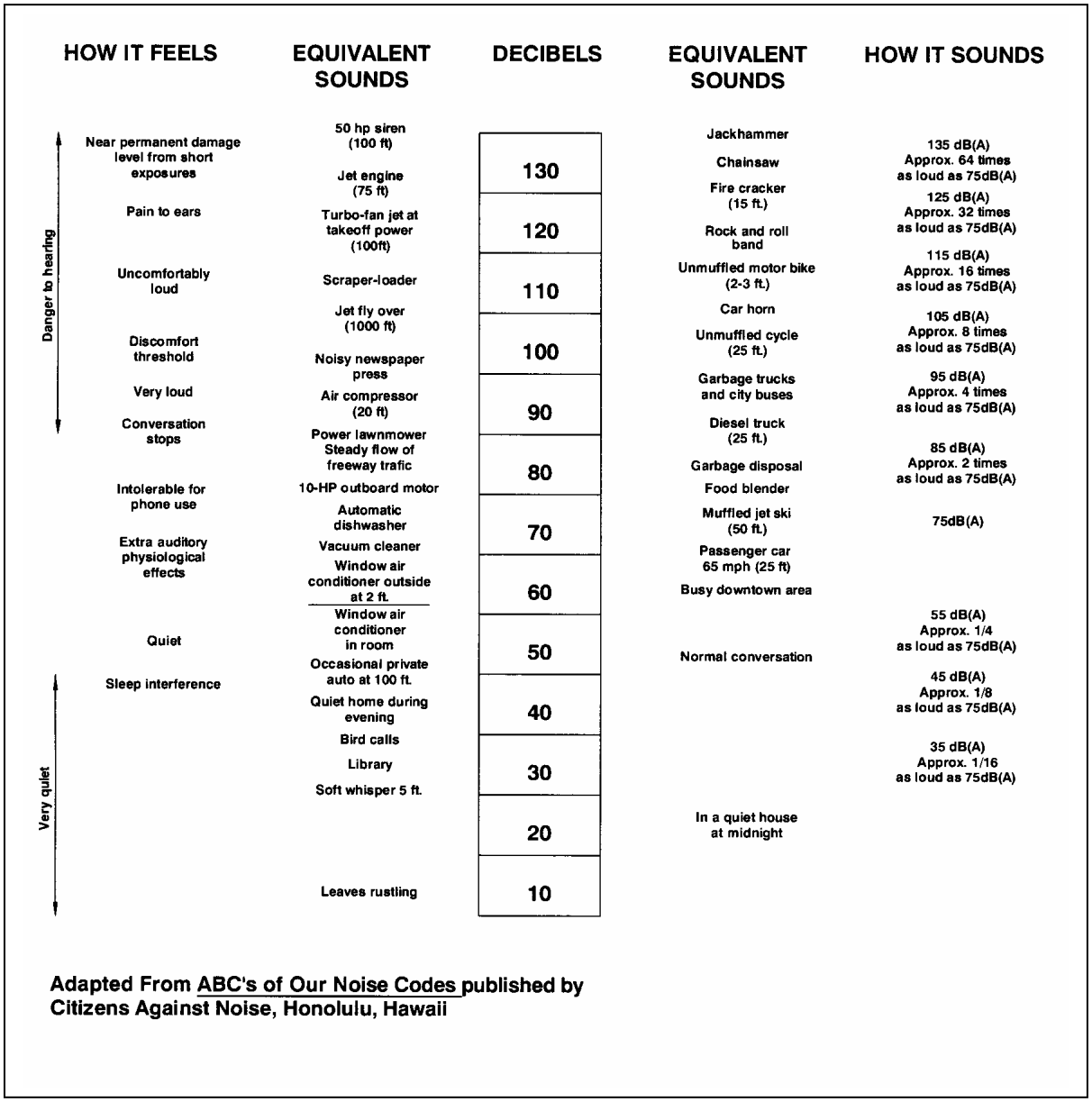


Figure 3-22. Relationship Relationship Between A-Scale Decibel Readings and Sounds of Daily Life.

Because of the remoteness of the LBA tract and because mining is already ongoing in the area, noise would have few off-site impacts. MMA (2005) conducted a very conservative noise modeling analysis of the existing West Antelope North (WAN) pit which showed that, at a distance of 16,000 feet, maximum noise levels would not exceed 54 dBA, which is equivalent to the sound level expected in a suburban, residential town. The nearest occupied residence (the Don Jacobs residence) is approximately 2,800 feet west of the westernmost extent of the West Antelope II LBA tract. If the tract is leased and mined, mining operations could be approximately 2,000 feet closer to this residence than the current lease would

allow (Figure 3-9). The minimum distance from current lease areas to the next nearest residence, located due west of the north part of the LBA tract, is approximately 16,300 feet. If the West Antelope II LBA tract is leased and mined, mining operations could be approximately 1,900 feet closer to this residence.

Wildlife in the immediate vicinity of mining may be adversely affected; however, anecdotal observations at surface coal mines in the area indicate that some wildlife may adapt to increased noise associated with coal mining activity. After mining and reclamation are completed, noise would return to premining levels.

3.14.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal and the associated noise impacts would not occur on the LBA tract. Currently approved mining operations and associated noise impacts would continue on the existing Antelope leases.

3.14.3 Regulatory Compliance, Mitigation and Monitoring

Mine operators are required to comply with MSHA regulations concerning noise, which include protecting employees from hearing loss associated with noise levels at the mines. MSHA periodically conducts mine inspections to ensure compliance with the requirements of the Federal Mine Safety and Health Act of 1977.

3.14.4 Residual Impacts

No residual impacts to noise are expected.

3.15 Transportation

3.15.1 Affected Environment

Transportation resources near the West Antelope II LBA tract include State Highway 59, County Road 37 (Antelope Coal Mine Road) in Converse County, County Road 4 (Antelope Road) in Campbell County, several unimproved local roads and accesses (unnamed two-track trails), the BNSF & UP railroad, oil and gas pipelines, utility/power lines, telephone lines, and associated ROWs. Figure 3-23 depicts the current transportation facilities, excluding the oil and gas pipelines, within and near the general analysis area. Figure 3-24 depicts the oil and gas pipelines within and near the general analysis area.

Highway 59, a paved two-lane road located west of the West Antelope II LBA tract, is the major north-south public transportation corridor within the PRB. Access to the LBA tract is on Douglas Road and Antelope Coal Mine Road from the west (from Highway 59) or Antelope Road / Antelope Coal Mine Road from the northeast. The county roads provide public and private access within the general analysis area. The unimproved local roads and accesses in the area are primarily

for private use. As shown in Figure 3-23, State Highway 59, County Road 37, and County Road 4 do not cross the West Antelope LBA tract under the Proposed Action. However, State Highway 59 does cross the southwestern corner of the portion of the BLM study area that includes the south block of the tract under Alternatives 1 and 2, and County Road 37 crosses the southeastern corner of the portion of the BLM study area that includes the south block of the tract under Alternatives 1 and 2.

The BNSF & UP Gillette-Douglas rail spur runs north-south along the eastern edge of the PRB, roughly parallel to and east of State Highway 59, with individual spur lines that connect each mine to the railroad for the purpose of transporting the coal that is mined in the eastern PRB.

The DM&E Railroad has proposed an expansion into the PRB of Wyoming. If constructed, the DM&E project would be the largest railroad construction project in the United States in the last 100 years (Sheridan Press 2006). The STB completed an EIS and gave final approval to the expansion project in 2002. After the EIS was successfully appealed, the STB issued a final SEIS on the expansion project December 30, 2005, which addressed four issues that were remanded back to the STB as a result of the appeal, and granted final approval to construct the rail line on February 15, 2006. The SEIS was also appealed, but was upheld by the US Court of Appeals for the Eighth Circuit in December 2006. In early September, 2007, Canadian Pacific Railway Ltd announced it is in the process of buying DM&E. If it is constructed as proposed, the DM&E rail line would potentially be in a position to haul coal produced by the Antelope Mine.

3.15.2 Environmental Consequences

3.15.2.1 Proposed Action and Alternatives 1 and 2

Essentially all of the coal mined on the LBA tract would be transported by rail. Since the West Antelope II LBA tract would be an extension of the existing Antelope Mine operations, the existing rail facilities and infrastructure would be used to recover the coal within the tract, if it is leased. As discussed in Section 4.1, BNSF & UP have upgraded and will continue to upgrade their rail capacities to handle the increasing coal volume projected from the PRB, with or without the leasing of the West Antelope II LBA tract. The construction of the proposed DM&E Railroad expansion into this area is not dependent on leasing the LBA tract.

As discussed above, State Highway 59 crosses the southwestern corner of the BLM study area for the south block of the tract under Alternatives 1 and 2. County Road 37 crosses the southeastern corner of the BLM study area for the south block of the tract under Alternatives 1 and 2. As discussed in Chapters 1 and 2, lands within 100 feet of the outside line of the ROW of a public road are considered unsuitable for mining under Criterion 3 of the coal unsuitability criteria (43 CFR 3461(c)). Although the lands underlying the ROWs for these

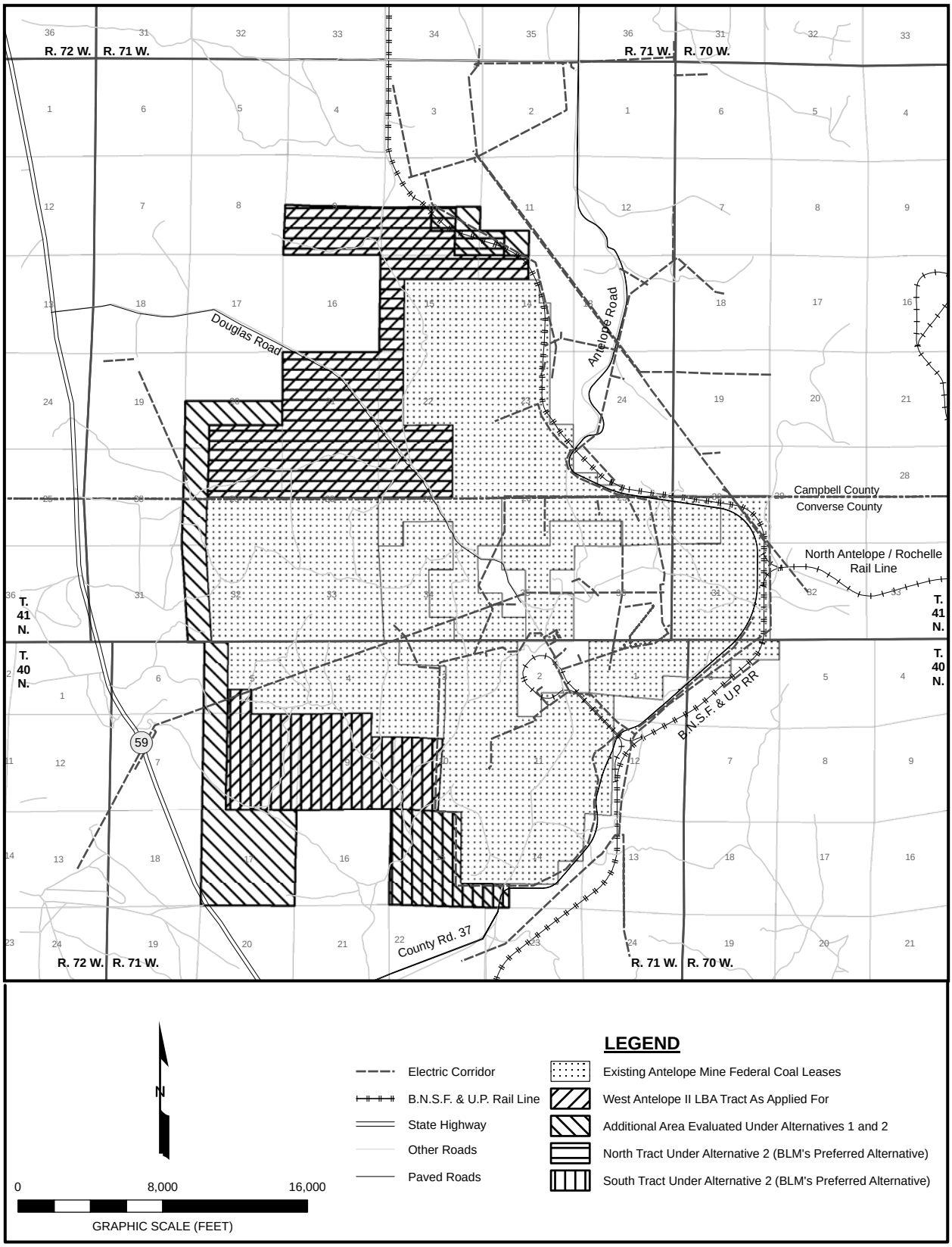


Figure 3-23. Transportation Facilities Within and Adjacent to the West Antelope II LBA Tract.

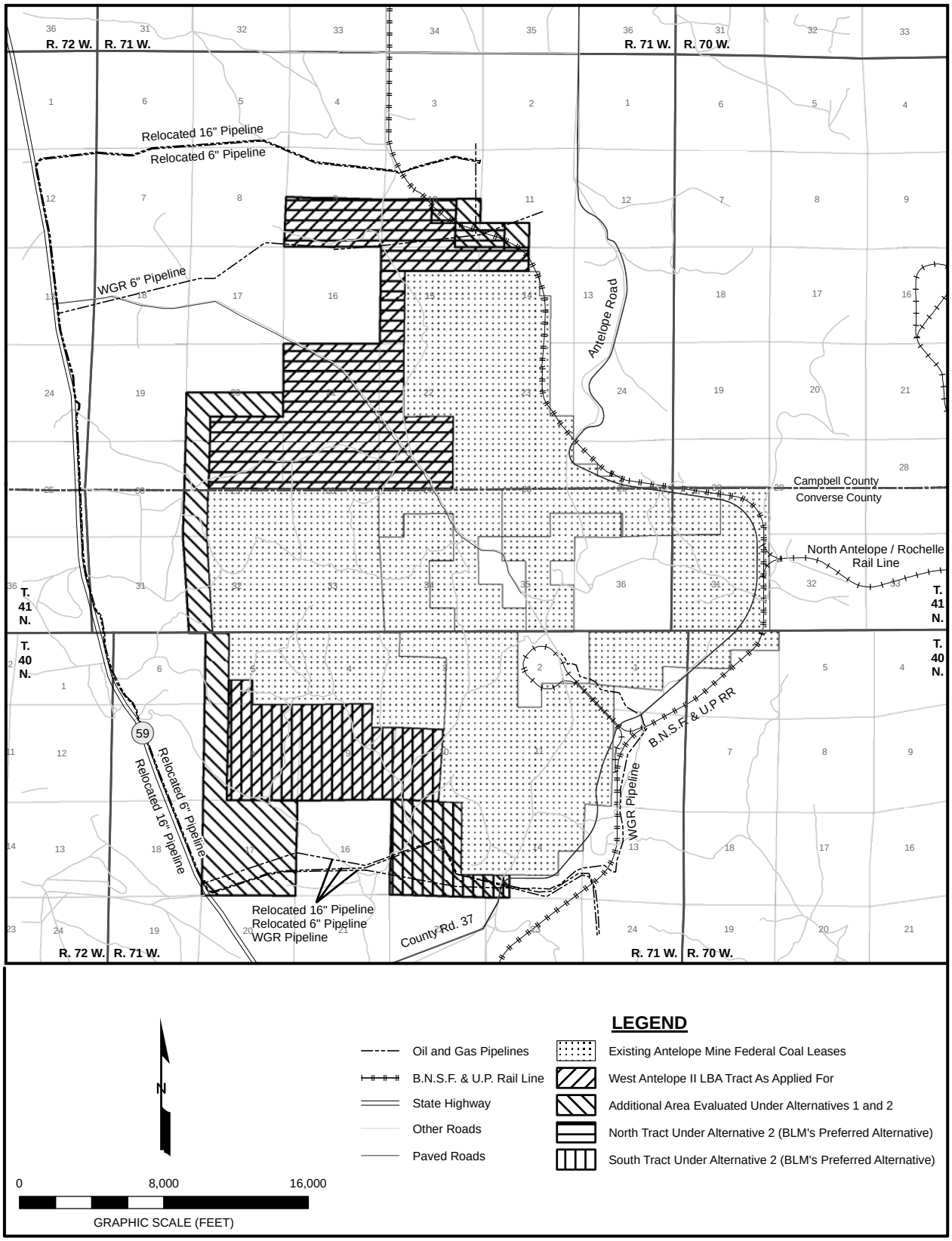


Figure 3-24. Oil and Gas Pipelines Within and Adjacent to the West Antelope II LBA Tract.

public roads would be considered unsuitable, they could be included in the West Antelope II LBA tract to allow recovery of economically mineable coal outside of the ROW and buffer zone. A stipulation stating that no mining activity may be conducted in the portion of the lease within the public road ROW and buffer zone will be attached if a lease is issued for this tract. The exclusion from mining by lease stipulation honors the finding of unsuitability under Unsuitability Criterion 3.

If the tract is leased and mined, pipelines and utility/power transmission lines that currently cross the LBA tract would have to be removed and relocated if they are currently active. Any relocation of these pipelines and utility lines would be handled according to specific agreements between the coal lessee and the pipeline and utility owners, if the need arises.

3.15.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts would not occur on from 4,314 up to 6,625 acres that would be disturbed under the Proposed Action or Alternatives 1 and 2, respectively.

The transportation resources located in those areas would not be affected by mining. Currently approved mining operations and any associated impacts to transportation resources would continue on the existing Antelope Mine leases. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.15.3 Regulatory Compliance, Mitigation and Monitoring

The regulatory requirements regarding transportation facilities require that existing pipelines and utility lines be relocated, if necessary, in accordance with specific agreements between the coal lessee and the pipeline and utility owners.

3.15.4 Residual Impacts

3.15.4.1 Coal Loss During Transport

With the opening of the Powder River Basin in Wyoming in the late 1970s, U.S. coal shipments have grown dramatically from 4.8 million carloads back then to 8.4 million carloads in 2006 as the railroads deliver low sulfur coal to help electric utilities achieve Clean Air Standards (FRA 2008). The largest rail coal movements are from the Powder River Basin to generating power plants in Illinois, Missouri, and Texas (FRA 2008).

Shifting and blowing coal dust and coal chunks coming off freshly loaded moving railroad cars can accumulate along railroad tracks, railroad rights-of-way, and on adjacent lands. Coal dust can wash into drainages where large deposits of lost coal can accumulate. Accumulated coal dust has been linked to train derailments and can also spontaneously combust and cause wildfires.

Coal can be lost from rail cars through leakage from the rail car discharge doors, spillage over the rail car sides, and can be blown from rail car tops during transit. In testing conducted by Union Pacific Railroad, Burlington Northern Sante Fe Railroad, and the National Coal Transportation Association, the average loss of coal from an individual rail car's rapid discharge doors was about 19 pounds per 216 miles, or 0.09 pounds per mile (NCTA 2007). The same testing indicated that an average of 225 pounds of coal was lost from the top of a coal car through either top spillage or being blown off during a 567 mile test trip, which equated to about 0.40 pounds per mile (NCTA 2007).

The derailment of two trains in the PRB in 2005 resulted from track instability problems caused by a buildup of coal dust and other particles on the rail bed in combination with high concentrations of moisture (UPR 2005). BNSF railway officials toured the PRB rail infrastructure in June, 2007. According to a BNSF official, when coal dust is blown off rail cars, it gets lodged in the rail bed, allowing moisture to intrude. The moisture then degrades the structural stability of the rail bed and leaves the rail more vulnerable to buckling under stress (Gillette News-Record 2007a). NCTA (2007) testing results suggested that rail car bottom spillage may have more of a negative impact on rail ballast stability than loss from the top of rail cars since the leakage is directly above and near the ballast. NCTA (2007) testing also showed that after the rapid discharge doors were adjusted, there was a 32 percent decrease in bottom spillage of coal.

Accumulating coal dust and deposition has become a concern in Converse County. The majority of coal mined in the PBR travels through Converse County on railroads. Coal dust blows off the freshly loaded coal cars on their way from the PRB mine load-outs to Bill and through Converse County (Casper Star Tribune 2007a). The Converse County Board of Commissioners is concerned with the coal dust piles that have accumulated in the county from coal being transported by rail.

Spontaneous combustion of accumulated coal dust can cause rangeland fires. Smoldering coal dust within a railroad right-of-way can ignite a wildfire and quickly spread to surrounding private lands if the fire is not immediately controlled. The Douglas Volunteer Fire Department Chief, Rick Andrews, estimates that coal fires account for at least 50 percent of the department's average summer call volume (Casper Star Tribune 2007a). Coal fires along the railroad tracks are an ongoing problem for the Douglas Volunteer Fire Department (Casper Star Tribune 2007a). Often water only temporarily puts down the flames; some fires repeatedly ignite over the course of several hours or days (Casper Star Tribune 2007a). While the county's rural fire district is compensated for some of

the costs involved in putting out fires caused by transported coal, the compensation doesn't come close to the actual costs, according to the Douglas Volunteer Fire Department Chief (Casper Star Tribune 2007a).

BLM was invited by a Converse county private land owner to examine and survey the coal deposition that has occurred from coal trains traveling through his land. On July 7, 2008, BLM personnel met with the private landowner and toured his rangeland that was adjacent to the railroad right-of-way, about 26 miles north of Douglas, Wyoming. BLM surveyed various coal accumulations in Box Creek; one area was found to have a coal accumulation of 1.8 feet thick (BLM 2008b). Water runoff washed lost coal from the trains into drainages; the amount of coal deposition varied along the tracks (BLM 2008b).

BNSF is working with the utility companies and the mines in trying to encourage larger chunks of crushed coal to be delivered (3-inch versus 2-inch) in an effort to reduce the amount of small particles that are created in the crushing process (Gillette News-Record 2007a). Another possibility that may help lessen blowing coal dust from trains is the use of surfactant applied to the tops of loaded coal cars (Gillette News-Record 2007a). When applied to coal, surfactant can stabilize and adhere coal dust to larger coal chunks. Some tests have shown that coal dust on railroad tracks can be reduced by up to 95 percent with surfactant use (Gillette News-Record 2007a). In order for a surfactant to be used, it would need to meet utility companies' burning specifications (Gillette News-Record 2007a).

A collaborative effort between the NCTA, PRB mines, and the BNSF and UP railroads has resulted in an improved design for a coal loading chute that distributes coal more evenly and produces a lower profile load (UPR 2006). Preliminary results have demonstrated that this new design may result in a 30 to 60 percent reduction in coal dust blowing off the top of cars during the early portion of the route (UPR 2006).

Converse County Commissioners have formally expressed concerns to BLM in regard to fire, health, and safety issues associated with blowing coal dust from trains. The Commissioners have stated that the health and well-being of Converse County citizens downwind of the railroad tracks continue to be jeopardized due to lack of coal dust mitigation in the coal mining permit process (BLM 2008c). The Converse County Commissioners have urged that coal dust mitigation be applied as a standard condition of approval upfront in the mining permit (BLM 2008c).

BLM does not authorize mining permits nor regulate mining operations with the issuance of a BLM coal lease. WDEQ is the agency that permits mining operations and has authority to enforce mining regulations. In Wyoming, WDEQ has entered into a cooperative agreement with the Secretary of the Interior to regulate surface coal mining operations. Mitigation and other requirements are developed as part of the mining and reclamation permit. These must be approved by WDEQ before mining operations can occur on leased federal coal lands.

Other agencies that may be stakeholders in this issue include the Federal Railroad Administration, which implements U.S. Department of Transportation environmental policies related to U.S. railroads, and the National Coal Transportation Association whose mission includes facilitating the resolution of coal transportation issues in order to serve the needs of the general public and industry (NCTA 2008).

3.16 Hazardous and Solid Waste

3.16.1 Affected Environment

Potential sources of hazardous or solid waste on the West Antelope II LBA tract would include spilled, leaked or dumped hazardous substances, petroleum products, and/or solid waste associated with coal and oil and gas exploration, oil and gas development, the BNSF & UP railroad, utility line installation and maintenance, or agricultural activities. No such hazardous or solid wastes are known to be present on the West Antelope II LBA tract. Wastes produced by current mining activities at the Antelope Mine are handled according to the procedures described in Section 2.1.2.

3.16.2 Environmental Consequences

3.16.2.1 Proposed Action and Alternatives 1 and 2

If the applicant mine acquires the LBA tract, the wastes that would be generated in the course of mining the tract would be similar to those currently being generated by the existing mining operation. The procedures that are used for handling hazardous and solid wastes at the existing mine are described in Chapter 2, Section 2.1.2. Wastes generated by mining the West Antelope II LBA tract would be handled in accordance with the existing regulations using the procedures currently in use and in accordance with WDEQ-approved waste disposal plans at the Antelope Mine.

3.16.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts would not occur on from 4,314 up to 6,625 acres that would be disturbed under the Proposed Action or Alternatives 1 and 2, respectively, and no waste materials would be generated as a result of coal removal on the tract. Currently approved mining operations would continue on the existing Antelope Mine leases. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.16.3 Regulatory Compliance, Mitigation and Monitoring

The regulatory requirements regarding production, use, and/or disposal of hazardous or extremely hazardous materials are discussed in Chapter 2. All mining activities involving the hazardous materials are and would continue to be conducted so as to minimize potential environmental impacts.

3.16.4 Residual Impacts

No residual hazardous and solid waste impacts are expected.

3.17 Socioeconomics

The social and economic study area for the proposed lease action and associated mining includes Converse and Campbell counties and the communities of Douglas, Gillette and Wright. These three communities are home to more than 95 percent of the mine's current workforce, as well as most of the mining services, retail and business and consumer service establishments in the area. Gillette and Douglas are also the county seats for the respective counties.

The Antelope Mine presently has a workforce of 430 employees. The current workforce represents an increase of about 180 employees following the acquisition of additional reserves in the West Antelope lease. The mine has also completed significant capital investments in mining equipment and rail loadout facilities to boost its production. The expansion in reserves associated with the West Antelope II LBA tract under the Proposed Action would sustain current rates of production [about 36 mmtpy) while extending the life of mine by approximately 11 years. The additional reserves associated with Alternatives 1 and 2 would add up to two more years to the life-of-mine beyond that associated with the Proposed Action. Assuming an increase in annual production to 42 mmtpy, the corresponding life-of-mine estimates are nine additional years under the Proposed Action and up to 11 additional years under Alternatives 1 and 2.

No major change in direct employment is anticipated at the Antelope Mine in conjunction with the Proposed Action or Alternatives 1 and 2 assuming annual production of 36 mmtpy, though as many as 25 additional workers may be needed at times during the life-of-mine as mining progresses to different locations. Raising annual production to 42 mmtpy could increase the incremental workforce needs to as many 40 workers, or 470 total employees, at times.

Residency patterns of new employees would be expected to mirror that of the mine's current workforce. Nearly 70 percent of the current workforce lives in or near Douglas, approximately 50 miles south of the mine. About 26 percent of the mine's workforce live in Campbell County; 90 workers (20 percent) in Gillette (about 65 miles north) and 25 workers (6 percent) in Wright (about 20 miles north). Company-sponsored bus service to and from the mine operates several times daily for employees living in Gillette and Douglas.

In 2006 the Antelope Mine had a total payroll, including benefits and incentives, of $36.7 million. In addition, the mine made outlays of $286 million for non-labor operating expenses, capital investments, and permits, licenses, fees and taxes. Approximately 20 percent of the latter sum was spent with vendors and suppliers in Wyoming or paid directly to state and local governments. The total also includes $62.7 million in Federal Mineral Royalties, reclamation and black lung taxes, a considerable portion of which returns to Wyoming.

3.17.1 Local Economy

3.17.1.1 Affected Environment

Coal production reported to the Wyoming State Inspector of Mines showed Wyoming's coal mines set a new annual production record of 444.9 million tons in 2006, an increase of 41 million tons (10.2 percent) over the 403.9 million tons produced in 2005; itself a record. PRB coal production (from Campbell and Converse Counties, 13 active mines) represented nearly 97 percent of the statewide coal production in 2006 and accounted for all of the gains in statewide production from 2005 to 2006 (Wyoming Department of Employment 2007a).

Energy resource development has been the primary stimulus behind a significant economic expansion across the state in recent years. Statewide total covered employment[2] stood at 254,302 in the first quarter of 2006, more than 10 percent higher than the corresponding total of 230,429 jobs in 2003. Nearly one-of-three new jobs created in the state during the 3-year period was in the mining industry, with most of that increase concentrated in support industries for oil and gas development. During the same period, statewide coal mining employment increased by 762 jobs to 5,567 jobs, a 16 percent net increase (Wyoming Department of Employment 2007b) and total employment grew by 513 jobs (12 percent) in Converse County and 4,422 jobs (22 percent) in Campbell County.

Local job growth occurred across most industries, but was concentrated in mining, construction, transportation, and local government (Wyoming Department of Employment 2007b). Mining, including the oil and gas industry, accounts for 30 percent of the total employment and 45 percent of the total payroll in Campbell County and 15 percent of employment and 25 percent of the total payroll in Converse County. Coal mining is the major constituent portion of the region's mining industry, unlike in many other areas of Wyoming, where oil and gas development is the primary constituent.

Labor market conditions in the region reflect recent economic expansion driven principally by energy resource development. Unemployment in both counties has

[2] Covered employment refers to those full- and part-time, private and government wage/salary workers covered under the state's unemployment insurance program. About 97% of non-agricultural workers are included. Exclusions include insurance and real estate agents on commission; most railroad workers; self-employed; unpaid volunteers or family workers; members of the military; and many agricultural workers.

declined since 2003. Average unemployment rates for 2006 were 3.4 percent in Converse County and 2.1 percent in Campbell County, even as the local labor force has grown due to immigration and the attraction of additional residents into the labor force (U.S. Bureau of Labor Statistics 2007).

Recent estimates of the state's Gross State Product (GSP)[3] highlight the significance of the minerals industry to the statewide economy. Estimates of the 2004 GSP indicate the mining industry, including oil and gas and support activities, accounted for 21.3 percent of the state's total GSP of $24.1 billion. The contribution of mining was nearly twice that of government, the next largest sector, and more than three times the contribution of the real estate industry, the next largest private sector. Coal mining and mining of other minerals accounted for 8.3 percent of the Wyoming GSP (Wyoming Department of Administration and Information 2007).

Wyoming, Converse and Campbell county governments, school districts, and local towns receive revenue from a variety of taxes and royalties on the production of federal coal. These include lease bonus bids, ad valorem taxes, severance taxes, royalty payments, sales and use taxes on equipment and other taxable purchases, and portions of required contributions to the federal AML program and Black Lung Disability Trust Fund. Lease bonus bids are paid for the right to enter into lease agreements for federal coal.

In 1994, the University of Wyoming estimated the total fiscal benefit to the State of Wyoming for coal produced in the PRB at $1.10 per ton (Borden et al. 1994). Calculating the estimated total fiscal benefit to the State of Wyoming in 2005 by including half of the bonus bid payments, half of the federal mineral royalties based on current prices, half of the AML fees, and all of the ad valorem taxes, severance taxes, and sales and use taxes for coal produced in Campbell County in 2004 results in an estimated $620 million, or $1.53 per ton (BLM 2006b).

Revenues to the federal government from the leasing and production of federal coal include retention of one-half of the lease bonus bids and federal mineral royalties. Bonus bids are paid in five annual installments, with half returned to the state. In 2004 and 2005, BLM held competitive sealed-bid lease sales for six coal tracts (NARO South, West Antelope, West Hay Creek, Little Thunder, West Roundup, and NARO North). The successful bonus bids for these six sales ranged from 30 cents per ton to 97 cents per ton and totaled $1.69 billion, including $146.3 million for the West Antelope tract (BLM 2006b).

Annual bonus bid payments from the six lease sales currently total $338.2 million. Three years remain on the payments from those sales, with an annual bonus bid payment of $169.1 million to the State of Wyoming derived directly from federal coal in the PRB. Three coal sales have been held in Wyoming in the first

[3] GSP is a measure of the total market value of goods and services produced by the labor, capital and property in the state, after netting out the value of intermediate outputs imported to the state.

four months of 2008, two of which were successful. The sales for the Eagle Butte West and South Maysdorf tracts yielded bonus bids within the range of the 2004 and 2005 sales (BLM 2008). Successful sales generate additional coal lease bonus bid disbursements. The coal lease bonus bid disbursements to the State of Wyoming are allocated to fund capital construction of schools, capital construction projects for cities, towns and counties, the state's highway fund, and community colleges.

Federal mineral royalties (FMR) are collected by the federal government at the time that produced coal is sold, with a royalty rate equal to 12.5 percent of the sale price. Following a deduction for administrative expenses (approximately one percent), 50 percent of the FMR are disbursed to the State of Wyoming. Total FMR disbursements to the state in fiscal year 2006, derived from all mineral production, not solely coal, was $1.07 billion (Wyoming CREG 2007). In 2006, the Antelope Mine paid $39.3 million in FMR.

In addition to the FMR, coal mines pay 31.5 cents per ton of surface coal produced to fund abandoned mine land (AML) reclamation programs. Collectively about 83 percent of the funds are returned to states and tribes with AML problems. Actual annual appropriations vary depending on Congressional authorizations and overall AML program priorities. Additional sources of revenue include federal income tax and annual rentals paid to the government. The Antelope Mine payments to the federal mining reclamation program exceeded $11.8 million in 2006.

Sales and use taxes are levied by the state and by local governments. Approximately 70 percent of the revenues generated from the statewide 4.0 percent levy are retained by the state, the remainder being distributed to the counties, cities and towns according to statutory formula. In addition, Converse and Campbell county governments each impose a 1.0 percent general purpose local option tax and Campbell County imposes a 0.25 percent specific county option tax. Sales and tax revenues are vital for local governments. Statewide total sales and use tax revenues totaled $810.4 million in 2006. A direct accounting of sales and use taxes paid by coal mining firms is not available, however, it is likely substantial given the operating budgets of the mines. An internal analysis of the mine's outlays yielded an estimated $3.5 million paid in sales and use taxes by the Antelope Mine in 2006.

Local governments and school districts also rely heavily on ad valorem/ property taxes levied on the real property and value of production. Due to the location and configuration of the mine and actual mining areas, Converse and Campbell county governments as well as Converse County School District #1 and Campbell County School District #1 all benefit from operations of the Antelope Mine. The permanent facilities are primarily located in Converse County. Most of the active mining areas are presently located in Campbell County, but production has also occurred from reserves located in Converse County over time.

Rising production and market values for oil and gas, and the increases in coal production tonnages have given rise to dramatic increases in the ad valorem tax bases of producing counties, particularly Campbell County. In 2005, Campbell County had an ad valorem tax base of $3.66 billion; more than 22 percent of the aggregate statewide assessed value on all real property and mineral production. Converse County had an assessed value of $432 million that same year, 14th among Wyoming's 23 counties. The coal mining industry accounted for 59 percent of Campbell County's total assessed value and 23.5 percent of that in Converse County – see Table 3-15. The Antelope Mine accounted for a majority share of the coal-related value in Converse County and a substantial amount in Campbell County. The mine is a major taxpayer in both counties.

Table 3-15. Contribution of Coal Mining to the 2005 Assessed Valuation of Converse and Campbell Counties.

	(1) Total Assessed Value	(2) Coal Mining (Real Property)	(3) State Assessed Minerals - Coal	(4) Coal-related Share of the Total [(2) + (3)]/(1)
Campbell County	$ 3,660,527,493	$ 163,424,869	$ 1,995,307,606	59.0%
Converse County	$ 432,232,521	$ 16,355,912	$ 85,208,985	23.5%

Sources: Wyoming Department of Revenue 2006 and Wyoming State Board of Equalization 2007.

3.17.1.2 Environmental Consequences

3.17.1.2.1 Proposed Action and Alternatives 1 and 2

The federal and state revenues that would be generated by the leasing and mining of the West Antelope II LBA tract would depend on which alternative is selected and the eventual sales price of produced coal. For this analysis the average sales price of coal is assumed to be $9.01 per ton, equal to the forecasted price in 2009 by the State of Wyoming's Consensus Revenue Estimating Group (CREG) to estimate the state's revenues from mineral severance and federal mineral royalty revenues over the next five years (Wyoming CREG 2006 and 2007). CREG assumes further increases of approximately 2 percent per year from 2009 through 2012. Consequently, the $9.01 may be conservative.

The projected federal and state revenues for the West Antelope II LBA tract presented in Table 3-16 are based on the coal production tonnages shown in Table 3-1 and potential bonus bids on the leased recoverable coal ranging from $0.30 to $0.97 per ton. Note that the projected revenues are based on the total tons of recoverable coal and hence are insensitive to changes in future annual production rates. If the West Antelope II LBA tract is leased and mined under the Proposed Action, the potential additional federal revenues would range from approximately $511 to $637million. Under Alternatives 1 and 2, potential additional federal revenues range from approximately $514 million to $766 million.

If the LBA tract is leased and mined under the Proposed Action, the potential incremental state and local revenues beyond those associated with No Action

range from $686 to $813 million. Under Alternatives 1 and 2, potential additional state revenues range from about $690 to $977 million.

The base of economic activity provided by wages and local purchases would continue for to up to 13 additional years, depending on the alternative and production rates.

Table 3-16. Projected Major Revenue Impacts from Leasing the West Antelope II LBA Tract Under the Proposed Action or Alternatives 1 and 2.[1]

Item	No Action Alternative (Existing Mine)	Proposed Action	Alternatives 1 and 2
State and Local Revenues	$ 657.3 mm	+ $ 686.4 to $ 813.0 mm	+ $ 690.2 to $ 976.8 mm
Federal Revenues	$ 473.7 mm	+ $ 510.6 to 637.1 mm	+ $ 513.5 to $ 765.5 mm
Increased Mine Life	0 yrs	11 yrs (36 mmtpy) 9 yrs (42 mmtpy)	11 to 13 yrs (36 mmtpy) 9 to 11 yrs (42 mmtpy)
Additional Employees	0	Up to 25 (36 mmtpy) Up to 40 (42 mmtpy)	Up to 25 (36 mmtpy) Up to 40 (42 mmtpy)

[1] Includes severance taxes, federal mineral royalties, and payments to the Abandoned Mined Lands and Black Lung Disability funds. State and local revenues include allowances for sales and use taxes on direct purchases by the mine and ad valorem/property taxes on real property and production. Revenues assume an average sales price of $9.01 per ton for coal.

3.17.1.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the coal included in the LBA tract under the Proposed Action (377.8 million tons of recoverable coal) or Alternatives 1 and 2 (up to 453.9 million tons) would not be mined and the economic and fiscal benefits associated with mining that coal would not be realized by the state or federal government. Currently approved mining operations and associated economic benefits would continue on the existing Antelope Mine leases, but would cease between nine and 13 years earlier than under the Proposed Action or Alternatives 1 and 2. Job losses, both those directly associated with the mine, as well as those secondary jobs supported by the mine, would occur following the cessation of operations.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.17.2 Population

3.17.2.1 Affected Environment

Converse County had an estimated population of 12,866 in July 2006, an increase of 762 residents (6.3 percent) over its population of 12,104 in 2000. Statewide

population grew by 4.2 percent during the same period – see Table 3-17. Douglas, the county seat and largest community in Converse County, had an estimated population of 5,581 in July 2005, compared to 5,288 residents in 2000.

Table 3-17. Population Change, 2000 to 2006.

Year	Campbell County	Converse County	Total Study Area
2000	33,698	12,104	45,802
2003	36,381	12,326	48,707
2006	38,934	12,866	51,800
Change, 2000 - 06	5,236	762	5,998
Percent Change	15.5%	6.3%	13.1%

Source: U.S. Census Bureau (2006b).

Campbell County's population climbed from 33,698 in 2000 to an estimated 38,934 in July 2006. This represents a 15.5 percent growth rate since 2000 making Campbell County the second fastest growing county in the state. Campbell County's population ranks it as the third most populous of Wyoming's 23 counties and Gillette's 2005 population of 22,685 is the fourth largest city in the state, following Cheyenne, Casper, and Laramie (U.S. Census Bureau 2007).

Based on the residency patterns of the mine's employees and the concentration of mine service companies in the Gillette area, the majority of the mine's current population likely reside in and are assimilated into the Douglas and Gillette communities.

In comparison to the statewide population, the median age of Campbell County residents was substantially lower, while that of Converse County residents was higher. However, both counties had relatively fewer minority residents, a higher percentage of residents under 18, and had larger average household sizes – see Table 3-18.

Table 3-18. Demographic Characteristics, 2000.

Characteristic	Wyoming	Campbell County	Converse County
Median Age	36.2	32.2	37.5
Percent Residents < 18 Years Old	26.1	31.0	28.5
Average Household Size (persons)	2.48	2.73	2.55
Percent Minority Residents	7.9	3.9	5.3

Source: PRB Coal Review Task1C Report (BLM 2005b)

3.17.2.2 Environmental Consequences

3.17.2.2.1 Proposed Action and Alternatives 1 and 2

As indicated by Table 3-16, leasing and subsequently mining the LBA tract would extend the life of the Antelope Mine, and current employment at the mine, by up to 13 years. Relatively little change in employment is expected at the mine under the Proposed Action or Alternatives 1 and 2 (up to 40 additional jobs, depending

on the annual production rates as discussed above). Consequently, leasing and mining of the LBA tract would not result in any noticeable incremental change in the study area population. Demands on public facilities and service would also see little change.

3.17.2.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the coal included in the LBA tract under the Proposed Action or Alternatives 1 and 2 would not be mined. Currently approved mining operations and associated employment levels would continue on the existing Antelope Mine leases. Without additional reserves, operations at the Antelope Mine would cease in about 2018, resulting in economic dislocations of the mine's workforce, their households, and others supported indirectly by the mine's operations. The net result would likely include population out-migration, with associated adverse impacts on local communities.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.17.3 Employment

3.17.3.1 Affected Environment

Coal mining has changed substantially in recent times, with new technologies and higher capacity equipment major contributors to these changes. Local coal mining employment grew rapidly during the 1970s as more mines opened and production climbed. Between 1980 and 1998, overall production rose while employee numbers generally decreased or remained constant. The employment declines followed large industry capital investments in facilities and production equipment, the majority of which were aimed at increasing productivity (BLM 2005b). Since 1998, direct employment in Powder River coal mines climbed as total annual production climbed by more than 45 percent (Wyoming Department of Employment 2007b).

In 2006, the mining sector, which includes oil and gas workers, accounted for almost 28 percent of all employment in the two-county study area, nearly four times the statewide percentage. Approximately 4,800 people were directly employed by surface coal mines or coal contractors in Converse and Campbell counties, representing about 17 percent of total employment labor force (Wyoming Department of Employment 2007a).

3.17.3.2 Environmental Consequences

3.17.3.2.1 Proposed Action and Alternatives 1 and 2

Leasing and subsequently mining the West Antelope II LBA tract would extend the life of the Antelope Mine by nine to 13 years, depending on annual production rates. As discussed above, limited increases in anticipated employment at the mine would occur under the Proposed Action and Alternatives 1 and 2. Consequently leasing the West Antelope II tract would also have limited effect on secondary employment in the region. Thus, there would be little net effect on the local labor market. The economic stability of the region would benefit by having the current Antelope Mine workforce living in the community and employed at the mine for up to 13 additional years.

3.17.3.2.2 No Action Alternative

Under the No Action Alternative, the coal included in the West Antelope II LBA tract under the Proposed Action or Alternatives 1 and 2 would not be mined. Mine life and existing employment levels would not be extended, though currently approved mining operations and associated employment would continue on the existing Antelope Mine leases. However, production would be completed and the direct jobs provided by the mine and those supported indirectly by its operations and the consumer expenditures of its workforce would be lost sooner than if leasing were to occur.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.17.4 Housing

3.17.4.1 Affected Environment

The 2000 census tallied 5,669 housing units in Converse County, of which 82.8 percent were occupied; 74 percent of which were owner-occupied and 26 percent renter-occupied. Of the 975 vacant units (17 percent), 316 were owned for seasonal or occasional use with 656 available for sale or rent, or otherwise vacant. The census counted 13,288 housing units in Campbell County, of which 12,207 (92 percent) were occupied; 74 percent by owners. Of the 1,081 vacant units, 215 were held for seasonal or occasional use and 866 were for sale, rent or vacant for other reasons (U.S. Census Bureau 2000).

Population growth since 2000 has prompted new housing construction in the region. Net additions to the number of housing units from 2000 through 2005 total 797 in Campbell County and 183 units in Converse County (Table 3-19). Building permits for 219 new units were issued by the City of Gillette in 2006. Construction has not kept pace with demand. As a consequence, vacancy rates

are near record lows and housing prices have climbed. In the second half of 2006, vacancy rates of rental units were 0.4 percent (6 units) in Campbell County and 1.4 percent (9 units) in Converse County (Wyoming Housing Database Partnership 2007).

Table 3-19. Total Housing Stock in 2000 and 2005.

Year	Campbell County	Converse County
2000	13,288	5,669
2005	14,085	5,852
Change	797	183

Source: U.S. Census Bureau (2006a)

A recent housing survey in Gillette yielded a vacancy rate of 0.2 percent for rental properties with many complexes having waiting lists of more than 50 people and wait times of up to nine months. That survey also estimated a vacancy rate of less than 10 percent among 11 mobile home parks (City of Gillette 2007).

In the fourth quarter of 2006, average housing rental costs in Campbell County were $697 for a two-bedroom, unfurnished apartment, $283 for a single-wide mobile home lot and $975 for a two or three-bedroom single family home. In Converse County, the equivalent rates substantially lower; $515 for an apartment, $152 for a mobile home lot and $545 for a single family home (Wyoming Department of Administration and Information 2007).

The average selling price of homes in Converse County in 2005, based on 195 sales, was $147,560, nearly 29 percent higher than the preceding year. In Campbell County the average sales price, based on 458 sales, was $185,874. That average represents a 7 percent increase over that in 2004 and fifth highest among Wyoming counties (Wyoming Housing Database Partnership 2007).

In addition to permanent housing, there is a substantial inventory of temporary or transient housing in the study area. Such housing includes hotels or motels, campgrounds, and possibly mobile home parks. Given the tight housing market in Gillette, some such units are reportedly being used for longer-term occupancy by workers and families waiting for traditional housing to become available (Langston 2005).

There are 17 motels in Gillette with 1,346 guest rooms and a 27-room motel in Wright. Gillette has two year-round commercial campgrounds with 150 hookups for RVs plus tent areas (Gillette Convention and Visitor's Bureau 2004). There are 7 motels with a total of 364 rooms in Douglas, along with three commercial campgrounds with 119 trailer/RV spaces (Wyoming Travel and Tourism Division 2007).

3.17.4.2 Environmental Consequences

3.17.4.2.1 Proposed Action and Alternatives 1 and 2

As discussed above, limited change in direct employment at the Antelope Mine is anticipated in conjunction with the leasing and mining of the West Antelope II LBA tract under the Proposed Action or Alternatives 1 and 2. Consequently, no substantial population influx and additional demand on housing resources is expected. Furthermore, any new employees would most likely be attracted to the Douglas area, the principal community of residence for employees at the Antelope Mine. Housing is relatively more available and affordable in the Douglas area.

3.17.4.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the coal included in the West Antelope II LBA tract under the Proposed Action or Alternatives 1 and 2 would not be mined. Housing markets would not be affected by any additional employment at the Antelope Mine. Currently approved mining operations and associated employment levels would continue on the existing mine leases. When the existing leases are mined out, mining operations would cease, likely triggering population out-migration from the area and adversely affecting housing markets.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.17.5 Local Government Facilities and Services

3.17.5.1 Affected Environment

The availability of revenues generated by mineral production has helped local government facilities and services address growing demands for public services. Current facilities and services are generally adequate for the current population, although several service providers are engaged in expansion plans to accommodate future growth and improve service delivery.

Converse County School District #1 and Campbell County School District #1 are the districts most directly affected by the Antelope mine's operations. Following steady declines between 1996 and 2003, enrollment in the Converse County School District #1 has stabilized at about 1,580 over the past three years. Total enrollment in Campbell County School District #1 declined by more than 500 students between 1998 and 2004, but then climbed by nearly 140 students in 2005 in response to economic and population growth in the county. In terms of enrollment, it is the third largest district in Wyoming (Wyoming Department of Education 2007).

Converse County School District #1 operates eight schools; six elementary, one junior high, and one high school. Campbell County School District #1 facilities include 15 elementary schools, two junior high schools, and two high schools (one with two campuses in Gillette). Converse County School District #1's facilities are adequate in terms of capacity for its present enrollment, however it has initiated planning and design for a new elementary school to accommodate recent and expected enrollment and is planning for the construction of new warehouse and transportation support facilities, access road improvements for schools, and systems maintenance and upgrades (Converse County School District #1 2007). The Campbell County School District is involved in a major five-year plan to replace several schools, modernize others and complete major systems maintenance and upgrades. The complete plan is budgeted at over $57 million. Plans for the next two years include completion of a new elementary school and additions to a high school (Wyoming School Facilities Commission 2007).

The Converse County and Campbell County Sheriff's departments provide police protection throughout their respective counties. In addition to general law enforcement, the Sheriff's staff provides court security, detention facilities, and animal control. For the 2004 fiscal year, the Campbell County Sheriff budgeted for 60 law enforcement employees. Recent improvements have increased the Campbell County detention facility to 128 beds, which includes separate modules for women and juveniles (BLM 2005b). The Converse County Sheriff includes 12 patrol deputies, plus additional staff in the communications and detention divisions.

Fire suppression throughout Campbell County is provided by the Campbell County Fire Department, which is governed by a city-county joint powers board (Vonsik 2005). The department maintains four stations in Gillette and six dispersed throughout the county. Fire suppression in rural Converse County is provided by the Converse County Rural Fire Control Association. The Douglas Volunteer Fire Department covers the city of Douglas. The Antelope Mine maintains equipment and trained staff to fight fires on mine property.

The primary medical care facilities serving the region are the Memorial Hospital of Converse County, a 25-bed acute care hospital located in Douglas, and the Campbell County Memorial Hospital, a 90-bed acute care hospital, located in Gillette. The Campbell County Memorial Hospital operates the Wright Clinic, a satellite clinic, located approximately 18 miles from the Antelope Mine. The clinic is staffed with a full-time, family practice physician.

Ambulance service for Campbell County is provided by the hospital, which has a 24-hour emergency service capability. The Campbell County Fire Department provides first responder service to emergency calls, but transport is the responsibility of the hospital affiliated ambulance service (Vonsik 2005). Emergency medical transport in Converse County is provided by an ambulance service operated by the Memorial Hospital of Converse County. The service

presently maintains and operates three ambulances with a paid staff. Response is augmented by the Douglas Volunteer Fire Department (Leon 2007).

The principal water and wastewater utilities are operated by the City of Douglas, City of Gillette and by the Wright Water and Sewer District. The City of Douglas has three water sources. The Little Boxelder Spring is a high-quality gravity-fed source located some 18 miles west of Douglas. This source provides up to 2 million gallons per day and meets the water demands in the fall and winter. The second water source is a 1.5 million gpd Sheep Mountain Well. This well came into service in the fall of 1994 and supplements the city water supply during peak demand and allows for reduced usage of the more costly treated water. The water treatment plant treats up to 2.5 million gpd of North Platte River water during the summer and is used primarily during heavy irrigation periods. It was not designed to service the community in winter, but can be brought on-line under emergency circumstances.

Douglas has multiple water storage facilities with a combined capacity of about 6 million gallons. The current water system is designed to accommodate a population of 10,000 people (Sweeney 2004). However, as a result of drought, the city implemented watering restrictions during summer months of the last four years. The construction of a new water treatment plant, scheduled for completion in 2008, may ease the need for water restrictions, but continued drought conditions could also result in a continuation of these restrictions (Fitzhugh 2007).

The City of Gillette water system has ample capacity for its service area during most of the year, however, the system operates close to capacity during the peak demand months of June, July and August. In the short term, the city intends to add several wells to the system to augment water supply during peak months. The city is also conducting a Level II Water Study to identify longer term solutions to its water supply problems. The City implemented voluntary conservation measures during the summer of 2007 and is considering changes in the water rate structure to reduce peak period consumption. The Level II study is likely to identify well field, transmission, pumping station and treatment additions to the current system. If approved by the city and if funding is secured, these improvements are anticipated to come on line during the next three to five years (Petersen 2007).

Gillette's sewer treatment system was designed for a service population of approximately 35,000 and improvements begun in the fall of 2004 were designed to increase treatment capacity to accommodate a projected population of 41,000. Currently, the system serves an estimated 25,000 people in the city and surrounding areas.

3.17.5.2 Environmental Consequences

3.17.5.2.1 Proposed Action and Alternatives 1 and 2

As discussed above, employment at the mine would not increase substantially under the Proposed Action and Alternatives 1 and 2. No additional demands on the existing community facilities or services in the county would be expected because little or no influx of new residents would be needed to fill new jobs. It is likely that the demand for public facilities and services would be satisfied by the existing facilities and services currently in place in Converse and Campbell Counties.

3.17.5.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the coal included in the West Antelope II LBA tract under the Proposed Action or Alternatives 1 and 2 would not be mined. Local government facilities and services would not be affected by any additional employment or associated population growth associated with the Antelope Mine. Currently approved mining operations and associated employment levels would continue on the existing Antelope Mine leases.

As discussed in Section 2.2, a decision to reject the West Antelope II lease application at this time would not preclude an application to lease the tract in the future.

3.17.6 Social Setting

3.17.6.1 Affected Environment

The social setting for coal development in the PRB, summarized in Section 4.2.12.9, is described in the Task IC Report for the PRB Coal Review (BLM 2005b). That report emphasizes Campbell County and its communities as the nucleus for coal development in the PRB. Converse County and the City of Douglas, also discussed in the Task 1C Report, are also affected by the Antelope Mine which is located partly within Converse County and is a major contributor to the county tax base. The Douglas area is home to 70 percent of the Antelope Mine workforce. The Antelope Mine has been in production since 1985 and the mine and its employees contribute to the social and economic stability of Converse County and the City of Douglas.

3.17.6.2 Environmental Consequences

3.17.6.2.1 Proposed Action and Alternatives 1 and 2

As discussed above, employment at the mine is not anticipated to increase substantially under the Proposed Action or Alternatives 1 and 2. Consequently,

little or no change in the social setting of Campbell or Converse counties or the communities of Gillette, Wright or Douglas would be anticipated under these alternatives.

3.17.6.2.2 No Action Alternative

Implementation of the No Action Alternative would result in the eventual loss of approximately 430 relatively high paying mining jobs in the PRB. An estimated 70 percent of those losses (315 jobs) would occur in Converse County and the community of Douglas. Loss of the Antelope Mine-related economic activity and tax revenues are described in preceding sections. These losses would likely result in a disruption in the social and economic stability of Converse County and the City of Douglas and some population relocation, unless Antelope Mine employees were able to find comparable employment within commuting distance of Douglas. Social effects of the No Action Alternative on Campbell County, the City of Gillette and the Town of Wright would be less substantial, because of the fewer number of employees involved and the potential for those employees to find other jobs in mines and other energy industries in Campbell County.

3.17.7 Environmental Justice

3.17.7.1 Affected Environment

Environmental Justice issues are concerned with actions that unequally impact a given segment of society either as a result of physical location, perception, design, noise, or other factors. On February 11, 1994, Executive Order 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations", was published in the *Federal Register* (59 FR 7629). The Executive Order requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations (defined as those living below the poverty level). The Executive Order makes it clear that its provisions apply fully to Native American populations and Native American tribes, specifically to effects on tribal lands, treaty rights, trust responsibilities, and the health and environment of Native American communities.

Communities within Campbell and Converse Counties, entities with interests in the area, and individuals with ties to the area all may have concerns about the presence of surface coal mines in the area. Environmental Justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well. Native American access to cultural and religious sites may fall under the umbrella of Environmental Justice concerns if the sites are on tribal lands or access to a specific location has been granted by treaty right.

Compliance with Executive Order 12898 concerning Environmental Justice was accomplished through opportunities for the public to receive information on this

EIS in conjunction with consultation and coordination described in Section 1.6 of this document. This EIS and contributing socioeconomic analysis provide a consideration of the impacts with regard to disproportionately high and adverse impacts on minority and/or low-income groups, including Native Americans.

3.17.7.2 Environmental Consequences

3.17.7.2.1 Proposed Action and Alternatives 1 and 2

Economic and demographic data indicate that neither minority populations nor people living at or below the poverty level make up "meaningfully greater increment" of the total population in Gillette, Wright, Campbell County, Douglas or Converse County than they do in the state as a whole. Also, the Native American population is smaller than in the state as a whole and there are no known Native American sacred sites on or near the study area for the West Antelope II LBA tract. Furthermore, there are few residences in close proximity to the current mine boundary or proposed West Antelope II LBA tract. Consequently, implementation of the Proposed Action or Alternatives 1 or 2 would not adversely affect the environmental justice considerations in the area.

3.17.7.2.2 No Action Alternative

Economic and demographic data indicate that neither minority populations nor people living at or below the poverty level make up "meaningfully greater increment" of the total population in Gillette, Douglas or the two counties than they do in the state as a whole. Also, the Native American population is smaller than in the state as a whole and there are no known Native American sacred sites on or near the existing Antelope Mine. Furthermore, there are few residences in close proximity to the existing mine boundary. Consequently, the No Action Alternative would not adversely affect the environmental justice considerations in the area.

3.17.8 Regulatory Compliance, Mitigation and Monitoring

Surface coal mines are required to pay royalty and other taxes and fees as required by federal, state, and local regulations. The BLM compares the amount of coal reported as produced with the estimated amount of coal in the ground to verify that royalties are paid on all of the coal that is mined.

3.17.9 Residual Effects

3.17.9.1 Human Health Impact Assessment

In 2008, public concerns were brought to BLM's attention in regard to conducting human health impact assessments in the PRB where coal mining activities occur. A health impact assessment (HIA) is a method used in assessing potential impacts of a proposed project on human health. HIAs examine health on a broad

scale, including social, emotional, and cultural impacts as well as physical impacts. HIAs rely on available scientific data, public testimony, and modeling to predict potential health impacts.

Public concerns included emissions from coal mining activities like particulate matter, PM_{10}, and nitrogen oxide exposure and their potential impact on human health and people living in the local PRB area.

BLM does not have jurisdiction in regard to conducting human health assessments. However, BLM has invited the Wyoming Department of Health/Environmental Health Section and the U.S. Center for Disease Control and Prevention to review and provide comment on the West Antelope II EIS.

Air pollution is controlled by state and federal air quality regulations and standards established under the federal Clean Air Act Amendments. State implementation plans are in place to ensure proposed actions like coal mining comply with all associated air quality regulations and criteria. The Wyoming Ambient Air Quality Standards are stricter than the National Ambient Air Quality Standards and are enforced by WDEQ.

As described in Section 3.4.2.3 of the EIS, the WDEQ/AQD developed a Natural Events Action Plan for the Coal Mines of the Powder River Basin. The plan, based on EPA Natural Event Policy guidance, identifies potential control measures for protecting public health and minimizing exceedences of the PM_{10} NAAQS.

All mines are required to conduct long-term air quality modeling to show that their proposed operations will comply with the National and Wyoming Ambient Air Quality Standards, and they are required to monitor to demonstrate that their actual air emissions do not exceed the standards. The WDEQ/Air Quality Division coal mining permit process requires air quality modeling of the primary air pollutants PM_{10} and NO_2. Please see Section 3.4.2.3 in the EIS to review air quality mitigation measures that WDEQ/AQD implemented in order to prevent exceedences of the National and Wyoming Ambient Air Quality Standards by surface coal mines.

3.18 The Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity

The NEPA regulations at 40 CFR 1502.16 require a discussion of the "relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" as part of an EIS. This requirement is duplicated in the BLM NEPA Handbook Chapter V, Section B.2.a.(3) and C.3.h.(2) (BLM 1988).

3.18.1 Local Area

If the West Antelope II LBA tract is leased, almost all components of the present ecological system, which have developed over a long period of time, would be modified as the coal is mined. In the long term, following reclamation, the land surface would be topographically lower and, although the reclaimed surface would resemble original contours, it would lack some of the original diversity of geometric form.

Soils and vegetation would be disturbed and the associated grazing and wildlife habitat that the West Antelope II LBA tract currently provides would be lost in the short term, during mining and reclamation. During mining of the LBA tract, there would be a loss of native vegetation from 4,108.6 acres (Proposed Action) up to a maximum of 6,309.2 acres (Alternatives 1 and 2). This disturbance would occur incrementally over a period of years. Soils would be replaced and vegetation would be restored, as required by the mining plan (see Sections 3.8 and 3.9). In the long term, the reclaimed lands would provide equivalent or better forage production capacity for domestic livestock. This would be required before the performance bond is released. Long-term productivity would depend primarily on post-mining range management practices which, to a large extent, would be controlled by the private landowners.

Mining would disturb pronghorn and mule deer habitat. As discussed in Section 3.10.5, potential sage-grouse habitat is scarce throughout the general project area. There would be loss and displacement of wildlife in the short term but, based on monitoring of previously reclaimed lands, it is anticipated that the reclaimed lands would provide habitat that would support a diversity of wildlife species similar to premining conditions in the long term. The diversity of species found in undisturbed rangeland would not be completely restored on the leased lands for an estimated 50 years after the initiation of disturbance. Re-establishment of mature sagebrush habitat, which is crucial for pronghorn and sage-grouse, would be expected to take even longer.

If the West Antelope II LBA tract is leased and mined, groundwater quality would be different from pre-mining conditions after reclamation. The water quality would remain adequate for livestock and wildlife. Depth to groundwater would increase in an area extending further to the west and south of the existing mine area. The water levels in the coal aquifer should return to premining levels at some time after mining has ceased because recharge areas would not be disturbed when recovering the coal in the LBA tract.

Mining operations and associated activities would degrade the air quality and visual resources of the area on a short-term basis. Following coal removal, removal of surface facilities, and completion of reclamation, there would be no long-term impact on air quality. The long-term impact on visual resources would be minor.

Short-term impacts to recreation values may occur from reduction in big game populations due to habitat disturbance and reduction in access to some public lands. These changes would primarily impact hunting in the lease area. However, because reclamation would result in a wildlife habitat similar to that which presently exists and access to any public lands affected by mining would be restored, there should be no long-term adverse impacts on recreation.

The short- and long-term economy of the region would be enhanced as a result of the Proposed Action and Alternatives 1 and 2. The Proposed Action and Alternatives 1 and 2 would extend the life of the Antelope Mine from nine to 13 years (see Table 2-2).

3.18.2 Greenhouse Gas Emissions

There has been, and continues to be, considerable scientific investigation and discussion as to the causes of recent historic rise in global mean temperatures, and whether a warming trend will continue. This section will address greenhouse gas emissions as specifically related to Antelope Mine, the mine adjacent to the West Antelope II LBA tract.

Greenhouse gases (GHGs) have been raised as a concern due to the greenhouse effect. The greenhouse effect is a theory that certain gases in the atmosphere impede the release of radiation from the earth, trapping heat in the atmosphere like glass in a greenhouse. GHGs currently include carbon dioxide (CO_2), methane (CH_4), water vapor, ozone, and nitrous oxide (NO_2). GHGs are not currently regulated, but there is a consensus in the international community that global climate change is occurring and that GHGs may play a role. If the coal in the West Antelope II LBA tract is leased and mined, GHGs would be released into the atmosphere.

As discussed in Chapter 1, BLM does not authorize mining through the issuance of a federal coal lease. WDEQ, with oversight from OSM, has regulatory authority in issuing permits to mine coal in Wyoming. However, BLM considers the impacts of mining coal in this EIS because it is a logical consequence of issuing a maintenance lease to an existing coal mine.

The use of the coal after it is mined is not determined at the time of leasing. However, almost all coal that is currently being mined in the Wyoming PRB is being used to generate electricity by coal-fired power plants. A discussion of emissions and by-products that are generated by burning coal to produce electricity is included in Section 4.2.13 of the EIS. A more complete discussion of the current status of global climate change is included in Chapter 4, Section 4.2.13.1.

As discussed in Chapter 2, under the currently approved mining plan, which represents the No Action Alternative, ACC anticipates that Antelope Mine would mine its remaining estimated 394.3 million tons of recoverable coal reserves in 11

years at an average annual production rate of approximately 36 million tons. Under the Proposed Action, ACC estimates that the life of the mine would be extended by about 11 additional years at an average annual coal production rate of approximately 36 million tons. If the average annual production rate increases to 42 million tons, which is the maximum rate allowed by the current air quality permit, the life of the mine would be extended by nine additional years under the Proposed Action. Under Alternatives 1 and 2, if the entire BLM study area is leased, ACC estimates the life of the mine would be extended by 11 to 13 years.

ACC conducted an inventory of expected greenhouse gas emissions that occurred in 2007 at Antelope Mine (Table 3-20). ACC also projected emissions for a typical year of operations at Antelope Mine if the West Antelope II lands are leased and mined by ACC. Emissions are measured as CO_2 equivalents (CO_2e), a conversion to put any of the various gases emitted, i.e. methane or nitrous oxides, into the equivalent greenhouse effect as compared to CO_2.

The inventory included all types of carbon fuels used in mining operations as well as electricity used on site, and mining processes such as blasting, methane released from mined coal, and spontaneous combustion. Additional categories are on-site rail transport as well as rail transport arranged by the buyers (Rio Tinto Energy America 2008).

Table 3-20. Greenhouse Gas Emissions, Antelope Mine

Source	**2007***	**Average Year with West Antelope II LBA***
Fuel	110,877	195,173
Electricity	77,574	111,854
Mining Process	36,772	40,884
On-site Rail	1959	2251
Total at Mine	227,182	347,911
Other Rail**	656,444	754,338

*CO_2e in tonnes

**Provided for reference, assumes 10 percent increase based on demand in eastern US

Projected emission rates increase if the West Antelope II tract is added to ACC's mining operations. The increase in CO_2 emissions would result from the additional diesel fuel that would be used in consideration of the added haul distances and overburden hauling, as well as increased electricity and explosives related to increasing strip ratios.

The Center for Climate Strategies estimated that activities in Wyoming accounted for approximately 56 million metric tons of gross CO_2e emissions in 2005 (Center for Climate Strategies 2007). Using that estimate, the 2007 Antelope Mine emissions total (Table 3-20) represents 0.41 percent of state-wide emissions. With

the addition of the West Antelope II LBA tract, the projected total Antelope Mine emissions would represent 0.63 percent of state-wide emissions.

Under Alternative 3, the emission rates would continue for 11 years at approximately the rates measured in 2007 when production was about 35 mmt. The incremental change with the addition of West Antelope II to the Antelope Mine represents the estimated emissions for the proposed action as well as Alternatives 1 and 2. Estimates assume that the annual production rate is 36 mmtpy. If the West Antelope II tract is leased and mined by ACC, the tract would add nine to 13 additional years to the life of the mine. Under these alternatives, the projected emissions would occur over those nine to 13 additional years of mine life.

Please see Section 4.2.13 for an assessment of cumulative impacts related to greenhouse gases, and how the proposed action and alternatives contribute.

3.19 Irreversible and Irretrievable Commitments of Resources

The major commitment of resources would be the mining and consumption of 394.3 million tons (Proposed Action) up to a maximum of 453.9 million tons (Alternatives 1 and 2) of coal to be used for electrical power generation. CBNG that is not recovered prior to mining would also be irreversibly and irretrievably lost (see additional discussion of the impacts of venting CBNG to the atmosphere in Section 3.18). It is estimated that one to two percent of the energy produced would be required to mine the coal, and this energy would also be irretrievably lost.

The quality of topsoil on approximately 4,108.6 acres (Proposed Action) up to a maximum of approximately 6,309.2 acres (Alternatives 1 and 2) would be irreversibly changed. Soil formation processes, although continuing, would be irreversibly altered during mining related activities. Newly formed soil material would be unlike that in the natural landscape.

Direct and indirect wildlife mortalities caused by mining operations or associated activity would be an irreversible loss.

Loss of life may conceivably occur due to the mining operations and vehicular and train traffic. On the basis of surface coal mine accident rates in Wyoming as determined by MSHA (1997) for the 10-year period 1987-1996, fatal accidents (excluding contractors) occurred at the rate of 0.003 per 200,000 man-hours worked. Disabling (lost time) injuries occurred at the rate of 1.46 per 200,000 man-hours worked. Any injury or loss of life would be an irretrievable commitment of human resources.

Disturbance of all known historic and prehistoric sites on the mine area would be mitigated to the maximum extent possible. However, accidental destruction of presently unknown archeological or paleontological values would be irreversible and irretrievable.

4.0 CUMULATIVE ENVIRONMENTAL CONSEQUENCES

Cumulative impacts result from the incremental impacts of an action added to other past, present, and reasonably foreseeable future actions, regardless of who is responsible for such actions. Cumulative impacts can result from individually minor, but collectively significant, actions occurring over time.

This section summarizes the cumulative impacts that are occurring as a result of existing development in the PRB[1] and considers how those impacts would change if other projected development in the area occurs and if the West Antelope II LBA tract is leased and mined.

BLM completed three regional EISs evaluating the potential cumulative impacts of surface coal development in the 1970s and early 1980s (BLM 1974, 1979, and 1981). A draft document for a fourth regional EIS was prepared and released in 1984 (BLM 1984). Since those regional EISs were prepared, BLM has prepared a number of NEPA analyses evaluating coal leasing actions and oil and gas development in the PRB. Each of these NEPA analyses includes an analysis of cumulative impacts in the Wyoming PRB.

Currently, the BLM is completing a regional technical study, called the PRB Coal Review, to help evaluate the cumulative impacts of coal and other mineral development in the PRB. The PRB Coal Review consists of three tasks:

- Task 1 identifies existing resource conditions in the PRB for the baseline year (2003) and, for applicable resources, updates the BLM's 1996 status check for coal development in the PRB.

- Task 2 defines the past and present development activities in the PRB and their associated development levels as of 2003 and develops a forecast of reasonably foreseeable development in the PRB through 2020. The reasonably foreseeable activities fall into three broad categories: coal development (coal mine and coal-related), oil and gas development (conventional oil and gas, CBNG, and major transportation pipelines), and other development, which includes development that is not energy-related as well as other energy-related development.

- Task 3 predicts the cumulative impacts that could be expected to occur to air, water, socioeconomic, and other resources if the development occurs as projected in the forecast developed under Task 2.

A series of reports have been prepared to present the results of the PRB Coal Review task studies. The Task 1, 2, and 3 reports represent components of a technical study of cumulative development in the PRB; they do not evaluate specific proposed projects, but they provide information that BLM is using to evaluate the cumulative impacts that would be expected to occur if specific

[1] Refer to page xvi for a list of abbreviations and acronyms used in this document.

projects or applications, such as the West Antelope II coal lease application, are approved. The Task 1 reports, which include air quality conditions, water resources conditions, social/economic conditions, and other resource conditions, and the Task 2 Report have been completed. The Task 3 reports for air quality conditions, social/economic conditions, and other resource conditions have been completed. The Task 3 evaluation of water resource conditions is in progress. The information in these reports is summarized later in this chapter, and the completed reports are available for viewing at the BLM offices in Casper and Cheyenne and on the Wyoming BLM website at http://www.blm.gov/wy/st/en/programs/energy/Coal_Resources/PRB_Coal/prbdocs.html.

The PRB includes portions of northeastern Wyoming and southeastern Montana. The Wyoming portion of the PRB is the primary focus of the PRB Coal Review reports. The Montana portion of the PRB is included in the Task 2 Report and in the Task 1 and 3 air resources studies. For the majority of resources in the Task 1 reports and for the Task 2 Report, the Wyoming portion of the PRB Coal Review study area encompasses all of Campbell County, all of Sheridan and Johnson Counties outside of the Bighorn National Forest, and the northern portion of Converse County (Figure 4-1). For some components of the Task 2 Report and for the Task 1 and 3 air resource studies, the Montana PRB Coal Review study area includes portions of Big Horn, Custer, Powder River, Rosebud, and Treasure Counties. For several resources, the Task 1 and Task 3 study areas include only potentially affected portions of the Wyoming PRB Coal Review study area; for other resources, the study area extends outside of Wyoming and Montana because the impacts would extend beyond the PRB. For example, the groundwater drawdown is evaluated in the area surrounding and extending west of the mines, because that is the area where surface coal mining operations would impact groundwater resources; but air quality impacts are evaluated over a multi-state area because they would be expected to extend beyond the PRB.

Section 4.1 summarizes the information presented in the PRB Coal Review Task 1 and Task 2 reports. Section 4.2 summarizes the predicted cumulative impacts to air, water, socioeconomic, and other resources presented in the PRB Coal Review Task 3 reports.

4.1 Past, Present, and Reasonably Foreseeable Development

Past, present, and reasonably foreseeable development in the Wyoming PRB are considered in the Task 1 and Task 2 reports for the PRB Coal Review. The Task 1 reports describe the existing situation as of the end of 2003, which reflects the past and present levels of development. The Task 2 Report defines the past and present development activities in the PRB as of the end of 2003 and projects reasonably foreseeable development in the Wyoming PRB through 2020.

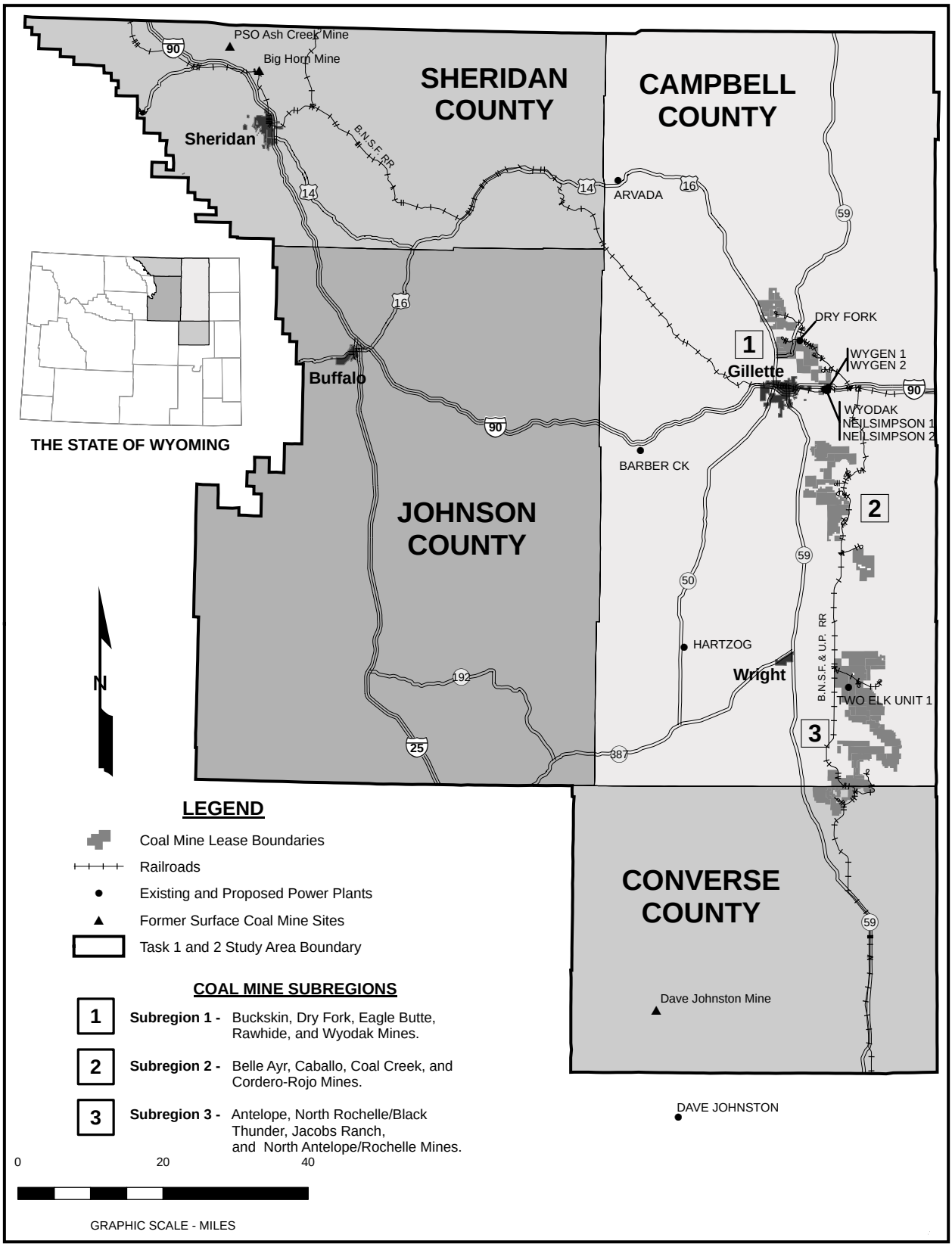


Figure 4-1. Wyoming Study Area for PRB Coal Review Studies Evaluating Current and Projected Levels of Development.

4.1.1 Coal Development

4.1.1.1 Coal Mine Development

The Powder River Federal Coal Region was decertified as a federal coal production region by the PRRCT in 1990. Decertification of the region allows leasing to take place on an application basis, as discussed in the regulations at 43 CFR 3425.1-5. Between 1990 and 2008, the BLM's Wyoming State Office held 25 competitive coal lease sales and issued 19 new federal coal leases containing more than 5.7 billion tons of coal using the LBA process. The lease sales are listed in Table 1-1, and the leased tracts are shown in Figure 1-1. This leasing process has undergone the scrutiny of two appeals to the IBLA and one audit by the GAO. As can be seen in Figure 4-2, leasing activity has generally paralleled production since decertification. This is consistent with the PRRCT's objective at the time of decertification, which was to use the LBA process to lease tracts of federal coal to maintain production at existing mines.

The pending applications in the Wyoming PRB are shown in Table 1-2.

BLM has also completed three exchanges involving federal coal resources in the Wyoming PRB since decertification:

- Belco Exchange – an exchange of lease rights for a portion of the former Hay Creek federal coal tract for lease rights to coal near Buffalo, Wyoming, which became unmineable when Interstate 90 was constructed. This exchange was authorized by Public Law 95-554 and completed in 2000.

- Pittsburg and Midway Coal Mining Company (P&M) Exchange – an exchange of federal coal in Sheridan County, Wyoming, for land and mineral rights in Lincoln, Carbon, and Sheridan Counties, Wyoming, completed in 2004.

- Powder River Coal Company AVF Exchange – an exchange of lease rights underlying an AVF at the Caballo Mine, which cannot be mined, for lease rights of equal value adjacent to existing federal leases at Powder River Coal Company's North Antelope Rochelle Mine, completed in 2006.

Table 4-1 provides information about the status, ownership and production levels for the existing surface coal mines in the Wyoming PRB in 2003 and their current status. In 2003, which was the baseline year for the PRB Coal Review Task 1 and Task 2 studies, there were 12 active surface coal mines and one inactive mine. Since 2003, the inactive mine (Coal Creek) has resumed operations and the North Rochelle Mine has ceased operation following its purchase by the operator of the Black Thunder Mine. The North Rochelle Mine leases were divided between Black Thunder and North Antelope Rochelle Mines

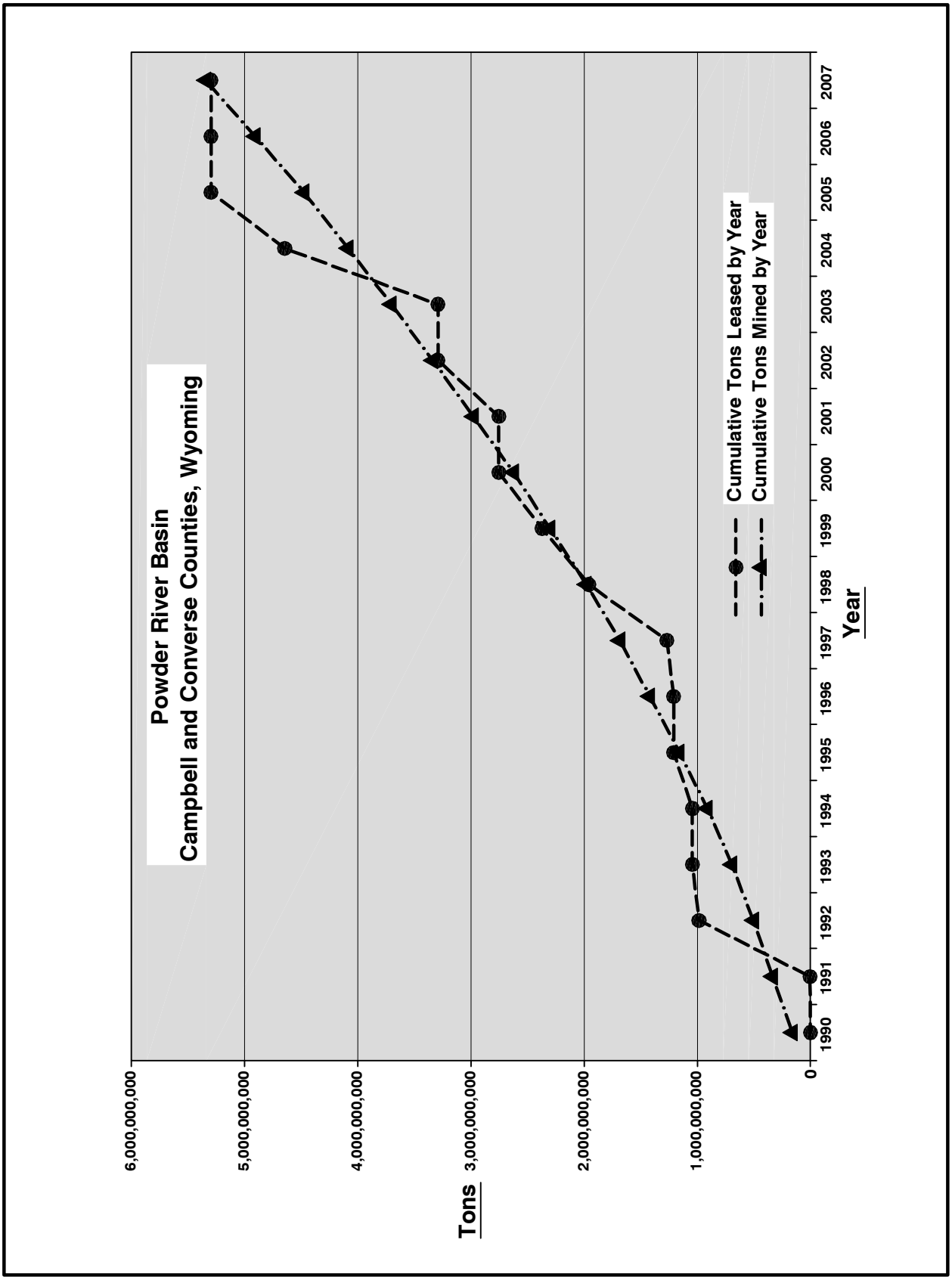


Figure 4-2. Tons of Federal Coal Leased Versus Tons of Coal Mined Since 1990.

Table 4-1. Status and Ownership of Wyoming PRB Coal Mines for 2003, the PRB Coal Review Baseline Year.

2003 Mine	1994 Mine Owner	2007 Mine Owner	Actual Coal Production (mm Tons)[1]	Permitted Production Level (mm Tons)[2]	Status and Additional Comments
SUBREGION 1 (North Gillette)					
Buckskin	SMC (Zeigler)	Kiewit Mining Properties	17.5	27.5	Active
Dry Fork	Phillips/WFA & Fort Union Ltd	WFA	4.4	24.4	Active (includes former Fort Union Mine)
Eagle Butte	Cyprus-Amax	Foundation Coal West	24.5	35.0	Active
Rawhide	Carter (Exxon)	Peabody Holding Co.	3.6	24.0	Active
Wyodak	Wyodak Resources	Wyodak Resources	4.8	12.0	Active (includes former Clovis Point Mine)
Total			**54.8**	**122.9**	
SUBREGION 2 (South Gillette)					
Belle Ayr	Cyprus-Amax	Foundation Coal West	17.9	35.0	Active
Caballo	Carter (Exxon) & Western Energy	Peabody Holding Co.	22.7	40.0	Active (includes Rocky Butte and West Rocky Butte leases)
Cordero Rojo	Kennecott & Drummond	Rio Tinto Energy America[3]	36.1	65.0	Active (consolidation of former Cordero and Caballo Rojo Mines)
Coal Creek	ARCO	Arch Coal Inc.	0	25.0	Inactive in 2003, operations resumed in 2006
Total			**76.7**	**165.0**	
SUBREGION 3 (Wright)					
Antelope	Kennecott	Rio Tinto Energy America[3]	29.5	32.0	Active
Black Thunder	ARCO	Arch Coal Inc.	62.6	90.0	Active
Jacobs Ranch	Kerr-McGee	Rio Tinto Energy America[3]	36.0	55.0	Active
N. Antelope/ Rochelle	Peabody	Peabody Holding Co.	80.1	85.0-105.0	Active (consolidation of former North Antelope and Rochelle Mines)
N. Rochelle	SMC (Zeigler)	Arch Coal Inc.	23.9	35.0	Inactive since 2005, leases split between Black Thunder and North Antelope Rochelle Mines
Total			**232.1**	**297.0-317.0**	
TOTAL FOR 3 MINE GROUPS			**363.6**	**584.9-604.9**	

1 Wyoming State Inspector of Mines (Wyoming Department of Employment 2003).
2 WDEQ permitting levels
3 Kennecott Energy Company changed its name to Rio Tinto Energy America in 2006.

in 2006. Peabody has deferred startup of their new mine, the School Creek Mine which is located between the Black Thunder and North Antelope Rochelle mines, until 2009 or later. These mines are all located in Campbell and Converse Counties, just west of the outcrop of the Wyodak coal, where the coal is at the shallowest depth (Figure 1-1). As indicated in Table 4-1, there have been numerous changes in mine ownership since decertification, which have resulted in mine consolidations and mine closings within the PRB.

Two recently active surface coal mines in Sheridan County (the Big Horn Coal Mine) and southern Converse County (the Dave Johnston Mine) have ended mining operations, relinquished their federal coal leases, and are reclaiming areas of disturbance.

There are existing permits for other surface coal mining-related operations in the PRB. These include the Ash Creek and Welch Mine permits in Sheridan County and the Izita Mine permit in Campbell County. Operations at these sites are completed and the disturbed areas have been reclaimed, but monitoring of the reclaimed areas is ongoing. The KFx Mine, located north of Gillette on privately owned coal, is mining coal for processing at the KFx coal enhancement plant, which is discussed in Section 4.1.1.2.4.

The active mines in the Wyoming PRB are geographically grouped into three subregions (Figure 4-1). For purposes of this cumulative impact discussion, these subregions are called the North Gillette, South Gillette, and Wright subregions. Table 4-1 lists the mines included in each subregion.

A fourth subregion includes former and proposed mines in Sheridan County, Wyoming, and existing mines just north of Sheridan County, in Montana. There are currently no active mines in the Wyoming portion of the fourth subregion. However, the PRB Coal Review Task 2 Report projected that a new mine would be developed by P&M near Sheridan by 2010. In April, 2007, P&M and CONSOL Energy Inc. announced that they have formed a new company, Youngs Creek Mining Company, LLC, and entered into a joint agreement to develop a new mine in Wyoming north of Sheridan (Reuters 2007). According to the announcement, engineering, environmental and permitting work are in progress, but actual mine construction will not start until the joint venture has enough coal sales under contract to justify the investment. The coal reserves included in this project are all privately owned.

The surface coal mines listed in Table 4-1 currently produce over 96 percent of the coal produced in Wyoming each year. Since 1989, coal production in the PRB has increased by an average of six percent per year. The increasing production is primarily due to increasing sales of low-sulfur, low-cost PRB coal to electric utilities who must comply with the Phase I requirements of Title III of the 1990 Clean Air Act Amendments. Electric utilities account for 97 percent of Wyoming's coal sales. In 2003 (the baseline year for the PRB Coal Review), more than 33 percent of the coal mined in the United States came from the Wyoming PRB.

BLM estimates that the surface coal mines listed in Table 4-1 currently have about 122,280 acres of federal coal leased in Campbell and Converse Counties. This represents approximately 3.97 percent of Campbell County, where the majority of the leases are located.

Task 2 of the PRB Coal Review projected coal development into the future for the years 2010, 2015, and 2020. Due to the variables associated with future coal production, two projected coal production scenarios (representing an upper and a lower production level) were developed to bracket the most likely foreseeable regional coal production level. The basis for the projected production levels included:

1) an analysis of historic PRB production levels in comparison to the gross domestic product and national coal demand;

2) an analysis of PRB coal market forecasts that model the impact of gross domestic product growth, potential regulatory changes affecting coal-fired power plants, and mining and transportation costs on PRB coal demand;

3) the availability, projected production cost, and quality of future mine-specific coal reserves within the PRB region; and

4) the availability of adequate infrastructure for coal transportation.

The projected upper and lower production levels subsequently were allocated to the Wyoming PRB subregions, discussed above, and to individual mines based on past market shares. Individual mine production levels were reviewed relative to potential future production constraints (e.g., loadout capacities), permitted production levels, mining costs, and coal quality. Then the projected future production was aggregated on a subregion basis. The actual 2003 production level and the two projected coal production scenarios for 2010, 2015, and 2020 are shown in Figure 4-3 and Tables 4-2 and 4-3.

Tables 4-2 and 4-3 also show the cumulative coal mining disturbance as of the baseline year and the cumulative coal mine disturbance projected for the future years for the upper and lower coal production scenarios. In these tables, the baseline year and cumulative projected disturbance areas are broken down into three categories:

- areas which are or projected to be permanently reclaimed;

- areas which are or projected to be undergoing active mining or which have been mined but are not yet reclaimed; and

- areas which are or projected to be occupied by mine facilities, haul roads, stockpiles, and other long-term structures, and which are therefore unavailable for reclamation until mining operations are completed.

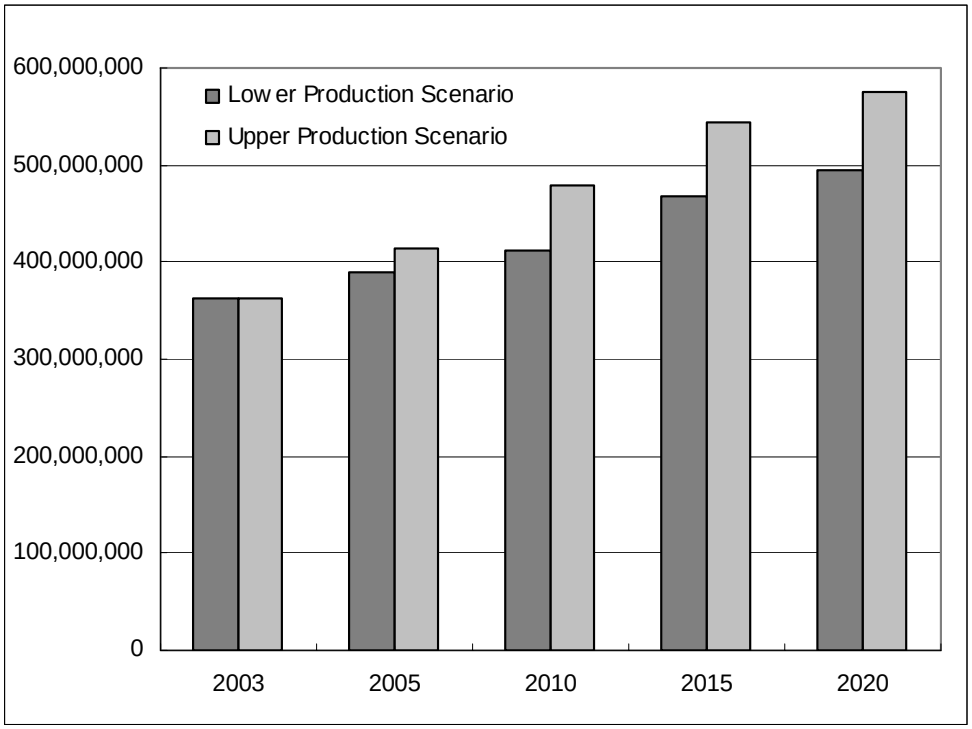


Figure 4-3. Projected total coal production from Campbell and Converse Counties under the Lower and Upper Coal Production Scenarios

The two tables also include estimates of baseline year and projected future coal mining employment, water consumption, and water production.

As discussed in Section 1.1, ACC estimates that there were 394.3 million tons of recoverable coal reserves on the existing Antelope Mine as of January 2007. In 2006, the mine produced approximately 33.9 million tons and the currently approved (by WDEQ/AQD) air quality permit allows mining of up to 42 million tons of coal per year. If the mine continues to produce at a rate of around 34 mmtpy, the remaining recoverable reserves would be depleted in about 11.6 years (2018). If the mine increases production to the permitted level, the remaining recoverable reserves at the Antelope Mine would be depleted in about 9.4 years (2016). ACC estimates that the West Antelope II LBA tract includes approximately 377.8 million tons of recoverable coal as applied for. If production levels do not increase over the current levels, mine life would be extended by as much as eleven years. However, if production levels increase to the currently permitted level or if WDEQ/AQD approves a higher annual rate of production, the coal would be recovered more quickly. The existing and projected coal development levels and associated disturbance shown in Tables 4-2 and 4-3 include production at the Antelope Mine during the baseline year (2003) and projected production at the mine for 2010, 2015, and 2020. As discussed above, the projected development levels shown in Tables 4-2 and 4-3 are based on projected demand and coal market forecasts, which are not affected by a decision to lease or not to lease the West Antelope II LBA tract.

Table 4-2. Baseline Year and Projected Wyoming PRB Coal Mine Development, Lower Coal Production Scenario.

Subregion	Annual Production (million tons)	Cumulative Disturbed Area (acres)	Cumulative Permanently Reclaimed Area (acres)	Cumulative Active Mining Area and Unreclaimed Mined Area (acres)	Cumulative Area Disturbed and Unavailable For Reclamation[1] (acres)	Total Mine Employment	Annual Water Consumption (mmgpy)	Annual Water Production (acre-ft)
Baseline year (2003)								
North Gillette Subregion	55	12,047	3,054	3,360	5,633	746	387	586
South Gillette Subregion	77	21,249	6,783	6,107	8,359	1,174	544	1,373
Wright Subregion	231	35,498	11,401	13,992	10,105	3,090	1,709	2,295
Total for 2003	**363**	**68,794**	**21,238**	**23,459**	**24,097**	**5,010**	**2,640**	**4,254**
Reasonably Foreseeable Development for 2010								
North Gillette Subregion	62	15,231	5,004	3,968	6,260	787	441	505
South Gillette Subregion	95	28,021	12,183	6,830	9,008	1,323	656	2,072
Wright Subregion	254	55,410	27,751	16,588	11,070	3,153	1,874	4,354
Total for 2010	**411**	**98,662**	**44,938**	**27,386**	**26,338**	**5,263**	**2,971**	**6,931**
Reasonably Foreseeable Development for 2015								
North Gillette Subregion	74	17,457	6,654	4,202	6,601	830	543	505
South Gillette Subregion	112	32,356	15,683	7,314	9,359	1,369	764	2,072
Wright Subregion	281	67,423	38,851	16,983	11,589	3,186	2,077	4,354
Total for 2015	**467**	**117,236**	**61,188**	**28,499**	**27,549**	**5,405**	**3,384**	**6,931**
Reasonably Foreseeable Development for 2020								
North Gillette Subregion	78	19,729	8,429	4,350	6,950	840	569	505
South Gillette Subregion	126	36,994	19,683	7,589	9,723	1,476	845	2,072
Wright Subregion	291	80,720	51,351	17,243	12,124	3,215	2,157	4,354
Total for 2020	**495**	**137,443**	**79,463**	**29,182**	**28,797**	**5,531**	**3,571**	**6,931**

[1] Area unavailable for reclamation includes disturbed areas occupied by permanent or long-term facilities such as buildings, roads, topsoil stockpiles, etc.
Source: PRB Coal Review Task 2 Report (BLM 2005d)

Table 4-3. Baseline Year and Projected Wyoming PRB Coal Mine Development, Upper Coal Production Scenario.

Subregion	Annual Production (million tons)	Cumulative Disturbed Area (acres)	Cumulative Permanently Reclaimed Area (acres)	Cumulative Active Mining Area and Unreclaimed Mined Area (acres)	Cumulative Area Disturbed and Unavailable For Reclamation[1] (acres)	Total Mine Employment	Annual Water Consumption (mmgpy)	Annual Water Production (acre-ft)
Baseline Year (2003)								
North Gillette Subregion	55	12,047	3,054	3,360	5,633	746	387	586
South Gillette Subregion	77	21,249	6,783	6,107	8,359	1,174	544	1,373
Wright Subregion	232	35,498	11,401	13,992	10,105	3,090	1,709	2,295
Total for 2003	**363**	**68,794**	**21,238**	**23,459**	**24,097**	**5,010**	**2,640**	**4,254**
Reasonably Foreseeable Development for 2010								
North Gillette Subregion	78	15,911	5,404	4,217	6,290	811	570	505
South Gillette Subregion	117	29,279	13,416	7,536	8,328	1,375	807	2,072
Wright Subregion	284	57,258	27,951	18,236	11,070	3,153	2,101	4,354
Total for 2010	**479**	**102,448**	**46,771**	**29,989**	**25,688**	**5,339**	**3,478**	**6,931**
Reasonably Foreseeable Development for 2015								
North Gillette Subregion	104	18,490	7,329	4,500	6,660	905	785	505
South Gillette Subregion	138	35,624	18,616	8,248	8,760	1,431	952	2,072
Wright Subregion	301	70,431	39,451	19,391	11,589	3,186	1,834	4,354
Total for 2015	**543**	**124,545**	**65,396**	**32,139**	**27,009**	**5,522**	**3,571**	**6,931**
Reasonably Foreseeable Development for 2020								
North Gillette Subregion	121	21,311	9,529	4,766	7,013	1,019	935	505
South Gillette Subregion	148	42,981	25,016	8,758	9,206	1,444	1,018	2,072
Wright Subregion	307	84,797	51,651	21,021	12,124	3,215	2,279	4,354
Total for 2020	**576**	**149,089**	**86,196**	**34,545**	**28,345**	**5,678**	**4,232**	**6,931**

[1] Area Unavailable for reclamation includes disturbed areas occupied by permanent or long-term facilities such as buildings, roads, topsoil stockpiles, etc.
Source: PRB Coal Review Task 2 Report (BLM 2005d)

4.1.1.2 Coal-Related Development

Coal-related development as defined for this analysis includes railroads, coal-fired power plants, major (230-kV) transmission lines, and coal technology projects. Table 4-4 summarizes the estimated disturbance associated with coal-related development activities for the baseline year and the projected disturbance through 2020. The subsequent paragraphs summarize the existing coal-related development in the Wyoming PRB and the reasonably foreseeable development considered in the PRB Coal Review.

Table 4-4. Baseline Year and Projected Wyoming PRB Coal-Related Development Scenario.

	2003	**2010**	**2015**	**2020**
Coal-Related Disturbance (Acres)	4,891	4,966	5,911	5,911

Source: PRB Coal Review Task 2 Report (BLM 2005d)

4.1.1.2.1 Coal Transportation

As discussed above, electric utilities account for about 97 percent of Wyoming's coal sales. Most of the coal sold to electric utilities is transported to power plants by rail. The coal mines in the Wright and South Gillette subregions are served by a joint BNSF & UP rail line. For the baseline year of 2003, the existing capacity of the line was estimated at approximately 350 mmtpy. For that same year, the existing capacity of the BNSF line, which services the North Gillette subregion, was estimated at 250 mmtpy.

The PRB Coal Review projected that two coal transportation projects would be developed prior to 2020 in Wyoming: expansion of the BNSF & UP rail facilities south of Gillette and the construction of the DM&E rail line in Wyoming and South Dakota. A third project proposed by the Tongue River Rail Company would be built between Decker and Miles City Montana.

UP and BNSF have been implementing plans to improve sections of the existing joint BNSF & UP rail line and to increase capacity from 350 mmtpy to more than 400 mmtpy. These plans include construction of 14 miles of a third main line track completed in Spring 2005 and 19 miles of a third main line track completed in 2006. An additional 46 miles of third and fourth main line track are under construction, with 25 miles of third mainline expected to be completed by March 2008 and 21 miles of fourth mainline to be completed by June 2008. Another 10 miles of fourth mainline is proposed with work beginning in 2008 and completion expected during 2009.

The increased capacity would accommodate the projected upper and lower production rates at the southern coal mines, which are projected to reach 400 mmtpy by 2010 under the upper coal production scenario or by 2016 under the lower coal production scenario (UP and BNSF press release 2006). These expansion projects are considered highly likely to occur.

The proposed DM&E rail line would include new rail construction in South Dakota and Wyoming (approximately 15 and 265 miles, respectively) and 600 miles of rail line rehabilitation in South Dakota and Minnesota. Approximately 78 miles of the new rail construction would occur in the PRB study area, where the project would provide new rail spur services to the mines in the South Gillette and Wright subregions. The STB released a final supplemental EIS for this project on December 30, 2005 and granted final approval to construct the rail line on February 15, 2006. The supplemental EIS, which addressed issues that were successfully appealed after an EIS was completed in 2001, was also appealed. The supplemental EIS was upheld by the US Court of Appeals for the Eighth Circuit in December 2006. In early September, 2007, Canadian Pacific Railway Ltd. announced it is in the process of buying DM&E.

The STB recently announced approval of the final stretch of the rail line proposed by the Tongue River Railroad Company. The company must acquire necessary federal and state permits and ROWs through private and public property before constructing the line. If it is constructed, it would provide a shorter route for some of the mines in the North Gillette subregion, which ship coal on the existing BNSF rail line (Billings Gazette 2007).

For the purposes of the PRB Coal Review, it was projected that the DM&E line would be constructed when the total rail haulage requirement from the eastern Wyoming PRB reaches 450 to 500 million tons per year and would potentially be operational by 2015. The construction of this rail line is considered moderately likely to occur. The PRB Coal Review assigned a low likelihood of development by 2010 under the upper coal production scenario, and projected the construction of the Tongue River Railroad Company line would not occur unless the Otter Creek Mine is developed.

4.1.1.2.2 Electric Power Generation

Currently, there are four coal-fired power plants in the Wyoming PRB study area for Tasks 1 and 2 (Figure 4-1). Black Hills Power Corporation owns and operates the Neal Simpson Units 1 and 2 (21.7-MW and 80-MW, respectively), Wygen I (80-MW), and Wyodak (330-MW) power plants, all of which are located approximately five miles east of Gillette, Wyoming. Pacific Power and Light's Dave Johnston Power Plant is located near Glenrock, Wyoming, outside of but adjacent to the study area.

There are also three separate interconnected gas-fired power plants (Hartzog, Arvada, and Barber Creek) located near Gillette, Wyoming. Each contains three separate 5-MW-rated turbines that provide electric power to Basin Electric and its customers. In winter, the maximum capacity can reach 22.6-MW from each site. All units are in operating condition, although they do not operate at maximum capacity.

Several additional power plants are projected to be built prior to 2020. The PRB Coal Review assumed that proposed coal-fired power plants that plan to initiate

operation by 2010 would have to have been undergoing air permit review by 2003 in order to obtain the required construction permits and complete construction by 2010. The following three identified projects are considered likely for development by 2010:

- Black Hills Power Corporation's Wygen II coal-fired unit, located east of Gillette. It is under construction and, according to the Black Hills Power Corporation's website, is scheduled to be in operation by the beginning of 2008 (Black Hills Corporation 2007). Wygen II will be a 90-MW plant and will utilize about 500,000 tons of coal per year. The facility will cover 60 acres within the existing 200-acre Black Hills Power and Light power plant area. Operation of this facility by 2010 is considered highly likely.

- North American Power Group has permitted a coal-fired power plant (Two-Elk Unit 1) at a 40-acre site located approximately 15 miles southeast of Wright, Wyoming. As originally permitted, the project also would include installation of a gas-fired turbine. The air permit originally was issued in August 2002. The unit would be dry-cooled, requiring very little water. The state has approved several hundred million dollars in tax-exempt bonds for the power plant and North American Power Group is completing financing for the remaining cost of the plant. The company recently announced that it has signed a transmissions agreement with Pacificorp and is planning to have the 320 MW plant in operation by October 2011 (Gillette News-Record 2007b, 2007c).

- Basin Electric Power Cooperative obtained permits from the Wyoming Industrial Siting Council in June, 2006, and WDEQ/AQD in October, 2007, to construct and operate the Dry Fork Station Power Plant. As proposed, the Dry Fork Station would be a coal-based, mine-mouth 385-MW power plant located near the Dry Fork Mine, north of Gillette, Wyoming. Construction on the plant started in October, 2007, after the air permit was approved. Basin Electric estimates that the plant will be operational by 2011 (WDEQ/ISD 2007). At the time of the PRB Coal Review study it was estimated that 1.2 million tons of coal per year would be required to fuel the facility. Construction and operation of this facility as scheduled is considered moderately likely.

The PRB Coal Review assumes that, under the upper coal production scenario, a maximum of one additional 700-MW coal-fired power plant would be constructed by 2020 in the Gillette area or near one or more of the operating coal mines. North American Power Group submitted an application in September, 2007, for a 750-MW coal-fired power plant, Two Elk 2, to be located at the same site as the proposed Two Elk plant, which is discussed above. Black Hills Power Corporation has also announced plans to construct the Wygen III power plant, which is planned to be similar in design to the Wygen II plant, starting in 2008. The study assumes that all existing power plants in the PRB region would remain operational through 2020.

4.1.1.2.3 Transmission Lines

Major transmission lines in the Wyoming PRB study area that support the regional distribution system are associated with the Dave Johnston power plant located near Glenrock, Wyoming, and the power plants operated by Black Hills Power Corporation, which are located east of Gillette. These 230-kV transmission lines have been in place for several years, and their associated permanent disturbance is minimal. Distribution power lines associated with conventional oil and gas and CBNG development also occur within the study area. For the PRB Coal Review, these lines were included by factoring them in proportionally on a per well basis.

The PRB Coal Review estimates that by 2020, one major transmission line would be constructed running south to Colorado markets and one would be constructed eastward to mid-west markets. Markets would dictate the size and location of such facilities, and these are not known as of this time. Because transmission lines are a necessary supporting infrastructure for power generating facilities to provide connection to the grid, the PRB Coal Review assumes they would be required as part of the overall system development for the proposed power plants discussed in the previous section. However, no specific proposals for these transmission lines had been identified when the PRB Coal Review analysis was conducted and, therefore, there was insufficient information to analyze or assign likelihood of development by 2020.

No specific proposals have since been announced, but the governors of California, Nevada, Utah, and Wyoming entered into a Memorandum of Understanding to encourage development of a high voltage power transmission line, the Frontier Line, connecting those states in April, 2005. Since that time, no specific plans have been announced as to the location or timing of the Frontier Line.

4.1.1.2.4 Coal Conversion Technology

With rising energy prices, there has been considerable interest in either enhancing the quality of PRB coal and/or converting the coal to other fuels. Test facilities were previously constructed by KFx at the Fort Union Mine (now part of the Dry Fork Mine), by AMAX (predecessor to Foundation Coal West, Inc.) at the Belle Ayr Mine, and by ENCOAL at the Buckskin Mine, but no commercial production occurred and these facilities have either been dismantled or are no longer in use. Although several coal conversion projects have been proposed, as discussed below, only one (the KFx Coal Beneficiation Project) was considered to have a high enough likelihood of proceeding to include it in the PRB Coal Review, based on its status and available information.

The KFx coal beneficiation plant, located near the Dry Fork Mine, north of Gillette, has been constructed but is not running at full capacity. KFx reported making its first production run and shipping coal to two customers for test burns in late December, 2005. In August, 2006, KFx reported that a trainload of

enhanced coal had been loaded and sent to a customer in Ohio. It is expected that the plant will eventually produce approximately 750,000 tons of enhanced coal per year. This operation has a high likelihood of proceeding with production given the technology being used and the forecast market conditions in the PRB. If the process and market prove competitive, the company has suggested that up to five additional units could be built in the PRB, but the likelihood for development of additional units is not known. As a result, the potential development of additional units was not analyzed in the PRB Coal Review.

The following coal conversion projects have been proposed, but were not included in the PRB Coal Review analysis because the likelihood of their occurrence was not known when the coal review analysis was conducted:

- Medicine Bow Fuel and Power, a subsidiary of DKRW Energy LLC, has announced that it plans to build a coal-to-liquids plant in northern Carbon County, Wyoming. GE Energy and Rentech Clean Energy Solutions are also involved in the project, which would obtain coal from Arch Coal's Hanna Mine facility. Both the plant and mine are located outside of the PRB. The primary product would be ultra-low-sulfur diesel fuel produced from sub-bituminous coal. The company is in the process of permitting the plant and expects to begin initial site work in 2008, with completion planned for 2011 (Casper Star Tribune 2007b).

- KFx has proposed joint ventures with Arch Coal, Inc. and Kiewit Mining Group to develop beneficiation plants at the Coal Creek and Buckskin Mines, respectively. The companies are evaluating these projects.

- Coal gasification development projects are being actively pursued by several groups, including the Wyoming Business Council, CCEDC, and CANDO. Specifically, CANDO is pursuing the development of hydrogen-fueled power generation and coal gasification leading to production of pure hydrogen with CO_2 as a by-product. While there appears to be substantial interest in these opportunities, it is unknown whether large-scale operations would be developed within the 2010 to 2020 timeframe, given permitting, engineering, and construction time requirements. When the PRB Coal Review was prepared, a project proponent with adequate financing to pursue a project that would utilize PRB coal had not been identified, and one has not been identified since.

A summary of past, present, and reasonably foreseeable coal mines, coal-related facilities, coal production, coal mine employment, and coal and coal-related disturbance in the Wyoming PRB is presented in Table 4-5.

Table 4-5. Past, Present, and Projected Wyoming PRB Coal Mine and Coal-Related Development Scenario.

Year	Coal Production (mmtpy)	Number of Active Coal Mines[1]	Number of Active Power Plants	Number of Active Coal Conversion Facilities[2]	Direct Coal Mine Employment	Total Coal Disturbance (acres)[3]
Past and Present						
1990	163	18	3	1	2,862	na
1995	247	19	4	1	3,177	na
2000	323	12	4	2	3,335	na
2003	363	12	4	0	5,010	73,685
Projected Development - Lower Coal Production Scenario						
2010	411	13[1]	7	1[2]	5,263	103,628
2015	467	13[1]	7	1[2]	5,405	123,147
2020	495	13[1]	7	1[2]	5,531	143,354
Projected Development - Upper Coal Production Scenario						
2010	479	13[1]	7	1[2]	5,339	107,414
2015	543	13[1]	7	1[2]	5,522	130,456
2020	576	13[1]	8	1[2]	5,678	155,000

[1] Mines have consolidated and may in the future. Also, new mines may be permitted to better access the coal reserves projected for mining by 2020.
[2] Several coal conversion facilities currently are being evaluated; however, there is only one for which the likelihood of future development currently can be assessed.
[3] Disturbance area includes coal mine and coal-related disturbance areas.
Source: Annual Report of the Wyoming State Mine Inspector (Wyoming Department of Employment 1990, 1995, 2000, and 2003) and PRB Coal Review Task 2 Report (BLM 2005d)

4.1.2 Oil and Gas Development

The following information on existing conventional and CBNG development is summarized from the PRB Coal Review Task 2 Report (BLM 2005d). The information reported is for 2003, which was the baseline year for the coal review.

4.1.2.1 Conventional Oil and Gas

Conventional oil and gas development includes all non-CBNG development activity. Approximately 1,500 conventional oil and gas wells, including producing, non-producing and injection wells, were drilled between 1990 and 2003 (IHS 2004) in the PRB Coal Review Task 2 Study Area. Of those, 60 percent were development wells, drilled in established producing areas. The remaining 40 percent were classified as wildcat wells, which are wells that are drilled in non-producing areas or drilled to evaluate untested prospective zones in producing areas. Approximately 75 percent of the wildcat wells were plugged and abandoned. By 2003, the successful new field wildcat wells had resulted in the discovery of 61 new fields that produced 719,000 barrels of oil and 1.45 bcf of non-CBNG (WOGCC 2004).

As of the end of 2003, there were approximately 3,500 producing conventional oil and gas wells in the Wyoming PRB study area plus 1,386 seasonally active wells (IHS 2004). The WOGCC reported that these wells produced approximately

13 million barrels of oil and 40 bcf of conventional gas in 2003 (WOGCC 2004). The USGS (2002a) estimated that the mean undiscovered non-coal bed hydrocarbon resource in the PRB (including Montana) is 1.8 billion BOE.

Most of Wyoming's current oil production is from old oil fields with declining production and the level of exploration drilling to discover new fields has been low (WSGS 2002). This situation is reflected in the PRB where, over the 10-year period from 1992 through 2002, oil production from conventional oil and gas wells in Campbell and Converse Counties decreased approximately 60.4 percent (from 32.8 million barrels in 1992 to 13.0 million barrels in 2002). Oil prices have been increasing, which is reversing projections of a continuing decline in oil and gas production; production is now expected to increase in the PRB, with a peak around 2010 of approximately 15.7 million barrels (WSO-RMG 2005). Oil production in the short term may also be bolstered by some planned CO_2 flood projects in the PRB (WSGS 2003). This projected temporary upward trend in conventional oil and gas development is reflected in the PRB Coal Review projections (Table 4-6).

The active wells identified in Table 4-6 include wells that produce year-round, seasonally producing wells, and service wells (mainly injection wells.) It is estimated that there are approximately 2,000 idle conventional oil and gas wells in the PRB study area (WOGCC 2005); however, the number of idle wells gradually would be reduced in the future through plugging programs, and the idle well locations (once the wells are abandoned) would be reclaimed and no longer represent a disturbance.

Table 4-6. Baseline Year and Projected Wyoming PRB Conventional Oil and Gas Development Scenario.

	Existing		Projected for Task 3 Study Area		
Category	**2003 Task 1 Study Area**	**2003 Task 3 Study Area**	**2010**	**2015**	**2020**
Annual Gas Production (bcf)[1]	39.9	36.3	33.8	30.9	28.0
Annual Oil Production (mmbo)	12.9	11.4	13.8	12.5	11.2
Active and Seasonably Active Wells	5,067	3,890	5,603	5,115	4,625

[1] Future gas production per well was estimated based on 2003 production levels per subwatershed. A greater number of future well sites were assumed to occur in locations with historically lower production rates, so the projected future conventional gas production varies within the cumulative effects study area relative to the number of projected producing wells.

Source: PRB Coal Review Task 2 Report (BLM 2005d)

4.1.2.2 CBNG Development

Natural gas production has been increasing in Wyoming. In the PRB, this is due to the development of shallow CBNG resources. Commercial development of

these resources began in limited areas west of and adjacent to the northernmost surface coal mines in the late 1980s. Since that time, CBNG development has spread south and west into other parts of the PRB Coal Review Task 1 and Task 2 study area.

On private and state oil and gas leases, the WOGCC and the Wyoming SEO authorize CBNG drilling. On federal oil and gas leases, BLM must analyze the individual and cumulative environmental impacts of all drilling (federal, state, and private), as required by NEPA, before CBNG drilling can be authorized. BLM does not authorize drilling on state or private leases but must consider the impacts from those wells in their NEPA analyses. In many areas of the PRB, the coal estate is federally owned, but the oil and gas estate is privately owned. A June 7, 1999 Supreme Court decision (98-830) assigned the rights to develop CBNG on a piece of land to the owner of the oil and gas estate.

Annual CBNG production increased rapidly in the PRB between 1999 and 2003 but has leveled off somewhat since then. At the end of 2003, there were 14,758 producing CBNG wells in the study area (IHS 2004), and total production for 2003 was 346 bcf, or 88 percent of the total gas production from the basin (WOGCC 2004). Total production for 2006 was 377 bcf (WOGCC 2007d). Average daily CBNG production was 900 mmcfpd in 2003 (Holcomb 2003) and it is estimated that it will average 1,150 mmcfpd (1.15 bcfpd) for 2007 (WOGCC 2007d). From 1987 to 2003, the total cumulative gas production from PRB coals was over 1.2 trillion cubic feet. The total water production for the same time period was approximately 2.3 billion barrels (96.6 billion gallons). Water production in 2003 amounted to more than 500 million barrels (21 billion gallons), or about 1.4 million barrels per day. According to the WOGCC website, water production in the PRB associated with CBNG production has varied between just over 1.4 million barrels per day and about 2.2 million barrels per day since December 2003.

Since the early 1990s, the Wyoming BLM has completed numerous EAs and two EISs analyzing CBNG projects. The most recent of these is the four-volume Final EIS and Proposed Plan Amendment for the PRB Oil and Gas Project, which was completed in January 2003 (BLM 2003b). The level of CBNG development since 2003 appears to be lower than was forecast in that document. New CBNG well numbers fell from a high of slightly more than 4,600 in 2001 to approximately 2,000 in 2004. The PRB Coal Review Task 2 Report discusses the uncertain trends for future CBNG activity in recent years. The methodology used to project future activity is detailed in Appendix E of that report. Table 4-7 shows the 2003 and projected 2010, 2015, and 2020 levels of CBNG development levels used to evaluate projected cumulative environmental impacts in the PRB Coal Review.

4.1.2.3 Oil and Gas Related Development

Oil and gas related development activities considered in the PRB Coal Review include major transportation pipelines and refineries. Table 4-8 summarizes the

net disturbance, reclamation, and water production associated with oil and gas activity (conventional oil and gas, CBNG, and major transportation pipelines) for 2003 (baseline year) and projects disturbance, reclamation, and water production for future years.

Table 4-7. Baseline Year and Projected CBNG Development Scenario for the Wyoming PRB.

	Existing		Projected to Task 3 Study Area		
Category	**2003 Task 1 Study Area**	**2003 Task 3 Study Area**	**2010**	**2015**	**2020**
Annual Production (bcf)	338	284	480	500	443
Active Wells	14,758	12,152	20,899	21,831	19,366

Source: PRB Coal Review Task 2 Report (BLM 2005d)

Table 4-8. Wyoming PRB Conventional Oil and Gas, CBNG, and Related Development Disturbance and Water Production.

	Existing[1]		Projected for Task 3 Study Area[1]		
Category	**2003 Task 1 Study Area**	**2003 Task 3 Study Area**	**2010**	**2015**	**2020**
Cumulative Disturbed Area (Acres)[2]	187,761	148,602	237,883	304,543	361,331
Cumulative Permanently Reclaimed Area (Acres)	115,045	90,548	160,175	225,426	288,536
Cumulative Unreclaimed Area (Acres)	72,715	58,053	77,707	79,108	72,794
Annual Water Production (mmgpy)	26,405	21,204	39,108	41,484	37,350

1 Minor discrepancies in total acreages are the result of number rounding.
2 Inclusive of conventional oil and gas and CBNG activities and major transportation pipelines. Disturbance associated with ancillary facilities (including gathering lines and distribution power lines has been factored in a per well basis.

Source: PRB Coal Review Task 2 Report (BLM 2005d)

4.1.2.3.1 Pipelines

The availability of pipeline capacity for the transport of oil and gas to outside markets is a key factor in the development of CBNG and conventional oil and gas resources in the Wyoming PRB. In 2003, the baseline year for the PRB coal Review, there were 13 major transportation pipeline systems in the PRB that transport gas resources to markets outside of the basin (Flores et al. 2001). The 2003 capacity of these pipeline systems was 1.9 bcf per day. The combined natural gas production (CBNG and conventional gas) in the Wyoming PRB Coal Review Task 1 and Task 2 study area was approximately 1.03 bcf per day.

Major transportation pipelines also provide for transport of CO_2 to conventional oil fields for EOR. Increased recovery of crude oil also may depend somewhat on the availability of CO_2 for EOR projects, as well as the availability of pipelines to transport oil to refineries for processing.

Gathering lines and power lines associated with conventional oil and gas and CBNG development also occur within the study area; disturbance from these ancillary facilities were factored into the PRB Coal Review analysis on a per well basis.

A 315-mile-long pipeline project, the Bison Pipeline Project, was proposed in 2004 to move natural gas northward, directly out of the PRB and into the Northern Border Pipeline system (FERC 2004). Approximately 53 miles of the proposed route is within the Wyoming PRB Coal Review study area. If it is constructed, it would have a 240 mmcfpd capacity as proposed. FERC had expected the Bison project proposal to be filed in December 2003, but no filing has been made with FERC (FERC 2004) and the project is not included as an active project in Wyoming on the FERC website. As a result, the Bison Pipeline project was assumed to have a low likelihood rating for the purposes of the PRB Coal Review.

The following two proposed pipeline projects in the PRB were listed on the Wyoming Pipeline Authority webpage (http://www.wyopipeline.com) as of October 2007: MDU Resources Group, Inc. Williston Basin Interstate Pipeline 'Grasslands Pipeline' Expansion and ONEOK Cantera Gas Holdings Fort Union Gas Gathering Expansion. These are both expansion projects which involve adding capacity to an existing pipeline. Information on pipeline projects proposed in Wyoming can also be found in the "For Citizens" section of the Federal Energy Regulatory Commission website at http://www.ferc.gov.

The amount of available pipeline capacity could limit the amount of future CBNG development. In 2003, it was estimated that growth of Wyoming PRB CBNG production could rise from the 2003 level of 900 mmcfpd up to 3 to 4 bcf per day around 2007 and remain at or above those levels until 2015 (Holcomb 2003). If CBNG production levels reach 3 to 4 bcf per day, it is reasonable to assume that several pipeline projects with up to 1.0 bcf per day capacity each could be built in the PRB. However, as discussed previously, the actual average production for 2007 is currently projected to be 1.15 bcfpd and, based on the assumptions in Appendix E of the PRB Coal Review Task 2 Report, the basin-wide CBNG production is projected to reach approximately 1.7 bcf per day in 2020. New pipeline construction projects were not considered in the PRB Coal Review analysis because the likelihood for additional new pipeline construction was unknown when the PRB Coal Review was prepared.

The CO_2 pipeline from Bairoil, Wyoming, to Salt Creek, Wyoming, may be extended into the PRB Coal Review study area to the Sussex Field to support additional EOR activity. Although it took many years for a CO_2 source to reach the Wyoming PRB, it is very likely that several pipelines could be built in the

study area in the near future to provide additional gas for EOR projects. However, no pipeline projects were identified that would transport CO_2 beyond Salt Creek and the likelihood for construction of additional CO_2 pipelines was unknown when the PRB Coal Review analysis was prepared, and they were not considered.

4.1.2.3.2 Refineries

There are no existing petroleum refineries in the Wyoming PRB study area, and no plans for the construction and operation of any petroleum refineries in the Wyoming portion of the PRB have been identified.

4.1.3 Other Development Activity

4.1.3.1 Other Mining

Uranium, sand, gravel, bentonite, and clinker (or scoria) have been and are being mined in the Wyoming PRB study area.

There are three defined uranium districts in the PRB: Pumpkin Buttes, Southern Powder River, and Kaycee (BLM 2003b). Numerous mined out or uneconomic uranium mining sites are present in these districts. Uranium is currently produced in the Southern Powder River District using the in-situ leach method. There is one operating in-situ uranium recovery site in the PRB, the Smith Ranch-Highland Mine in Converse County, but the recent increase in interest in uranium for power plants here and abroad is generating interest in new development in the PRB. According to the U.S. Nuclear Regulatory Commission website (http://www.nrc.gov), interest has been expressed in restarting in-situ operations at the Christianson Ranch Site in Johnson County, Wyoming, and an application has been received from Energy Metals Corporation to construct and operate an in-situ uranium recovery facility at Moore Ranch in Campbell County, Wyoming. Based on commodity forecasts and uranium activity as of June 2004, the likelihood and potential timing of new uranium mining operations in the PRB was not known, and additional development was not projected in the PRB Coal Review analysis.

Bentonite is weathered volcanic ash that is used in a variety of products, including drilling mud and kitty litter, because of its absorbent properties. There are three major bentonite producing districts in and around the PRB: the Colony District in the Northern Black Hills, the Clay Spur District in the Southern Black Hills, and the Kaycee District west of Kaycee, Wyoming. Within the PRB Coal Review study area, bentonite is mined at Kaycee (WMA 2006). The PRB Coal Review assumed that bentonite mining would continue throughout the study period and that production would continue at existing active mines, with no new mines developed through 2020.

Aggregate, which is sand, gravel, and stone, is used for construction purposes. In the PRB, the more important aggregate mining localities are in Johnson and

Sheridan Counties (WSGS 2004). The largest identified aggregate operation is located in northern Converse County. It has an associated total disturbance area of approximately 67 acres, of which four acres have been reclaimed.

Scoria or clinker (which is formed when coal beds burn and the adjacent rocks become baked) is used as aggregate where alluvial terrace gravel or in-place granite/igneous rock is not available. Scoria generally is mined in the Converse and Campbell Counties portion of the Wyoming PRB study area.

Increased sand, gravel, and scoria production and associated surface disturbance are anticipated in the Wyoming PRB study area in the future because aggregate would be required for road maintenance and new construction activities as other primary resources, such as coal and oil and gas, continue to be developed. New operations and increased production from existing operations can be expected. These operations would vary in size based on the immediate need from the primary industries, but there is no specific information about these projected operations. As a result, new sand, gravel, or scoria operations were not analyzed in detail in the PRB Coal Review.

4.1.3.2 Industrial Manufacturing

There are a number of existing industrial manufacturing establishments located in the Wyoming PRB Coal Review study area. Most are relatively small with fewer than 25 employees; they predominately serve regional and local markets, and most are directly or indirectly related to energy resource development and production. Over the years, some of these firms have expanded such that they now support activities and serve markets outside of the region, but those operations remain dependent upon the local and regional markets to sustain their existing operations.

The PRB Coal Review anticipates that increased coal production would result in an increased demand for fuels and explosives. This increased demand could result in the need for the development of new off-site chemical feedstock plants in the study area. Project-specific information is not available, however, and the potential development of new chemical feedstock plants was not considered in the PRB Coal Review.

Local economic development organizations, including CCEDC and CANDO, are continually engaged in efforts to recruit or assist new business formation in the PRB study area. For example, CANDO has pursued development of long-term potential projects; however, the outcomes of those projects are uncertain and little information and detail are available. As a result, they were not considered in the PRB Coal Review.

4.1.3.3 Reservoirs

Currently, there are five key water storage reservoirs in the Wyoming PRB Coal Review study area (Healy, Lake DeSmet, Muddy Guard No. 2, Gillette, and Betty

No. 1) (HKM Engineering et al. 2002a and 2002b). The total disturbance associated with these five key water storage areas is 3,263 acres.

Based on the applicable water plans prepared for the Wyoming Water Development Commission for its Basin Planning Program (HKM Engineering et al. 2002a and 2002b), there are long range projections for development of additional reservoirs in the Wyoming PRB study area. However, none of these reservoirs have reached the planning stage; therefore, there was not enough information to analyze them in the PRB Coal Review.

4.1.3.4 Other Non-Energy Development

In addition to the specific projects and developments described above, a network of public and private physical infrastructure, private enterprises, and public activities has been developed in the PRB over time. Examples of infrastructure include the highway and road networks, airports, government offices, hospitals, public schools, municipal water systems, and extensive residential and commercial real estate development. Private enterprises include local retail and service establishments, newspaper publishing, and transportation and distribution firms.

The construction, maintenance, and continuing operations associated with this network of development represent an extensive series of public and private investments, as well as changes in land use, surface disturbances, water consumption, and the factors that characterize local air quality. Those investments and changes have occurred over a period of time and in response to many different influences.

Some of the identified and anticipated plans or proposals for future investment in public, private, and commercial infrastructure in the PRB are summarized below.

- The WYDOT State Transportation Improvement Program for 2004 includes anticipated 2005 through 2009 construction costs of approximately $215.4 million for highway and airport maintenance, reconstruction, and improvement projects in the PRB Coal Review Study area. No construction of new highways is scheduled and no new airports are proposed between now and 2009.

- A $10.7 million expansion and renovation of the Campbell County courthouse was completed in late 2005.

- Expansion of the CAM-PLEX conference and multi-event center facility in Gillette was approved in a special election in May 2005.

- The 2005 approved master plans for Wyoming public school facilities spending included a total of $72.3 million in new capital construction for

the seven school districts that are completely or partially in the Wyoming PRB study area (WSFC 2005).

- Construction and maintenance projects for the City of Gillette include a recently completed project to renovate and expand the waste water treatment plant.

- Commercial development includes recently completed construction of a Home Depot store and expansion of the Wal-Mart store in Gillette.

A capital facilities tax ballot question in Campbell County in the 2004 election asking voters to approve the imposition of a $0.01 sales and use tax (to be used for updated and expanded diesel mechanic and welding programs at the Gillette Campus of the Northern Wyoming Community College (now Gillette College) and for two community development projects in Wright) and an increase in the lodging tax were defeated in 2004. A renewed attempt to get the lodging tax on the ballot for the 2006 primary election failed to gain the approval of the Campbell County Board of Commissioners. In their 2007 session, the Wyoming Legislature committed to pay half of the cost of a technical education center at Gillette College that will house diesel technology, welding and industrial electrician programs. The Campbell County Board of Commissioners has approved a tax increase to pay for the other half of the cost of the project.

Given the timing, scale, year-to-year variability, relatively short construction timetables associated with such investments, the existence of a relatively large and diversified construction industry in the region and nearby areas, and the limited potential for these projects to alter long-term conditions in the PRB, they are not included in the PRB Coal Review analysis. However, one or more of these and similar projects could warrant consideration in a cumulative analysis for a site-specific project due to proximity or coincidental project schedules and timetables.

4.2 Cumulative Environmental Consequences

Section 4.1 of this chapter discusses existing and projected levels of development in the Wyoming PRB, and includes summaries of the results of PRB Coal Review Task 2 studies. This section summarizes the existing conditions resulting from baseline year (2003) development and the cumulative environmental consequences of the projected development for 2010, 2015, and 2020 based on the results of the analyses conducted for PRB Coal Review Task 1 and 3 reports, respectively.

As discussed in Section 4.1, the Wyoming portion of the PRB is the primary focus of the PRB Coal Review analyses. For the majority of resources in the Task 1 analysis, the Wyoming PRB Coal Review study area encompasses all of Campbell County, all of Sheridan and Johnson Counties outside of the Bighorn National Forest, and the northern portion of Converse County (Figure 4-1). The study areas for the Task 3 analyses are different. For the majority of the

resources considered in the PRB Coal Review, the Task 3 study area is based on watershed boundaries in the PRB and includes the portions of the Upper Powder River, Little Powder River, Upper Belle Fourche River, Upper Cheyenne River, Antelope Creek, and Dry Fork Cheyenne River subwatersheds that lie within Sheridan, Johnson, Campbell and northern Converse Counties (Figure 4-4). This study area includes over 4 million acres. Table 4-9 summarizes the total disturbance and reclamation acreages for the baseline year of 2003 and the total projected disturbance and reclamation acreages for 2010, 2015, and 2020 within the Task 3 study area described above.

Table 4-9. Baseline Year and Projected Wyoming PRB Total Development Scenario – Task 3 Study Area.

Year	Total Acres Disturbed[1]	Acres Reclaimed[1]	Acres Unreclaimed[1]	Acres Unavailable for Reclamation[2]	Acres Affected by Coal Mining
Baseline Year					
2003	220,688	111,786	108,901	27,073	68,794
Projected Development - Lower Coal Production Scenario					
2010	339,912	205,113	134,799	29,389	98,662
2015	426,084	286,614	139,472	31,546	117,236
2020	503,085	367,999	135,085	32,794	137,443
Projected Development - Upper Coal Production Scenario					
2010	343,698	206,946	136,752	28,739	102,448
2015	433,392	290,822	142,570	31,006	124,545
2020	514,732	374,732	139,998	32,342	149,089

[1] Minor discrepancies in total acreages are the result of number rounding.
[2] Includes coal mine and coal-related disturbance.
Source: PRB Coal Review Task 2 Report (BLM 2005d)

A total of approximately 220,688 acres of this land area had been disturbed by development activities as of 2003, which represents about 5.6 percent of the Task 3 study area. This is projected to increase to as much as 514,732 acres in 2020 under the upper coal production scenario which would represent approximately 13.1 percent of the Task 3 study area. This projected disturbance includes coal mining, coal-related development, and oil and gas and related development disturbance in the Task 3 study area. Areas reclaimed during each future time period shown in Table 4-9 reflect how much of the disturbed acreage is projected to be permanently reclaimed by that point in time. The acres of unreclaimed disturbance would be reclaimed incrementally or following a project's completion, depending on the type of development activity and permit requirements. The acres currently not available for reclamation are occupied by long-term facilities that are needed to conduct mining operations or coal-related activities. These areas would be reclaimed near the end of each mine or facility's life.

Adjustments were made to the study area described above and shown in Figure 4-4 for several resources as described below:

- The potential air quality impacts were evaluated over a multi-state area (including most of Wyoming, southeastern Montana,

southwestern North Dakota, western South Dakota, and northwestern Nebraska) because they would be expected to extend beyond the Wyoming and Montana PRB study area that was used to identify emissions sources for the air quality analysis.

- The groundwater drawdown was evaluated in the area surrounding and extending west of the surface coal mines, shown in Figure 4-4, because that is the area where groundwater drawdown related to surface coal mining operations and CBNG production operations would overlap.

- The socioeconomic impact analysis focused on Campbell County, but also considered Converse, Crook, Johnson, Sheridan, and Weston Counties as directly affected and Niobrara and Natrona Counties as indirectly affected.

4.2.1 Topography and Physiography

The PRB is located within the Upper Missouri Basin Broken Lands physiographic subprovince that includes northeastern Wyoming and eastern Montana to the Canadian border. The topography generally is of low to moderate relief with occasional buttes and mesas. The general topographic gradient slopes down gently from southwest to northeast with elevations ranging from 5,000 to 6,000 ft above sea level on the southern and western portions of the basin to less than 4,000 ft above sea level on the north and northeast along the Montana state line. The major drainages in the basin are the Tongue, Powder, Belle Fourche, and Cheyenne rivers. Most of the drainages in the area are intermittent and have flows during high precipitation events or during periods of snowmelt. The drainages are part of the upper Missouri River Valley drainage basin.

The disturbance associated with the majority of the past, present, and projected activities have resulted in or would result in the alteration of the surface topography. Surface coal mining, which is projected to continue in the area of the existing coal mines shown in Figure 4-4, permanently alters the topography by removing the overburden and coal and then replacing the overburden.

Recontouring during reclamation to match approximate original contours, as required by regulation, reduces the long-term impact to topography. After mined-out areas are reclaimed, the restored land surfaces are typically gentler, with more uniform slopes and restored basic drainage networks. Oil and gas exploration and development has occurred and is projected to continue throughout most of the Task 3 study area. It also results in the alteration of topography to accommodate facilities (e.g., well pads, power plants, etc.) and roads, but the disturbance tends to occur in smaller, more discrete areas than coal mining and the development is spread out over a larger area.

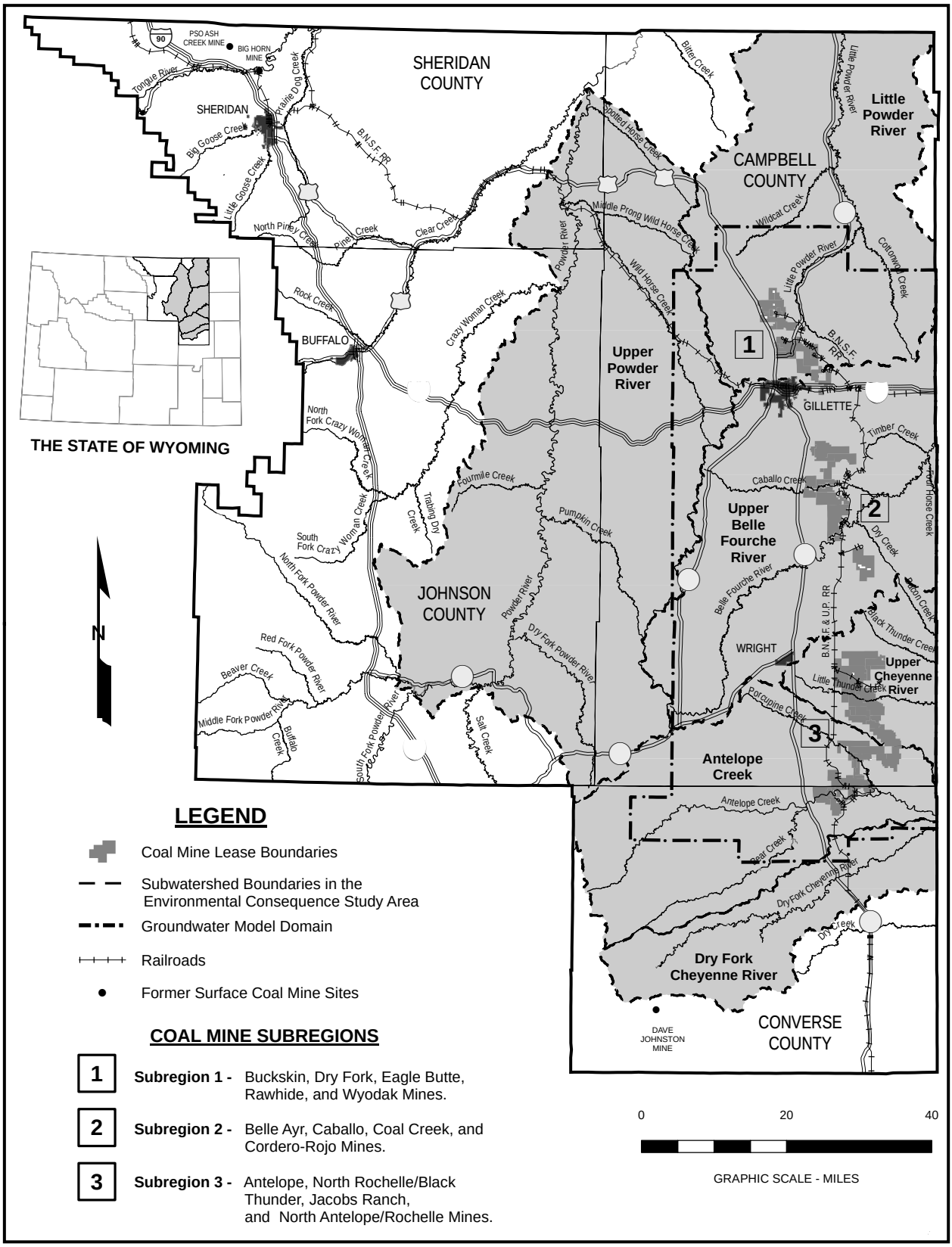


Figure 4-4. Wyoming Task 3 Study Area for PRB Coal Review Studies Evaluating Projected Environmental Consequences.

The disturbance and reclamation acreages associated with all existing and projected development in the Task 3 study area for the years 2003, 2010, 2015, and 2020 are given in Table 4-9.

4.2.2 Geology, Mineral Resources, and Paleontology

The cumulative effects study area for geology, mineral resources, and paleontology is the PRB Coal Review Task 3 study area (Figure 4-4).

The PRB is one of a number of structural basins in Wyoming and the Rocky Mountain area that were formed during the Laramide Orogeny. The basin is asymmetric with a structural axis that generally trends northwest to southeast along the western side of the basin (Flores et al. 1999). Earthquakes, landsides, and subsidence do not present a hazard in the PRB based on the lack of active faults in the study area (USGS 2004b); the low risk of ground shaking in the region if a maximum credible earthquake were to occur (Frankel et al. 1997); and the absence of evidence of subsidence, landslides, or other geologic hazards in association with CBNG production.

4.2.2.1 Coal

Most of the coal resources of the basin are found in the Fort Union and Wasatch Formations. Although coals are present in the Wasatch, they are thinner and less continuous than the coals in the Fort Union and, therefore, they are not as economically important as the coals in the Fort Union for either coal mining or CBNG development. Projected levels of coal production and disturbance under the lower and upper coal production scenarios are shown in Tables 4-2 and 4-3.

In the coal mine areas, the overburden and coal would be removed and the overburden replaced, resulting in a permanent change in the geology of the area and a permanent reduction of coal resources.

4.2.2.2 Oil and Gas

Drilling for conventional oil and gas in the Wyoming PRB has declined considerably in the last 15 years. However, as discussed above, increasing prices have led to increased interest in drilling and there remains potential for finding and developing these resources in the deeper formations of the basin. Conversely, CBNG production increased rapidly from 1999 through 2002 but began to level off in 2003. Projected production rates for conventional oil and gas and CBNG in 2010, 2015, and 2020 are shown in Tables 4-6 and 4-7.

Oil and gas and related development accounts for most of the projected mineral disturbance outside of the coal mining areas. It generally would result in only shallow, discrete areas of surface disturbance, as discussed above. The acreages over which these impacts were occurring (as of 2003) and are projected to occur in the years 2010, 2015, and 2020 are shown in Table 4-9.

4.2.2.3 Other Mineral Resources

As discussed in Section 4.1.3.1, other mineral resources that are being mined in the Wyoming PRB include uranium, bentonite, clinker, and aggregate. Production of uranium and bentonite is not likely to be affected by development of coal or CBNG in the PRB. Aggregate and clinker production levels are more likely to be affected by other mineral development levels because these resources would be used in construction projects related to other mineral development.

4.2.2.4 Paleontology

Scientifically significant paleontological resources, including vertebrate, invertebrate, plant, and trace fossils, are known to occur in many of the geologic formations within the Wyoming PRB. These fossils are documented in the scientific literature, in museum records, and are known by paleontologists and land managers familiar with the area.

The Wasatch Formation is the most geographically widespread unit exposed on the surface over most of the Task 3 study area. It is underlain by the Fort Union Formation. The fossiliferous Morrison and Lance Formations crop out in the western portion of the basin but occur at depth in the vicinity of the coal mines and CBNG activity in the eastern portion of the basin. Within the Task 3 study area, the highly fossiliferous White River Formation occurs only on Pumpkin Buttes in southwestern Campbell County.

As of 2003, no significant or unique paleontological localities had been recorded on federal lands in the PRB. However, the lack of localities in the PRB does not mean that scientifically significant fossils are not present, as much of the area within and surrounding the PRB has not been adequately explored for paleontological resources. As a result, development activities in the Task 3 study area have the potential to adversely affect scientifically significant fossils, if they are present in or adjacent to disturbance areas.

The potential for impacts to scientifically significant fossils would be greatest in areas where Class 4 or 5 formations are present (see Section 3.3.3.1). The Wasatch Formation is classified as a Class 5 formation. The Fort Union Formation is classified as a Class 3 formation, which means that fossil content varies in significance, abundance, and predictable occurrence. The greatest potential impact to surface and subsurface fossils would result from disturbance of surface sediments and shallow bedrock during construction and/or operations, depending on the type of project. Potential subsurface disturbance of paleontological resources (e.g., during drilling operations) would not be visible or verifiable. The areas over which these impacts occurred as of 2003 and are projected to occur as a result of all projected development in the years 2010, 2015, and 2020 are shown in Table 4-9. As only portions of the Task 3 study area have been evaluated for the occurrence of paleontological resources, and discrete locations for development activities cannot be determined at this time,

no accurate estimate can be made as to the number of paleontological sites that may be affected by cumulative development activities.

Development activities which involve federally owned surface and/or minerals are subject to federal guidelines and regulations protecting paleontological resources. Protection measures, permit conditions of approval, and/or mitigation measures would be determined on a project-specific basis at the time of permitting to minimize potential impacts to paleontological resources as a result of these activities.

4.2.3 Air Quality

The Task 1A Report for the PRB Coal Review (BLM 2005a) documents the modeled air quality impacts of operations during a baseline year, 2002, using actual emissions and operations for that year. Emissions from permitted minor sources were estimated, due to unavailability of actual emissions data. The baseline year analysis evaluated impacts both within the PRB itself and at selected sensitive areas surrounding the region. The analysis specifically looked at impacts of coal mines, power plants, CBNG development, and other development activities. Results were provided for both Wyoming and Montana at the individual receptor areas. The Task 2 Report for the PRB Coal Review (BLM 2005d) identifies reasonably foreseeable development activities for the years 2010, 2015, and 2020.

The Task 3A Report for the PRB Coal Review (BLM 2006a) evaluates the impacts on air quality and air quality-related values for the year 2010 using the development levels projected for 2010 and the same model and meteorological data that were used for the baseline year study in the Task 1A Report. Impacts for 2015 and 2020 were projected qualitatively based on evaluation of anticipated changes in emissions and on modeled impacts for the 2010 lower and upper coal production scenarios. BLM is now planning to update the model and conduct an impact analysis for the year 2015. As currently proposed, a revised baseline year emissions inventory would be developed using 2004 actual emissions data or emissions estimates and incorporating recent analyses of emissions in Wyoming and Montana, which were not available when the 2010 modeling study was done.

Existing and projected emissions sources for the baseline year (2002) and 2010 analyses were identified within a study area comprised of the following counties in the PRB in Wyoming and Montana:

- Campbell County, all of Sheridan and Johnson Counties except the Bighorn National Forest lands to the west of the PRB, and the northern portion of Converse County, Wyoming.

- Rosebud, Custer, Powder River, Big Horn, and Treasure Counties, Montana.

A state-of-the-art, guideline dispersion model was used to evaluate impacts of the existing and projected source emissions on several source groups, as follows:

- Near-field receptors in Wyoming and Montana covering the PRB Coal Review Task 1A and 3A study area in each state. Overall, the near-field receptor grid points were spaced at one kilometer intervals over the study area;

- Receptors in nearby federally designated pristine or "Class I" areas; and

- Receptors at other sensitive areas (Class II sensitive areas).

The EPA guideline CALPUFF model system (Scire et al. 1999a) and the same meteorological data set were used for the Task 1A and Task 3A studies. The impacts for the baseline year (2002) and for 2010 lower and upper coal production scenarios were directly modeled. As discussed above, the modeling domain extends over most of Wyoming, southeastern Montana, southwestern North Dakota, western South Dakota, and western Nebraska. An interagency group participated in developing the modeling protocol and related domain that were used for this analysis.

The modeling approach for the Task 3A Report used actual emissions from existing sources representative of 2002 operations and adjusted those emissions for the expected level of development in 2010. No specific emissions data were available for the projected levels of development. The baseline year emissions data were gathered from a variety of sources, but mainly relied on data collected by the WDEQ/AQD and the MDEQ. Only actual emission sources inside the study area described above were included in the modeling. Key major sources were included, such as the coal-fired power plants, gas-fired power plants, and sources that were included in the Title V (operating permit) program. The Dave Johnston power plant, which is located outside of but adjacent to the study area in Converse County, was included in the baseline year study and in the projected emissions. Some operational adjustments were made to accommodate small sources with air permits that were presumed to be operating at less than full capacity. Emissions from other sources, including estimated construction-related fugitive dust emissions, were computed based on EPA emission factors and on input data from WDEQ/AQD.

Meteorological data were developed for 1996 for the modeling domain, using the guideline Version V of the CALMET (Scire et al. 1999b) diagnostic model, identical to that used in the PRB Oil and Gas EIS Project (BLM 2003b) and in the Task 1A Report. These data provide a four-dimensional depiction that represents actual meteorological conditions for that year. The data baseline was enhanced by using data for specific surface stations and precipitation data. Terrain and land use data from the USGS also were used. Modeling data settings generally were set to default values. Baseline year ozone concentrations also were incorporated into the model using measured concentrations representative of the study area, and were not changed for this study.

The existing regional air quality conditions generally are very good in the PRB Coal Review Task 1A and Task 3A study area. There are limited air pollution emissions sources (few industrial facilities, including the surface coal mines, and few residential emissions in relatively small communities and isolated ranches) and good atmospheric dispersion conditions. The available data show that the region is in compliance with the ambient air quality standards for NO_2 and SO_2. There have been no monitored exceedances of the annual PM_{10} standard in the Wyoming PRB. However, as discussed in Chapter 3 (Section 3.4.2.1), monitoring sites at some of the surface coal mines have shown some exceedances of the 24-hour PM_{10} standard since 2000. Exceedances of the 24-hour PM_{10} standard for Antelope Mine are discussed in Chapter 3 Section 3.4.2.1.

Air quality modeling indicates the projected mine activities at the Antelope Mine will be in compliance with the PM_{10} ambient air standards for the life of the mine at the permitted mining rate of 42 mmtpy. The applicant has indicated that they propose to mine the West Antelope II tract between 36 and 42 mmtpy. Visibility data collected around the region indicate that, although there are some days with notable impacts at Class I areas, the general trend in the region shows little change in visibility impacts at Badlands National Park and at the Jim Bridger Wilderness area over the period from 1989 to 2003 (Figure 3-10).

Predicted impacts from baseline year (2002) and projected 2010 emissions were modeled for three air quality criteria pollutants (NO_2, SO_2, and PM_{10}), along with changes in air quality-related values at Class I areas and at identified sensitive areas. For regulatory purposes, the Class I PSD evaluations are not directly comparable to the air quality permitting requirements, because the modeling effort does not identify or separately evaluate increment consuming sources that would need to be evaluated under the PSD program. The cumulative impact analysis focuses on changes in cumulative impacts, but not on a comparison to PSD-related evaluations, which would apply to specific sources.

Table 4-10 presents the modeled impacts on ambient air quality at the near-field receptors in Montana and Wyoming. Results indicate the maximum impacts at any point in each receptor group, and data are provided for the baseline year (2002) analysis and for both coal production scenarios for 2010.

Based on the modeling results, the baseline year (2002) maximum impacts on ambient air quality were well below the ambient air quality standards for NO_2, SO_2, and Annual PM_{10} in both Montana and Wyoming. The 2002 maximum modeled 24-hour PM_{10} are greater than the 150 $\mu g/m^3$ ambient air standard for some near-field receptors near PRB sources in both Montana and Wyoming. The modeling also indicated that visibility impacts in the surrounding Class I areas in 2002 were above the detectable levels at many receptor areas.

For the Montana near-field receptors, the modeling for the 24-hour PM_{10} levels projects a maximum impact above the NAAQS for both coal production scenarios for 2010. The upper coal production scenario shows an increase in the impact of more than 40 percent above the baseline year for this parameter. Projected

Table 4-10. Projected Maximum Potential Near-field Impacts (µg/m³).

Pollutant	Averaging Time	Base Year (2002) Impacts	2010 Lower Coal Production Scenario Impacts	2010 Upper Coal Production Scenario Impacts	NAAQS	Wyoming AAQS	Montana AAQS	PSD Class II Increments
Wyoming Near-field								
NO_2		37.3	42.4	49.0	100	100	--[1]	25
SO_2	Annual	3.9	4.8	5.6	80	60	--[1]	20
		14.5	33.5	34.8	365	260	--[1]	91
		37.9	148.0	154.2	1,300	1300	--[1]	512
	Annual							
PM_{10}	Annual	42.7	49.0	**56.6**	--[2]		--[1]	17
		335.5	**378.8**	**439.9**	150	150	--[1]	30
Montana Near-field								
	24-hour							
NO_2	Annual	8.85	11.3	11.8	100	--[1]	100	25
	3-hour	365.8	415.9	519.5	-- 50	--[1]	564	--
SO_2	Annual	1.3	2.3	2.7	80	--[1]	80	20
	24-hour	18.9	19.5	20.4	365	--[1]	365	91
		74.7	76.4	79.8	1,300	--[1]	1,300	512
		240.7	246.4	257.3	--	--[1]	1,300	--
	1-hour							
PM_{10}	Annual	19.6	22.5	27.7	--[2]	[1]	50	17
		175.8	**200.0**	**247.7**	150	--[1]	150	30
	24-hour							
	3-hour							
	1-hour							
	24-hour							

1 No standard or increment.

2 On September 21, 2006, the EPA announced final revisions to the NAAQS for particulate matter, which were published in the Federal Register on October 17, 2006 and took effect December 18, 2006. The revision not only strengthened the 24-hour $PM_{2.5}$ standard from 65 to 35 ug/m³, but also revoked the annual PM_{10} standard of 50 µg/m³. Wyoming will enter into rulemaking to revise the Wyoming Ambient Air Quality Standards. Until that time, however, Wyoming will retain the 50 ug/m³ annual PM_{10} standard. See additional discussion in Chapter 3, Section 3.4.2.1.

Bold values indicate projected exceedances of AAQS.

Source: PRB Coal Review Task 3A Report (BLM 2006a)

impacts for NO_2, SO_2, and Annual PM_{10} show compliance with the NAAQS and the Montana AAQS. Large percentage increases in annual SO_2 impacts are projected, but the impacts themselves are well below the NAAQS.

For the Wyoming near-field receptors, the modeling projects maximum 24-hour PM_{10} levels greater than the 150 μg/m^3 ambient air standard for the 2010 lower and upper coal production scenarios at some receptors. For the 2010 upper development scenario, the modeled levels are above 150 μg/m^3 at seven of the near-field receptors in Wyoming; those receptors are confined in an area of intensive coal development. As shown in Table 4-10, the maximum modeled PM_{10} impacts from all sources are nearly three times the 24-hour standard for the 2010 upper coal production scenario. As discussed in Section 3.4.2.2.1, modeling tends to over-predict the 24-hour impacts of surface coal mining and, as a result, WDEQ/AQD does not consider short-term PM_{10} modeling to be an accurate representation of short-term impacts. In view of this, a Memorandum of Agreement between WDEQ/AQD and EPA Region VIII, dated January 24, 1994, allows WDEQ/AQD to conduct monitoring in lieu of short-term modeling for assessing coal mining-related impacts in the PRB. This agreement also requires Wyoming to implement "Best Available Work Practice" mitigation measures at any mine where an exceedance of the PM_{10} NAAQS has occurred. The monitored exceedances at surface coal mines in the Wyoming PRB and the measures that WDEQ/AQD has implemented or is proposing to implement to prevent future exceedances of the PM_{10} NAAQS are discussed in Chapter 3, Sections 3.4.2.1 and 3.4.2.3.

The maximum modeled impacts on the annual PM_{10} levels are also projected to be above the standard (50 μg/m^3) at one near-field receptor in Wyoming for the 2010 upper coal production scenario. Impacts of NO_2 and SO_2 emissions are predicted to be below the NAAQS and Wyoming AAQS at all Wyoming near-field receptors. A large portion of the impacts for all scenarios would be associated with coal-related sources, although non-coal sources would contribute a notable portion of the impact.

Table 4-11 lists the three Class I areas and two Class II areas where the modeled impacts are the greatest. Table 4-11 includes a comparison to ambient air quality standards and PSD increments; however, it must be noted that this modeling analysis did not separate PSD increment-consuming sources from those that do not consume increment. The PSD-increment comparison is provided for informational purposes only and cannot be directly related to a regulatory interpretation of PSD increment consumption. For the Class I Northern Cheyenne Indian Reservation, modeled impacts for the baseline year (2002) and the two coal production scenarios for 2010 are less than the annual SO_2 PSD Class I increment; slightly above the PSD Class I increment levels for annual PM_{10}, 24-hour SO_2, and 3-hour SO_2; and well above the Class I increments for 24-hour PM_{10}. For annual NO_2, the modeled impacts for the Northern Cheyenne Reservations are less than the annual increment for the baseline year and lower coal production scenario and slightly above the annual increment for the upper coal production scenario. In the other two Class I areas,

Table 4-11. Maximum Predicted PSD Class I and Sensitive Class II Area Impacts (μg/m³)[1].

Location	Pollutant	Averaging Period	Base Year (2002) Impacts	2010 Lower Coal Production Scenario	2010 Upper Coal Production Scenario	PSD Class I/II Increments
Class I Areas						
Northern Cheyenne Indian Reservation	NO_2	Annual	2.0	2.3	**2.7**	2.5
	SO_2	Annual	0.6	0.8	0.9	2
		24-hour	**6.1**	**6.5**	**6.9**	5
		3-hour	**26.8**	**27.9**	**29.3**	25
	PM_{10}	Annual	**5.0**	**5.8**	**7.0**	4
		24-hour	**42.0**	**47.8**	**59.4**	8
Washakie Wilderness Area	NO_2	Annual	0.1	0.1	0.1	2.5
	SO_2	Annual	0.0	0.1	0.1	2
		24-hour	1.0	3.0	3.3	5
		3-hour	2.0	5.1	5.6	25
	PM_{10}	Annual	0.3	0.4	0.4	4
		24-hour	**14.5**	**16.5**	**16.9**	8
Wind Cave National Park	NO_2	Annual	1.2	1.5	1.7	2.5
	SO_2	Annual	0.2	0.4	0.5	2
		24-hour	1.2	3.5	3.8	5
		3-hour	3.5	9.9	10.3	25
	PM_{10}	Annual	1.3	1.7	1.9	4
		24-hour	**10.7**	**14.0**	**15.7**	8
Sensitive Class II Areas						
Crow Indian Reservation	NO_2	Annual	5.7	6.2	6.7	25
	SO_2	Annual	0.8	0.9	0.9	20
		24-hour	4.7	5.1	5.3	91
		3-hour	14.7	15.1	15.7	512
	PM_{10}	Annual	3.0	3.7	4.0	17
		24-hour	**30.5**	**35.1**	**36.7**	30
Cloud Peak Wilderness Area	NO_2	Annual	0.5	0.7	0.7	25
	SO_2	Annual	0.1	0.2	0.3	20
		24-hour	1.4	3.3	3.7	91
		3-hour	3.6	6.5	7.9	512
	PM_{10}	Annual	0.8	1.1	1.2	17
		24-hour	13.3	17.1	17.9	30

[1] The PSD demonstrations serve information purposes only and do not constitute a regulatory PSD increments consumption analysis.
Bold values indicate exceedance of PSD Class I or II standards.
Source: PRB Coal Review Task 3A Report (BLM 2006a)

only the 24-hour PM_{10} impacts are higher than the comparison to the PSD increment levels for the baseline year and both coal production scenarios. In the sensitive Class II areas, all modeled impacts are well below the Class II PSD increment for the upper coal production scenario. In the other two Class I areas, only the 24-hour PM_{10} impacts are higher than the comparison to the PSD increment levels for the baseline year and both coal production scenarios. In the sensitive Class II areas, all modeled impacts are well below the Class II PSD increments, with the exception that the 24-hour PM_{10} impacts are greater than the Class II 24-hour PM_{10} increments at the Crow Indian Reservation for the baseline year and both coal production scenarios.

The projected modeled visibility impacts for the baseline year (2002) and for the lower and upper coal production scenarios for 2010 for all analyzed Class I and sensitive Class II areas are listed in Table 4-12. For the baseline year, the maximum visibility impacts at Class I areas were determined to be at the Northern Cheyenne Indian Reservation in Montana and at Wind Cave and Badlands National Parks in South Dakota. For these locations, modeling showed more than 200 days of impacts with a change of 10 percent or more in extinction. A 10 percent change in extinction corresponds to 1.0 dv.

To provide a basis for discussing the modeled visibility impacts resulting from the projected increased production under the lower and upper coal production scenarios for 2010, the modeled visibility impacts for 2002 were subtracted from the model results for 2010. Table 4-12 shows the number of additional days that the projected impacts were greater than 1.0 dv (10 percent in extinction) for each site for the upper and lower coal production scenarios. Using Badlands Park as an example, the modeling analysis projected 238 days with impacts greater than 1.0 dv in 2002. Under the 2010 lower coal production scenario, the modeling analysis projects an additional 19 days with impacts greater than 1.0 dv, or a total of 257 days with impacts greater than 1.0 dv.

For acid deposition, all predicted impacts are below the deposition threshold values for both nitrogen and sulfur compounds. There are substantial percentage increases in deposition under the lower and upper coal production scenarios for 2010; however, impacts remain well below the threshold values. The acid neutralizing capacity of sensitive lakes also was analyzed, and results are summarized in Table 4-13. No significant impacts were projected at any of the lakes for the baseline year study; however, the lower and upper coal production scenarios for 2010 show an increased impact at Florence Lake, leading to an impact that is above the 10 percent ANC. Impacts also are predicted to be above the 1 μeq/L threshold for Upper Frozen Lake.

The study also modeled impacts of selected hazardous air pollutant emissions (benzene, ethyl benzene, formaldehyde, n-hexane, toluene, and xylene) on the near-field receptors in Montana and Wyoming. Model results for the 2010 upper coal production scenario show that impacts were predicted to be above the acute Reference Exposure Level for formaldehyde (94 $\mu g/m^3$) at two receptors in Wyoming but are below all Reference Exposure and Reference Concentrations for

Table 4-12. Modeled Change in Visibility Impacts at Class I and Sensitive Class II Areas.

Location	2002 No. of Days >10%	2010 Lower Coal Production Scenario Change in No. of Days > 10%	2010 Upper Coal Production Scenario Change in No. of Days > 10%
Federally and Tribally Designated Class I Areas			
Badlands National Park [1]	238	19	26
Bob Marshall WA	12	2	4
Bridger WA	47	4	7
Fitzpatrick WA	42	3	5
Fort Peck Indian Reservation	69	8	9
Gates of the Mountain WA	14	6	7
Grand Teton National Park	26	2	5
North Absaorka WA	47	6	6
North Cheyenne Indian Reservation	305	5	10
Red Rock Lakes	16	3	5
Scapegoat WA	14	4	4
Teton WA	40	4	5
Theodore Roosevelt National Park	98	15	22
UL Bend WA	49	4	5
Washakie WA	53	2	3
Wind Cave National Park	261	11	15
Yellowstone National Park	42	7	8
Sensitive Class II Areas			
Absaorka Beartooth WA	53	3	5
Agate Fossil Beds National Monument	199	26	30
Big Horn Canyon National Rec. Area	108	7	8
Black Elk WA	263	16	22
Cloud Peak WA	137	8	8
Crow Indian Reservation	284	10	15
Devils Tower National Monument	279	15	21
Fort Belknap Indian Reservation	46	3	4
Fort Laramie National Historic Site	153	27	30
Jedediah Smith WA	23	1	2
Jewel Cave National Monument	267	14	18
Lee Metcalf WA	25	2	4
Mount Naomi WA	8	6	8
Mount Rushmore National Monument	248	19	25
Popo Agie WA	47	7	8
Soldier Creek WA	223	23	29
Wellsville Mountain WA	6	5	7
Wind River Indian Reservation	66	12	15

[1] The U.S. Congress designated the Wilderness Area portion of Badlands National Park as a mandatory Federal PSD Class I area. The remainder of Badlands National Park is a PSD Class II area.

Source: PRB Coal Review Task 3A Report (BLM 2006a)

Table 4-13. Predicted Total Cumulative Change in Acid Neutralizing Capacity of Sensitive Lakes.

Location	Lake	Background ANC (μeq/L)	Area (hectares)	Base Year 2002 Change (percent)	2010 Lower Coal Production Scenario Change (percent)	2010 Upper Coal Production Scenario Change (percent)	Thresholds (percent)
Bridger Wilderness Area	Black Joe	67.0	890	1.3	1.88	1.97	10
	Deep	60.0	205	1.4	2.08	2.18	10
	Hobbs	70.0	293	0.9	1.37	1.43	10
	Upper Frozen	5.0	65	0.7[1]	0.99[1]	1.04[1]	[1]
Cloud Peak	Emerald	55.3	293	5.3	6.59	6.89	10
	Florence	32.7	417	8.9	11.52	12.03	10
Fitzpatrick Wilderness Area	Ross	53.5	4,455	0.9	1.37	1.43 [1]	10
Popo Agie Wilderness Area	Lower Saddlebag	55.5	155	1.9	2.58	2.70	10

[1] Data for Upper Frozen Lake presented in changes in μeq/L rather than percent change. (For lakes with less than 25 μeq/L background ANC.)
Source: PRB Coal Review Task 3A Report (BLM 2006a)

Chronic Inhalation levels in Montana and for other compounds in Wyoming. Essentially, the modeled impacts for 2010 showed a continuation of the patterns exhibited for the baseline year analysis.

For 2015 and 2020, the PRB Coal Review Task 3A Report includes a qualitative analysis of potential air quality impacts and the impacts from individual source groups, based on the projected changes from 2002 to 2010 for the respective coal production scenarios. The production from conventional oil and gas and CBNG activities is projected to peak at 2010, with slight declines predicted over the following decade. Therefore, from these sources, expected impacts would decrease slightly from 2010 to 2015 and 2020. The coal mining sources would be the major contributors to PM_{10} impacts in the near-field, and these impacts would result from the proximity of the receptors to the coal mining operations. If coal mines expand or relocate, those impacts likely would follow that development; however, the specific impacts would need to be addressed with a more refined modeling effort, specifically including accurate source parameters.

Power plants currently are the major contributors to all SO_2 impacts in the near-field in both states. However, the projected impacts are well below any ambient standard or PSD increment. According to the PRB Coal Review Air Quality modeling analysis, predicted future expansion modeled to the year 2020 should not jeopardize the attainment of those standards. Impacts on NO_2 concentrations are the result of emissions from all the source groups. No one source group dominates the NO_2 impacts in the near-field.

A pattern that is similar to the near-field receptors holds true for the Class I and sensitive Class II receptor groups. Essentially, the mine operations would continue to dominate the PM_{10} impacts, the power plants would continue to dominate the SO_2 impacts (although they would continue to be below the standards), and the overall source groups would continue to contribute to NO_2 impacts, but impacts should remain below the NO_2 standard for 2015 and 2020.

Based on modeling results, none of the acid deposition thresholds were exceeded at Class I areas for either the baseline year or for the lower or upper coal production scenarios for 2010. In general, the projected increases in coal development (and power plants) are not expected to raise the deposition levels above the threshold, extended into 2020. The only concern relates to the acid deposition into sensitive lakes. The model results showed that the increased deposition, largely from SO_2 emissions from power plants, exceeded the thresholds of significance for the ANC at two sensitive (high alpine) lakes. The results indicate that with increased growth in power plant operations, the reduced ANC of the sensitive lakes would become significant and would need to be addressed carefully for each proposed major development project.

WDEQ/AQD and WDEQ/LQD mitigation and monitoring requirements for coal mine emissions are discussed in Sections 3.4.2.3 and 3.4.3.3. The discussion in these sections includes the operational control measures that are currently in place and would be required for mining operations on LBAs that are issued in

the future, as well as measures that may be required to avoid future exceedances of the WAAQS and NAAQS and/or future mine-related impacts to the public.

4.2.4 Water Resources

Surface and groundwater are used extensively throughout the PRB for agricultural water supply, municipal water supply, and both domestic and industrial water supply. Surface water use is limited to major perennial drainages and agricultural areas within the basin are found mainly along these drainages. Municipal water supply comes from a combination of surface and groundwater. Domestic and industrial water supply primarily is from groundwater.

The PRB Coal Review Task 1B Report (BLM 2006c) describes the existing water resource conditions in the PRB Task 1 study area (Figure 4-1). The Task 3B Report (BLM 2008a) provides an assessment of the cumulative impact to surface and ground water resources associated with future projected levels of coal mining, coal mine dewatering, CBNG groundwater withdrawal and surface disposal, and coal mine and conventional oil and gas surface disposal of groundwater in the Task 3 study area (Figure 4-4). The groundwater portion of the impact analysis has not yet been completed. The surface water analysis addresses the cumulative impacts to surface water quality and channel stability as a result of surface discharge of groundwater by CBNG development and coal mine dewatering. The surface water quality portion of this analysis has been completed, but the channel stability portion is not yet complete. The following discussion includes a summary the results of the Task 1B Report and the Task 3B surface water quality impact analysis. The Task 3B channel stability and groundwater impact analyses will be incorporated into future EIS analyses when they are completed.

4.2.4.1 Groundwater

There are five main aquifers in the PRB Coal Review Task 1 study area (Figure 4-1) that can be used for water supply:

- Madison Aquifer System;
- Dakota Aquifer System;
- Fox Hills/Lance Aquifer System;
- Fort Union/Wasatch Aquifer System; and
- Quaternary Alluvial Aquifer System.

The Fort Union/Wasatch Aquifer System includes the coal and overburden aquifers that are directly affected by surface coal mining and CBNG development. It is also a major source of local water supply for domestic and stock water use. Table 4-14 shows the recoverable groundwater in the components of the Fort Union/Wasatch Aquifer System. The volumes of recoverable groundwater from the sandstones within the Wasatch/Tongue River

Aquifer, the Lebo Confining Layer, and the Tullock Aquifer were determined from the volume of sandstone in each of these units multiplied by the 13 percent specific yield value for sandstone. Similarly, the volume of recoverable groundwater from the coals within the Wasatch/Tongue River was calculated from the volume of coal multiplied by the 0.4 percent specific yield value for coal. As a result of statutory requirements and concerns, several studies and a number of modeling analyses have been conducted to help predict the impacts of surface coal mining on groundwater resources in the Wyoming portion of the PRB. Some of these studies and modeling analyses are discussed below.

Table 4-14. Recoverable Groundwater in the Fort Union/Wasatch Aquifer System.

Hydrogeologic Unit	Surface Area (acres)	Average Formation Thickness (ft)	Percentage of Sand/Coal	Average Sand/Coal Thickness (ft)	Specific Yield (percent)	Recoverable Groundwater (acre-feet)[1]
Wasatch-Tongue River Aquifer Sandstones	5,615,609	2,035	50.0	1,018	13.0	743,169,695
Wasatch-Tongue River Aquifer Coals	4,988,873	2,035	6.2	126	0.4	2,514,392
Lebo Confining Layer Sandstones	6,992,929	1,009	33.0	250	13.0	227,270,193
Tullock Aquifer Sandstones	7,999,682	1,110	52.0	430	13.0	447,182,224

[1] Calculated by multiplying Surface Area × Average Sand/Coal Thickness × Specific Yield. These numbers vary slightly from the numbers presented in Table 3-5 of the Final Environmental Impact Statement and Proposed Plan Amendment for the PRB Oil and Gas Project (BLM 2003b).
Source: BLM 2003b

In 1987, the USGS, in cooperation with the WDEQ and OSM, conducted a study of the hydrology of the eastern PRB. The resulting description of the cumulative hydrologic effects of all current and anticipated surface coal mining (as of 1987) was published in 1988 in the USGS Water-Resources Investigation Report entitled "*Cumulative Potential Hydrologic Impacts of Surface Coal Mining in the Eastern Powder River Structural Basin, Northeastern Wyoming*", also known as the "USGS CHIA" (Martin et al. 1988). This report evaluates the potential cumulative groundwater impacts of surface coal mining in the area and is incorporated by reference into this EIS. The USGS CHIA analysis considered the proposed mining at the Antelope Mine. It did not evaluate potential groundwater impacts related to additional coal leasing in this area and it did not consider the potential for overlapping groundwater impacts from coal mining and CBNG development.

Each mine must assess the probable hydrologic consequences of mining as part of the mine permitting process. The WDEQ/LQD must evaluate the cumulative hydrologic impacts associated with each proposed mining operation before approving the mining and reclamation plan for each mine, and they must find

that the cumulative hydrologic impacts of all anticipated mining would not cause material damage to the hydrologic balance outside of the permit area for each mine. As a result of these requirements, each existing approved mining permit includes an analysis of the hydrologic impacts of the surface coal mining proposed at that mine. If revisions to mining and reclamation permits are proposed, then the potential cumulative impacts of the revisions must also be evaluated. If the West Antelope II LBA tract is leased to the applicant, the existing mining and reclamation permit for the Antelope Mine must be revised and approved to include the new lease before it can be mined.

The PRB Oil and Gas Project FEIS (BLM 2003b) includes a modeling analysis of the groundwater impacts if an additional 39,000 new CBNG wells are drilled in the PRB by the end of 2011. The project area for this EIS, which covers all of Campbell, Sheridan, and Johnson Counties, as well as the northern portion of Converse County, is similar to the study area for the PRB Coal Review Task 1 and Task 2 study area (Figure 4-1).

Another source of data on the impacts of surface coal mining on groundwater is the monitoring that is required by WDEQ/LQD and administered by the mining operators. Each mine is required to monitor groundwater levels and quality in the coal and in the shallower aquifers in the area surrounding their operations. Monitoring wells are also required to record water levels and water quality in reclaimed areas.

The coal mine groundwater monitoring data are published each year by GAGMO, a voluntary group formed in 1980. Members of GAGMO include most of the companies with operating or proposed mines in the Wyoming PRB, WDEQ, the Wyoming SEO, BLM, USGS, and OSM. GAGMO contracts with an independent firm each year to publish the annual monitoring results. GAGMO also periodically publishes reports summarizing the water monitoring data collected since 1980 in the Wyoming PRB (e.g., Hydro-Engineering 1991, 1996, and 2001a).

The major groundwater issues related to surface coal mining that have been identified are:

- the effect of the removal of the coal aquifer and any overburden aquifers within the mine area and replacement of these aquifers with backfill material;
- the extent of the temporary lowering of static water levels in the aquifers around the mine due to dewatering associated with removal of these aquifers within the mine boundaries;
- the effects of the use of water from the subcoal Fort Union Formation by the mines;
- changes in water quality as a result of mining; and

- potential overlapping drawdown due to proximity of coal mining and CBNG development.

The impacts of large scale surface coal mining on a cumulative basis for each of these issues are discussed in the following paragraphs.

The effect of replacing the coal and overburden with backfill is the first major groundwater concern. The following discussion of recharge, movement, and discharge of water in the backfill aquifer is excerpted from the USGS CHIA (Martin et al. 1988):

> Postmining recharge, movement, and discharge of groundwater in the Wasatch aquifer and Wyodak coal aquifer will probably not be substantially different from premining conditions. Recharge rates and mechanisms will not change substantially. Hydraulic conductivity of the spoil aquifer will be approximately the same as in the Wyodak coal aquifer allowing groundwater to move from recharge areas where clinker is present east of mine areas through the spoil aquifer to the undisturbed Wasatch aquifer and Wyodak coal aquifer to the west.

Monitoring data verify that recharge has occurred and is continuing in the backfill (Hydro-Engineering 1991, 1996, 2001a, and 2005). The water monitoring summary reports prepared each year by GAGMO list current water levels in the monitoring wells completed in the backfill and compare them with the 1980 water levels, as estimated from the 1980 coal water-level contour maps. In the 1991 GAGMO 10-year report, some recharge had occurred in 88 percent of the 51 backfill wells reported at that time (Hydro-Engineering 1991). In the GAGMO 20-year report, 79 percent of the 82 backfill wells measured contained water (Hydro-Engineering 2001a).

Coal companies are required by state and federal law to mitigate any water rights that are interrupted, discontinued, or diminished by mining.

The cumulative size of the backfill area in the PRB and the duration of mining activity would be increased by mining the currently pending LBA tracts, including the West Antelope II LBA tract. Because the mined-out areas are being backfilled and the monitoring data demonstrate that recharge of the backfill is occurring, substantial additional impacts are not anticipated as a result of the pending leasing actions.

Clinker or scoria, the baked and fused rock formed by prehistoric burning of the Wyodak-Anderson coal seam, occurs all along the coal outcrop area (Figure 3-12) and is believed to be the major recharge source for the backfill aquifer, just as it is for the coal. However, not all clinker is saturated. Some clinker is mined for road-surfacing material, but saturated clinker is not generally mined since abundant clinker exists above the water table and does not present the mining problems that would result from mining saturated clinker. Therefore, the major

recharge source for the backfill aquifer is not being disturbed by current mining. Although clinker is present in the West Antelope II LBA tract general analysis area, the tract has no appreciable amounts of clinker.

The second major groundwater issue is the extent of water level drawdown in the coal and shallower aquifers in the area surrounding the mines. In general, the saturated sand aquifers in the Wasatch Formation overburden have limited extent and, as a result, the drawdowns in the Wasatch Formation are much smaller and cover much less area than the coal drawdowns. In this EIS, assessment of cumulative impacts to groundwater related to surface coal mining is based on impact predictions made by the Antelope Mine and the other adjacent mines (North Antelope Rochelle, Black Thunder, and Jacobs Ranch Mines). Those drawdowns are extrapolated to evaluate the potential impacts of mining of the West Antelope II LBA tract. Figure 4-5 depicts the extrapolated extent of the five-ft cumulative drawdown contour within the Wyodak coal aquifer resulting from the four mines in the South Gillette subregion. The extent of the five-ft drawdown contour is used by WDEQ/LQD to assess the cumulative extent of the impact to the groundwater system caused by mining operations.

The GAGMO 20-year report provides actual groundwater drawdown information after 20 years of mining (Hydro-Engineering 2001a). Most of the monitoring wells included in the GAGMO 20-year report (488 wells out of 570) are completed in the coal beds, in the overlying sediments, or in sand channels or interburden between the coal beds at 16 active and proposed mine sites. Since 1996, some BLM monitor wells have been included in the GAGMO reports.

The USGS CHIA predicted the approximate area of five feet or more water level decline in the Wyodak coal aquifer which would result from “all anticipated coal mining”. “All anticipated coal mining” included 16 surface coal mines operating at the time the report was prepared and six additional mines proposed at that time. All of the currently producing mines, including the Antelope Mine, were considered in the USGS CHIA analysis (Martin et al. 1988). The study predicted that water supply wells completed in the coal may be affected as far away as eight miles from mine pits, although the effects at that distance were predicted to be minimal.

As drawdown propagates to the west, available drawdown in the coal aquifer increases. Available drawdown is defined as the elevation difference between the potentiometric surface (elevation to which water will rise in a well bore) and the bottom of the aquifer. Proceeding west, the coal depth increases faster than the potentiometric surface declines, so available drawdown in the coal increases. Since the depth to coal increases, most stock and domestic wells are completed in units above the coal. Consequently, with the exception of CBNG wells, few wells are completed in the coal in the areas west of the mines. Those wells completed in the coal have considerable available drawdown, so it is unlikely that surface coal mining would cause adverse impacts to wells outside the immediate mine area.

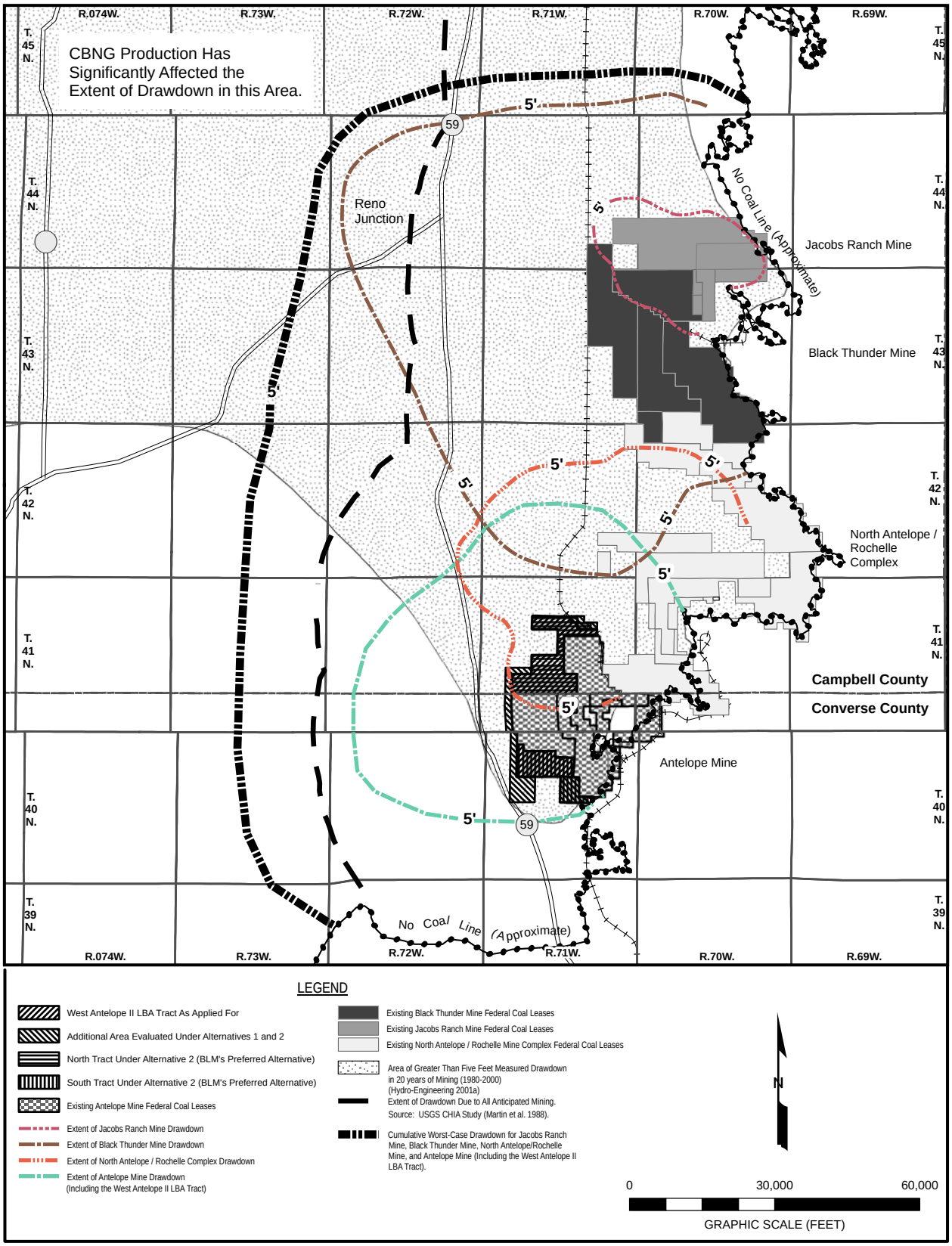


Figure 4-5. Extrapolated Extent of Cumulative Drawdown Within the Wyodak Coal Aquifer in the South Gillette Subregion.

Wells in the Wasatch Formation were predicted to be impacted by drawdown only if they were within 2,000 ft of a mine pit (Martin et al. 1988). Drawdown occurs farther from the mine pits in the coal than in the shallower aquifers because the coal is a confined aquifer that is areally extensive. The area in which the shallower aquifers (Wasatch Formation, alluvium, and clinker) experience a five-ft drawdown would be much smaller than the area of drawdown in the coal because the shallower aquifers are generally discontinuous, of limited areal extent, and often unconfined.

When the USGS CHIA was prepared, there were about 1,200 water supply wells within the maximum impact area defined in that study. Of those wells, about 580 were completed in Wasatch aquifers, about 100 in the Wyodak coal aquifer, and about 280 in strata below the coal. There were no completion data available for the remainder of the wells (about 240) at the time the USGS CHIA was prepared.

If the West Antelope II LBA tract is leased and mined, the groundwater drawdown would be extended into the area surrounding the proposed new lease. When a lease is issued to an existing mine for a maintenance tract, the mine must revise its existing mining permit to include the new tract in its mine and reclamation plans. In order to do that, the lessee would be required to conduct a detailed groundwater analysis to predict the extent of drawdown in the coal and overburden aquifers caused by mining the new lease. WDEQ/LQD would use the revised drawdown predictions to update their cumulative hydrologic impact analysis (WDEQ CHIA) for this portion of the PRB. The applicant has installed monitoring wells that would be used to confirm or refute drawdown predicted by analysis. This analysis would be required as part of the WDEQ mine permitting procedure discussed in Sections 1.2 and 1.3.

Potential water-level decline in the subcoal Fort Union Formation is the third major groundwater issue. Water level declines in the Tullock Aquifer have been documented in the Gillette area. According to Crist (1991), these declines are most likely attributable to pumpage for municipal use by Gillette and for use at subdivisions and trailer parks in and near the city of Gillette. Most of the water-level declines in the subcoal Fort Union wells occur within one mile of the pumped wells (Crist 1991, Martin et al. 1988). Many of the mines have water supply wells completed in zones below the coal, but the mine facilities in the PRB are separated by a distance of one mile or more, so little interference between mine supply wells would be expected.

In response to concerns voiced by regulatory personnel, several mines have conducted impact studies of the subcoal Fort Union Formation. The OSM also commissioned a cumulative impact study of the subcoal Fort Union Formation to address the effects of mine facility wells on this aquifer (OSM 1984). Conclusions from these studies are similar and may be summarized as follows:

- Because of the discontinuous nature of the sands in this formation and because most large-yield wells are completed in several different sands, it is difficult to correlate completion intervals between wells.

- In the Gillette area, water levels in this aquifer have probably declined because the city of Gillette and several subdivisions have utilized water from the formation (Crist 1991). (Note: Gillette is mixing Fort Union Formation water with water from wells completed in the Madison Formation. Also, because drawdown has occurred, some operators are able to dispose of CBNG water by injecting it into the subcoal Fort Union Formation near the city of Gillette.)

- Because large saturated thicknesses are available (locally) in this aquifer unit, generally 500 ft or more, a drawdown of 100 to 200 ft in the vicinity of a pumped well would not dewater the aquifer.

Most of the existing coal mines have permits from the Wyoming SEO for subcoal Fort Union Formation water supply wells. The Antelope Mine uses two wells completed in the sub-coal Fort Union Formation (WS-1 and WS-2) to supply water for human consumption and mining operations (Figure 3-11). Extending the life of the Antelope Mine by issuing a new lease would result in additional water being withdrawn from the subcoal Fort Union Formation, but no new sub-coal water supply wells would be required. The additional water withdrawal would not be expected to extend the area of water level drawdown over a substantially larger area due to the discontinuous nature of the sands in the Tullock Member and the fact that drawdown and yield reach equilibrium in a well due to recharge effects. Due to the distances separating subcoal Fort Union Formation wells used for mine water supply, these wells have not experienced interference and are not likely to in the future.

Water requirements and sources for proposed power plants are not currently known, however, there are no proposed power plants in the immediate vicinity of the Antelope Mine. The Wyoming SEO is discouraging further development of the lower Fort Union Formation aquifers, so the most likely groundwater source for future power plants the Lance-Fox Hills Aquifer System. This would reduce the chances that the power plants would add to cumulative hydrologic impacts of mining and CBNG production.

The fourth issue of concern with respect to groundwater is the effect of mining on water quality. Specifically, what effect does mining have on the water quality in the surrounding area, and what are the potential water quality problems in the backfill aquifer following mining?

In a regional study of the cumulative impacts of coal mining, the median concentrations of dissolved solids and sulfates were found to be higher in water from backfill aquifers than in water from either the Wasatch Formation overburden or the Wyodak coal aquifer (Martin et al. 1988). This is expected because blasting and movement of the overburden materials exposes more

surface area to water, increasing dissolution of soluble materials, particularly from the overburden materials that were situated above the saturated zone in the premining environment.

One pore volume of water is the volume of water that would be required to saturate the backfill following reclamation. The time required for one pore volume of water to pass through the backfill aquifer is greater than the time required for the postmining groundwater system to reestablish equilibrium. According to the USGS CHIA, estimates of the time required to reestablish equilibrium range from tens to hundreds of years (Martin et al. 1988).

The major current use of water from the aquifers being replaced by the backfill (the Wasatch Formation overburden and Wyodak coal aquifers) is for livestock because these aquifers are typically too high in dissolved solids for domestic use and well yields are typically too low for irrigation (Martin et al. 1988). Chemical analyses of 336 samples collected between 1981 and 1986 from 45 wells completed in backfill aquifers at 10 mines indicated that the quality of water in the backfill will, in general, meet the state standard for livestock use of 5,000 mg/L for TDS when recharge occurs (Martin et al. 1988).

The 2000 annual GAGMO report (Hydro-Engineering 2001b) evaluated samples from 48 backfill wells in 1999 and found that the TDS in 75 percent were less than 5,000 mg/L, TDS in 23 percent were between 5,000 and 10,000 mg/L, and TDS in one well was above 10,000 mg/L. An analysis of about 2,000 samples collected from 95 backfill monitoring wells between 1986 and 2002 found that the water quality in 75 percent of the wells were within the acceptable range for the Wyoming livestock standard, with 25 percent exceeding that standard (Ogle 2004).

Water quality data for the backfill aquifer for the southern group of coal mines (Antelope, North Antelope Rochelle, Black Thunder and Jacobs Ranch) for the period from 1981 to 2005 was compiled by WDEQ/LQD and presented in the most recently prepared WDEQ CHIA for that mine group (Ogle et al. 2006). The median TDS concentration of groundwater from the backfill aquifer in that group of mines was 3,670 mg/L, based on 869 samples. The report concluded that the water quality in the backfill aquifer in the southern group of mines meets the requirements for livestock use, although the data show that the concentration of major ions measured in water samples taken from the backfill aquifer is consistently higher that the concentrations measured in the premining aquifers. The 2005 Annual GAGMO report (Hydro-Engineering 2006) indicates that TDS concentrations in 2005 ranged from 802 mg/L at BTB-24 (Black Thunder Mine) to 12,409 mg/L at SP-4-NA (North Antelope Rochelle Mine). The TDS concentrations at Antelope Mine in 2005 ranged from 2,360 mg/L at OWS-10 to 5,800 mg/L at OWS-12. These values are consistent with the findings of the WDEQ CHIA. The incremental effect on groundwater quality due to leasing and mining the West Antelope II LBA tract would be to increase the total volume of backfill and, thus, the time for equilibrium to reestablish.

The fifth area of concern is the potential for cumulative impacts to groundwater resources due to the proximity of coal mining and CBNG development. The Wyodak coal is being developed by mining and CBNG production in the same general area. Dewatering activities associated with CBNG development have overlapped with and expanded the area of groundwater drawdown in the coal aquifer in the PRB over what would occur due to coal mining development alone, and this would be expected to continue.

Numerical groundwater flow modeling was used to predict the impacts of the cumulative stresses imposed by mining and CBNG development on the Fort Union Formation coal aquifer in the PRB Oil and Gas Project EIS (BLM 2003b). Modeling was necessary because of the large areal extent, variability, and cumulative stresses imposed by mining and CBNG development on the Fort Union coal aquifers. Information from earlier studies was incorporated into the modeling effort for this analysis.

As expected, the modeling indicated that the groundwater impacts from CBNG development and surface coal mining would be additive in nature and that the addition of CBNG development would extend the area experiencing a loss in hydraulic head to the west of the mining area. The 20-year GAGMO report stated that drawdowns in all areas have greatly increased due to the water production from the Wyodak coal aquifer by CBNG producers (Hydro-Engineering 2001a).

Drawdowns in the coal caused by CBNG development would be expected to reduce the need for dewatering in advance of mining, which would be beneficial for mining operations. Wells completed in the coal may also experience increased methane emissions in areas of significant aquifer depressurization. There is a potential for conflicts to occur over who (coal mining or CBNG operators) is responsible for replacing or repairing private wells that are adversely affected by the drawdowns; however, the number of potentially affected wells completed in the coal is not large.

As discussed previously, coal companies are required by state and federal law to mitigate any water rights that are interrupted, discontinued, or diminished by coal mining. In response to concerns about the potential impacts of CBNG development on water rights, a group of CBNG operators and local landowners developed a standard water well monitoring and mitigation agreement that can be used on a case-by-case basis as development proceeds. All CBNG operators on federal oil and gas leases are required to offer this water well agreement to the surface landowners (BLM 2003b).

After CBNG development and coal mining projects are completed, it will take longer for groundwater levels to recover due to the overlapping drawdown impacts caused by the dewatering and depressuring of the coal aquifer by both operations.

4.2.4.2 Surface Water

For the PRB Coal Review Task 1B Report, which describes the baseline year (2003) water resource conditions including surface water use and surface water availability, the Wyoming PRB is divided into two major water planning areas: the Powder/Tongue River Basin and the Northeast Wyoming River Basins.

The main rivers in the Powder/Tongue River Basin are the Tongue River and the Powder River. The Powder/Tongue River Basin receives substantial surface water runoff from the Big Horn Mountains, leading to major agricultural development along drainages in the Tongue River and Powder River basins. Reservoirs are used throughout the basin for agricultural water supply and for municipal water supply in the Powder/Tongue River Basin. Water use in the Powder/Tongue River Basin as of 2002 is summarized in Table 4-15.

Table 4-15. Water Use as of 2002 in the Powder/Tongue River Basin.

	Dry Year		**Normal Year (acre-feet per year)**		**Wet Year**	
Water Use Categories	**Surface Water**	**Ground-water**	**Surface Water**	**Ground-water**	**Surface Water**	**Ground-water**
Agricultural	178,000	200	184,000	200	194,000	300
Municipal	2,700	500	2,700	500	2,700	500
Domestic	---	4,400	---	4,400	---	4,400
Industrial[1]	---	68,000	---	68,000	---	68,000
Recreation			Non-consumptive			
Environmental			Non-consumptive			
Evaporation	11,300	--	11,300	--	11,300	--
Total	**192,000**	**73,100**	**198,000**	**73,100**	**208,000**	**73,200**

[1] Includes conventional oil and gas production water and CBNG production water.
Source: HKM Engineering et al. 2002a

The Little Bighorn River, Tongue River, Powder River, Crazy Woman Creek, and Piney Creek carry the largest natural flows in the Powder/Tongue River Basin. Many of the other major drainages are affected by irrigation practices to the extent that their flows are not natural (HKM Engineering et al. 2002a). Water availability in the major sub-basins of the Powder/Tongue River Basin is summarized in Table 4-16. This table presents the amount of surface water in acre-feet that is physically available above and beyond allocated surface water in these drainages. As a result of the Yellowstone River Compact, Wyoming must share some of the physically available surface water in the Powder/Tongue River Basin with Montana.

The main rivers in the Northeast Wyoming River Basins are the Belle Fourche in Campbell and Crook Counties and the Cheyenne River in Converse, Weston, and Niobrara Counties. Water in these rivers and their tributaries comes from groundwater baseline flow and from precipitation, especially from heavy storms during the summer months. Water use in the Northeast Wyoming River Basins as of 2002 is summarized in Table 4-17.

Stream flow in the major drainages of the Northeast Wyoming River Basins is much less than in the Powder/Tongue River Basin, due to the absence of a major mountain range to provide snow melt runoff. Water availability in the major sub-basins of the Northeast Wyoming Rivers Basin is summarized in Table 4-18.

Table 4-16. Surface Water Availability in the Powder/Tongue River Basin.

	Surface Water Availability (acre-feet per year)		
Sub-basin	**Wet Years**	**Normal Years**	**Dry Years**
Little Bighorn River	152,000	113,000	81,000
Tongue River	473,000	326,000	218,000
Clear Creek	213,000	124,000	80,000
Crazy Woman Creek	69,000	32,000	16,000
Powder River	547,000	324,000	16,000
Little Powder River	48,000	12,000	3,000
Total	**1,502,000**	**931,000**	**414,000**

Source: HKM Engineering et al. 2002a

Table 4-17. Water Use as of 2002 in the Northeast Wyoming River Basins.

	Dry Year		Normal Year (acre-feet per year)		Wet Year	
Water Use Categories	**Surface Water**	**Ground-water**	**Surface Water**	**Ground-water**	**Surface Water**	**Ground-water**
Agricultural	65,000	11,000	69,000	17,000	71,000	17,000
Municipal	---	9,100	---	9,100	---	9,100
Domestic	---	3,600	---	3,600	---	3,600
Industrial (Oil and Gas)[1]	---	46,000	---	46,000	---	46,000
Industrial (Other)[2]	---	4,700	---	4,700	---	4,700
Recreation			Non-consumptive			
Environmental			Non-consumptive			
Evaporation (Key Reservoirs)	14,000	---	14,000	---	14,000	---
Evaporation (Stock Ponds)	6,300	---	6,300	---	6,300	---
Total	**85,300**	**74,400**	**89,300**	**80,400**	**91,300**	**80,400**

[1] Includes conventional oil and gas production water and CBNG production water.
[2] Includes electricity generation, coal mining, and oil refining.
Source: HKM Engineering et al. 2002b

The portions of the PRB Coal Review Task 3B Report that have been completed evaluate cumulative impacts to surface water quality as a result of CBNG, conventional oil and gas, and surface coal mining development in 2003, and projected development in 2010, 2015, and 2020 in the PRB Coal Review Task 3 study area (Figure 4-4). The surface water resources in the PRB Coal Review Task 3 study area consist primarily of intermittent and ephemeral streams and scattered ponds and reservoirs. A major impact of the projected development activities would be direct surface disturbance of these surface water features.

Table 4-9 summarizes the cumulative baseline (2003) and projected (in 2010, 2015, and 2020) acres of surface disturbance and reclamation. The projected activities would result in surface disturbance in each of the six Task 3 study area subwatersheds (Figure 4-4). Discrete locations for development disturbance and reclamation areas cannot be determined based on existing information. However, the projected disturbance would primarily involve the construction of additional linear facilities, product gathering lines, and road systems associated with conventional oil and gas and CBNG activities, plus additional disturbance associated with extending coal mining operations onto lands adjacent to the existing mines.

Table 4-18. Surface Water Availability in the Northeast Wyoming River Basins.

	Surface Water Availability (acre-feet per year)		
Sub-basin	**Wet Years**	**Normal Years**	**Dry Years**
Redwater Creek	34,000	26,000	17,000
Beaver Creek	30,000	20,000	14,000
Cheyenne River	103,000	31,000	5,000
Belle Fourche River	151,000	71,000	13,000
Total	**318,000**	**148,000**	**49,000**

Source: HKM Engineering et al. 2002b

Surface disturbing activities can result in sediment input to water bodies, which affects water quality parameters such as turbidity and bottom substrate composition. Contaminants also can be introduced into water bodies through chemical characteristics of the sediment. Studies have shown that TDS levels in streams near reclaimed coal mine areas have increased from one percent to seven percent (Martin et al. 1988). Typically, sedimentation effects are short-term in duration and localized in terms of the affected area. Suspended sediment concentrations would stabilize and return to typical background concentrations after construction or development activities have been completed. It is anticipated that sediment input associated with development disturbance areas would be minimized by implementation of appropriate erosion control measures, as would be determined during future permitting.

Future coal mining could remove intermittent or ephemeral streams and stock ponds in the Little Powder River, Upper Belle Fourche River, Upper Cheyenne River, and Antelope Creek subwatersheds. As discussed in Section 3.5.2, the Antelope Mine is in the Antelope Creek subwatershed. Coal mine permits provide for removal of first- through fourth-order drainages. During reclamation, third- and fourth-order drainages must be restored; first- and second-order drainages often are not replaced (Martin et al. 1988).

Coal mining-related surface water would be discharged into intermittent and ephemeral streams in four subwatersheds (Antelope Creek, Little Powder River, Upper Belle Fourche River, and Upper Cheyenne River). Based on current trends, it is assumed that most, if not all, of the coal mine-produced water

would be consumed during operation. As discussed in Section 3.5.2.2, changes in surface runoff would occur as a result of the destruction and reconstruction of drainage channels as mining progresses. Sediment control structures would be used to manage discharges of surface water from the mine permit areas. State and federal regulations require treatment of surface runoff from mined lands to meet effluent standards.

The PRB Coal Review assumes that future permitting would allow a portion of CBNG-produced water to be discharged to intermittent and ephemeral drainages as is currently allowed in the six subwatersheds in the PRB Coal Review Task 3 study area (Figure 4-4). It is estimated that up to 39,108, 41,899, and 37,390 mmgpy of water would be produced in 2010, 2015, and 2020, respectively.

The PRB Coal Review Task 3B surface water quality impact analysis utilizes the surface water model described in the Surface Water Quality Analysis Technical Report (Greystone 2003), which was prepared in support of the PRB Oil and Gas Project EIS (BLM 2003b), to evaluate the cumulative impacts to surface water resources from surface discharge of CBNG development. Based on past monitoring in receiving streams, most CBNG discharge water either infiltrates or evaporates within a few miles of the discharge points and generally is not recorded at USGS Stream gauging stations. Impacts to surface water flow and quality are therefore generally limited to within a few miles of the discharge point. In view of this, the PRB Coal Review Task 3B water quality impact analysis assumes a conveyance loss of 70 percent for the water quality assessment and modeling analysis.

Key water quality parameters for predicting the potential effects of CBNG development in the surface water quality impact analysis focused on the suitability of surface water for irrigated agriculture. Sodium adsorption ratio, or SAR, and salinity, measured by electrical conductivity or EC, were utilized for this prediction. Most restrictive (MRPL) and least restrictive (LRPL) regulatory standards for EC and SAR applicable to the subwatersheds were developed and used in the analysis. The limits presented in Table 4-19 were used during the comparison of EC and SAR valued for resulting mixtures of existing streamflows and discharges from CBNG wells under various flow conditions and the CBNG water discharge projections for 2010, 2015, and 2020.

Table 4-19. Summary of Proposed Limits for SAR and EC

Subwatershed	**Most Restrictive Proposed Limit (MRPL)**		**Least Restrictive Proposed Limit (LRPL)**	
	SAR	**EC (µS/cm)**	**SAR**	**EC (µS/cm)**
Little Powder	5	2,000	9.75	2,500
Powder	2	2,000	9.75	2,500
Belle Fourche	6	2,000	10	2,500
Cheyenne, Antelope Creek	10	2,000	10	2,500

Source: Wyoming DEQ, Montana DEQ, and South Dakota Legislative Council

The impacts to water quality on the receiving drainages assumed two hydrologic conditions: dry year conditions and normal year conditions. The impact analysis, conducted using monthly flows, comparatively evaluated the water quality parameters (SAR and EC) of the receiving drainage before and after mixing with discharge water generated by the CBNG wells within that drainage. In general, the water discharged from the CBNG wells reflected increased levels of SAR and reduced levels of EC compared to the water quality of the receiving drainages. Impacts to water quality are likely to be maximized during the low flow months; consequently, the comparative evaluation of water quality also focused on the minimum monthly flow associated with the dry year and normal year conditions.

The water quality impact analysis made several observations regarding the overall effects of mixing CBNG well production water with surface water in the PRB Coal Review Task 3 study area. These general observations are summarized below.

Before mixing, the surface water in the Upper Powder River exceeds the MRPL for both EC and SAR throughout the majority of the year. Levels of SAR are less than the LRPL while EC values generally exceed the LRPL from July through December. After mixing, a minimal reduction in EC and a minor increase in SAR are projected, which reflects the relatively small contribution of CBNG well production water to the much larger flows in the Upper Powder River. Projected SAR values exceed the MRPL through out the year while meeting the LRPL. Projected EC values exceed the MRPL throughout the majority of the year and the LRPL from July though December.

For Antelope Creek and the Dry Fork Cheyenne River under the before mixing scenario, the SAR values are relatively low and do not exceed the MRPL. The EC values exceed the MRPL during the low-flow months, but are typically less than the LRPL all year. After mixing, SAR levels increase but are projected to continue to meet the MRPL and a reduction in EC is projected that meets the MRPL throughout the year. This is a reflection of the lack of surface water in these streams combined with the relatively low values for EC and SAR in the CBNG well production water.

Before mixing, the surface water in the Little Powder River exceeds the MRPL for EC and SAR throughout the majority of the year. SAR levels remain below the LRPL throughout the year, but EC levels exceed the LRPL during the low flow months. After mixing, the projected SAR values exceed the MRPL throughout the year and exceed the LRPL from one month (in 2003) to five months (in 2010 and 2015) of the year. The projected EC exceeds the MRPL for four months of the year but meets the LRPL throughout the year.

For the Upper Cheyenne River before mixing, the SAR levels do not exceed the MRPL and the EC levels exceed the MRPL for eleven months of the year and the LRPL for nine months of the year. After mixing, the projected SAR levels continue to meet the MRPL throughout the year and the projected EC levels

exceed the MRPL for 10 or more months of the year and the LRPL for six or more months of the year.

Before mixing, the surface water in the Upper Belle Fourche River exceeds the MRPL for SAR from November though January while meeting the LRPL throughout the year. The EC levels exceed the MRPL from September through January and exceed the LRPL from November through January. After mixing, the projected SAR values exceed the MRPL six or more months of the year while continuing to meet the LRPL throughout the year. The projected EC values meet the MRPL throughout the year.

The suitability of the mixed water for irrigation purposed is related to EC and SAR. In general, the water most suitable for irrigation has a relatively low SAR and a relatively high EC. Elevated SAR values may reduce permeability in clayey soils, which reduces the rate of water infiltration. As discussed above, the water discharged from the CBNG wells is generally characterized by higher levels of SAR and reduced levels of EC compared to the water quality of the receiving drainages. In those cases where mixing results in a significant increase in SAR and the EC is moderately low, the water was considered unsuitable. For Antelope Creek, the Dry Fork Cheyenne River, the Little Powder River and the Upper Belle Fourche River, the projected water quality after mixing demonstrated adequate suitability for irrigation during normal year conditions and unsuitability for irrigation during some to all of the irrigation season during dry year conditions. In general, for periods where CBNG well production water represents the majority of the flow available for irrigation purposes, there is a reduction in the suitability of the water for irrigation purposes.

4.2.5 Alluvial Valley Floors

The identified AVFs for all coal mines in the PRB Coal Review study area are described in the PRB Coal Review Task 1D Report (BLM 2005c), based on individual mine State Decision Documents. Regulatory determinations of AVF occurrence and location are completed as part of the permitting process for coal mining operations, because their presence can restrict mining activities under SMCRA and Wyoming laws. The WDEQ/LQD administers the AVF regulations for coal mining activities in Wyoming. Coal mine-related impacts to designated AVFs generally are not permitted if the AVF is determined to be significant to agriculture. If an AVF is determined not to be significant to agriculture or if the permit to affect the AVF was approved prior to the effective date of SMCRA, the AVF can be disturbed during mining but must be restored to essential hydrologic function during reclamation.

The formal AVF designation and related regulatory programs described above are specific to coal mining operations; however, other development-related activities in the study area would potentially impact AVF resources. The portions of the PRB Coal Review Task 3 study area that lie outside of the mine permit areas have generally not been surveyed for the presence of AVFs;

therefore, the locations and extent of the AVFs outside of the mine permit areas have not been determined.

4.2.6 Soils

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts to soils as a result of projected development activities in the PRB Coal Review Task 3 study area. The area of surface coal mining disturbance and reclamation for the baseline year (2003) and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in Tables 4-2 and 4-3. The area of disturbance and reclamation for all development for the baseline year and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in Table 4-9.

Development activities such as increased vehicle traffic, vegetation removal, soil salvage and redistribution, discharge of CBNG produced groundwater, and construction and maintenance of project-specific components (e.g., roads, ROWs, well pads, industrial sites, and associated ancillary facilities) would result in cumulative impacts to soils in the study area. In general, soil disturbance and handling from these activities would generate both long-term and short-term impacts to soil resources through accelerated wind or water erosion, declining soil quality factors, compaction, and the essentially permanent removal of soil resources at industrial sites.

Of the types of development projects in the study area, coal mining activities would create the most concentrated cumulative impacts to soils. This is due to the large acreages involved and the tendency of mining operations to occur in contiguous blocks. These factors would encourage widespread accelerated wind and water erosion. Extensive soil handling would cause compaction and a corresponding loss of permeability to water and air; a decline in microbial populations, fertility, and organic matter; and potential mixing of saline and/or alkaline soil zones into seedbeds, which would reduce soil quality. There would be a limited availability of suitable soil resources for reclamation uses in some areas.

However, for surface coal mining operations, there are measures that are either routinely required or can be specifically required as necessary to reduce impacts to soil resources and to identify overburden material that may be unsuitable for use in reestablishing vegetation, as discussed in Sections 3.3.1.3, 3.4.2.3, and 3.8.3.

As described in Appendix E of the PRB Coal Review Task 2 Report (BLM 2005d), a variety of CBNG water disposal methods may be employed in the Task 3 study area. The potential impacts to soils would depend on the water treatment method, if any, and the nature of the disposal method. As discussed in the PRB Coal Review Task 3D Report (BLM 2005f), due to elevated SAR levels in water produced from the Wyodak-Anderson coal zone in the Upper Powder River and Little Powder River subwatersheds, land applications of CBNG-produced water

in those areas could increase soil alkalinity. As discussed above in Section 4.2.4.2, the SAR values are relatively low for Antelope Creek and are not projected to exceed the MRPL after mixing with discharged CBNG water and land application of CBNG-produced water is not anticipated. The specific approaches to CBNG water discharges, the resource conditions and locations in which they occur, the timing of discharges, and the discharge permit stipulations from regulatory and land management agencies would determine the extent and degree of potential impacts to soils.

4.2.7 Vegetation, Wetlands and Riparian Areas

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts to vegetation, wetlands, and riparian areas as a result of projected development activities in the PRB Coal Review Task 3 study area. The area of surface coal mining disturbance and reclamation for the baseline year (2003) and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 related to surface coal mining are shown in Tables 4-2 and 4-3. For all projected development, the baseline year area of disturbance and reclamation and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in Table 4-9.

4.2.7.1 Vegetation

The PRB is characterized as a mosaic of general vegetation types, which include prairie grasslands, shrublands, forested areas, and riparian areas. These broad categories often represent several vegetation types that are similar in terms of dominant species and ecological importance. Fourteen vegetation types were identified within the PRB Coal Review Task 1 study area, of which 10 primarily consist of native vegetation and are collectively classified as rangeland. These vegetation types include short-grass prairie, mixed-grass prairie, sagebrush shrubland, other shrubland, coniferous forest, aspen, forested riparian, shrubby riparian, herbaceous riparian, and wet meadow. The remaining vegetation types support limited or non-native vegetation and include cropland, urban/disturbed, barren, and open water. The vegetation types are described in more detail in the Task 1D Report for the PRB Coal Review (BLM 2005c).

Impacts to vegetation can be classified as short-term and long-term. Potential short-term impacts arise from the removal and disturbance of herbaceous species during a project's development and operation (e.g., coal mining, CBNG drilling and production, etc.), which would cease upon project completion and successful reclamation in a given area. Reclaimed mine land is defined by WDEQ/LQD as affected land that has been backfilled, graded, topsoiled, and permanently seeded in accordance with the approved practices specified in the reclamation plan (Christensen 2002). Species composition on the reclaimed lands may be different than on the surrounding undisturbed lands. The removal of woody species would be considered a long-term impact since these species take approximately 25 years or longer to attain a size comparable to woody species present within proposed disturbance areas. Potential long-term

impacts would also include permanent loss of vegetation and vegetative productivity in areas that would not be reclaimed in the near term (e.g., power plant sites, etc.).

4.2.7.2 Special Status Plant Species

Special status plant species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed and federally proposed species (species that are protected under the ESA), BLM Sensitive Species, USDA-FS Sensitive Species, and WGFD Species of Special Concern in Wyoming. Further discussions of species that are protected under the ESA, BLM Sensitive Species, and USDA-FS Sensitive Species are included in Appendices H and I of this EIS. One federally listed species (Ute ladies'-tresses orchid) and three USDA-FS sensitive species (Barr's milkvetch, Rosy palafox, and Lemonscent) are known to occur in the PRB Coal Review Task 3 study area. Three BLM sensitive species [Nelson's milkvetch and Laramie columbine (Casper Field Office) and William's wafer-parsnip (Buffalo Field Office) may occur in the PRB Coal Review Task 3 study area.

Potential direct impacts to special status plant species in the study area could include the incremental loss or alteration of potential or known habitat, associated with past and projected activities. Direct impacts also could include the direct loss of individual plants within the PRB Coal Review Task 3 study area, depending on their location in relation to development activities. Indirect impacts could occur due to increased dispersal and establishment of noxious weeds, which may result in the displacement of special status plant species in the long term.

4.2.7.3 Noxious and Invasive Weed Species

Once established, invasive and non-native plant species can out-compete and eventually replace native species, thereby reducing forage productivity and the overall vigor and diversity of existing native plant communities. The State of Wyoming has currently designated the following 25 plant species as noxious weeds:

- Field bindweed (*Convolvulus arvensis* L.)
- Canada thistle (*Cirsium arvense* L.)
- Leafy spurge (*Euphorbia esula* L.)
- Perennial sowthistle (*Sonchus arvensis* L.)
- Quackgrass (*Agropyron repens* (L.) Beauv.)
- Hoary cress (whitetop) (*Cardaria draba* and *Cardaria pubescens* (L.) Desv.)
- Perennial pepperweed (giant whitetop) (*Lepidium latifolium* L.)
- Ox-eye daisy (*Chrysanthemum leucanthemum* L.)
- Skeletonleaf bursage (*Franseria discolor* Nutt.)

- Russian knapweed (*Centaurea repens* L.)
- Yellow toadflax (*Linaria vulgaris* L.)
- Dalmatian toadflax (*Linaria dalmatica* (L.) Mill.)
- Scotch thistle (*Onopordum acanthium* L.)
- Musk thistle (*Carduus nutans* L.)
- Common burdock (*Arctium minus* (Hill) Bernh.)
- Plumeless thistle (*Carduus acanthoides* L.)
- Dyers woad (*Isatis tinctoria* L.)
- Houndstongue (*Cynoglossum officinale* L.)
- Spotted knapweed (*Centaurea maculosa* Lam.)
- Diffuse knapweed (*Centaurea diffusa* Lam.)
- Purple loosestrife (*Lythrum salicaria* L.)
- Saltcedar (*Tamarix* spp.)
- Common St. Johnswort (*Hypericum perforatum*)
- Common Tansy (*Tanacetum vulgare*)
- Russian olive (*Elaeagnus angustifolia* L.)

Campbell County does not currently have a declared county weed list.

The 2007 Converse County Declared List of Weeds is below.

- Black henbane (*Hyocyamus niger*)
- Bull thistle (*Cirsium vulgare* (Savi) Tenore)
- Chicory (*Cichorium intybus* L.)
- Common crupina (*Crupina vulgaris*)
- Common mullein (*Verbascum thapsus*)
- Dames Rocket (*Hesperis matronalis*)
- Goatsrue (*Galega officinalis*)
- Gorse (*Ulex europaes*)
- Halogeton (*Halogeton glomeratus*)
- Iberian starthistle (*Centaurea iberica*)
- Italian thistle (*Carduus pycnocephalus*)
- Jointed goatgrass (*Aegilops cylindrica* Host.)
- Meadow knapweed (*Centaurea pratensis*)
- Medusahead (*Taeniatherum caput-medusae* (L.) Nevski)
- Orange hawkweed (*Hieracium aurantiacum*)
- Purple starthistle (*Centaurea calcitrapa*)
- Rush skeleton weed (*Chondrilla juncea*)
- Sandbur (*Cenchrus incertus* M.A. Curtis)
- Scentless chamomile (*Matricaria perforate*)
- Scotch broom (*Cytisus scoparius*)
- Squarrose knapweed (*Centaurea virgata* var. *squarrosa*)

- Sulfur cinquefoil (*Potentilla recta*)
- Syrian beancaper (*Zygophyllum fabago*)
- Tansy Ragwort (*Senecia jacobea*)
- Teasel (*Dipsacus fullonum*)
- Wild licorice (*Glycyrrhiaz lepidota*)
- Yellow hawkweed (*Hieracium pratense*)
- Absinth Wormwood (*Artemisia absinthium* L.)
- Babybreath (*Gypsophila paniculata* L.)
- Blue Mustard (*Chorispora tenella* (Pall.) DC.)
- Buffalobur (*Solanum rostratum* Dun.)
- Bur Buttercup (*Ranunculus testiculatus* Crantz)
- Common Cocklebur (*Xanthium strumarium* L.)
- Common Sunflower (*Helianthus annus* L.)
- Curly Dock (*Rumex crispus* L.)
- Curlycup gumweed (*Grindelia squarrosa* (Pursh) Dunal)
- Downy Brome (*Bromus tectorum* L.)
- Poison Hemlock (*Conium maculatum* L.)
- Puncturevine (*Tribulus terrestris* L.)
- Redstem Filaree (*Erodium cicutarium* (L.) L'Her.ex Ait)
- Showy Milkweed (*Asclepias speciosa* Torr.)
- Wavyleaf Thistle (*Cirsium undulatum* (Nutt.) Spreng.)
- Western Sticktight (*Lappula occidentalis* (S. Wats.) Greene)

Development-related construction and operation activities would potentially result in the dispersal of noxious and invasive weed species within and beyond the surface disturbance boundaries, which would result in the displacement of native species and changes in species composition in the long term. The potential for these impacts would be higher in relation to the development of linear facilities (e.g., pipeline ROWs, oil- and gas-related road systems, etc.) than for site facilities (e.g., mines, power plants, etc.) due to the potential for dispersal of noxious weeds over a larger area.

Chapter 4, Section 2(d)(xiv) of the WDEQ/LQD rules and regulations requires that surface coal mines address weed control on reclaimed areas as follows:

> The operator must control and minimize the introduction of noxious weeds in accordance with Federal and State requirements until bond release.

Accordingly, the reclamation plans for the existing Antelope Mine and for all other surface coal mines in the Wyoming PRB include steps to control invasion by weedy (invasive nonnative) plant species. As discussed in Chapter 3, Section 3.9.4, Antelope Mine works with both the Converse County and Campbell County Weed and Pest Departments and conducts an active noxious weed control program on their existing coal leases. Similar measures to identify and control noxious weeds are used at all of the surface coal mines in the Wyoming PRB as a result of the WDEQ/LQD regulatory requirements.

Mitigation to control invasion by noxious weeds for CBNG developers is determined on a site-specific basis and may include spraying herbicides before entering areas and washing vehicles before leaving infested areas. BLM reviews weed educational material during preconstruction on-site meetings with CBNG operators, subcontractors, and landowners. BLM also attaches this educational information to approved APDs or PODs (BLM 2003b). BLM also participates in a collaborative effort with the South Goshen Cooperative Extension Conservation District, the USDA-Natural Resources Conservation Service, private surface owners, WGFD, and the Weed and Pest District in a prevention program that includes a long-term integrated weed management plan, public awareness and prevention programs, and a common inventory (BLM 2003b).

4.2.7.4 Wetland and Riparian Species

Operations associated with development activities in the study area would result in the use of groundwater. Annually, during 2010-2020, from 30,000-35,000 mmgpy of CBNG-produced water would be discharged to impoundments or intermittent and ephemeral streams or reinjected. The discharge of produced water could result in the creation of wetlands in containment ponds, landscape depressions, and riparian areas along segments of drainages that previously supported upland vegetation. In addition, existing wetlands and riparian areas that would receive additional water would become more extensive and potentially support a greater diversity of wetland species in the long term. Alternately, the discharge of abnormally high flows or water with SARs of 13 or more could impact existing vegetation as discussed in the Task 1D Report for the PRB Coal Review (BLM 2005c). For agricultural uses, the current Wyoming water quality standard for SAR is 8.0 (WDEQ/WQD 2005). SARs of 5 to 10 have been observed in discharge waters in the study area (BLM 2003b). Once water discharges have peaked and subsequently decrease in the long term, the extent of wetlands and riparian areas and species diversity would decrease accordingly. After the complete cessation of water discharges, artificially-created wetland and riparian areas once again would support upland species and previously existing wetland and riparian areas would decrease in areal extent.

4.2.8 Wildlife and Fisheries

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts to wildlife as a result of projected development activities in the PRB Coal Review Task 3 study area. The area of habitat disturbance and reclamation related to surface coal mining for the baseline year (2003) and the projected cumulative areas of habitat disturbance and reclamation for 2010, 2015, and 2020 are shown in Tables 4-2 and 4-3. The baseline year area of total habitat disturbance and reclamation and the projected cumulative total areas of habitat disturbance and reclamation for 2010, 2015, and 2020 are shown in Table 4-9.

Impacts to wildlife can be classified as short-term and long-term. Potential short-term impacts arise from habitat disturbance associated with a project's

development and operation (e.g., coal mines, CBNG wells, etc.) and would cease upon project completion and successful reclamation in a given area. Potential long-term impacts consist of long-term or permanent changes to habitats and the wildlife populations that depend on those habitats, irrespective of reclamation success, and habitat disturbance related to longer term projects (e.g., power plant facilities, rail lines, etc.). Direct impacts to wildlife populations as a result of development activities in the study area could include direct mortalities, habitat loss or alteration, habitat fragmentation, or animal displacement. Indirect impacts could include increased noise, additional human presence, and the potential for increased vehicle-related mortalities.

Habitat fragmentation from activities such as roads, well pads, mines, pipelines, and electrical power lines also can result in the direct loss of potential wildlife habitat. Other habitat fragmentation effects such as increased noise, elevated human presence, dispersal of noxious and invasive weed species, and dust deposition from unpaved road traffic can extend beyond the surface disturbance boundaries. These effects result in overall changes in habitat quality, habitat loss, increased animal displacement, reductions in local wildlife populations, and changes in species composition. However, the severity of these effects on terrestrial wildlife would depend on factors such as sensitivity of the species, seasonal use, type and timing of project activities, and physical parameters (e.g., topography, cover, forage, and climate).

4.2.8.1 Game Species

Big game species that are present within the Task 3 study area include pronghorn, white-tailed deer, mule deer, and elk. Potential direct impacts to these species would include the incremental loss or alteration of potential forage and ground cover associated with construction and operation of the past, present and reasonably foreseeable future development discussed in Section 4.1. Development associated with coal mining, drilling for CBNG, ancillary facilities, agricultural operations, urban areas, and transportation and utility corridors result in vegetation removal. Assuming that adjacent habitats would be at or near carrying capacity and considering the variabilities associated with drought conditions and human activities in the study area, the PRB Coal Review Task 3D study concluded that displacement of wildlife species (e.g., big game) as a result of development activities would create some unquantifiable reduction in wildlife populations.

There are a number of big game habitat ranges within the PRB Coal Review Task 3 study area. In Wyoming, the WGFD and the BLM have established habitat classifications based on seasonal use. Classification types include crucial winter, severe winter, winter yearlong, and yearlong. Crucial winter range areas are considered essential in determining a game population's ability to maintain itself at a certain level over the long term. As discussed in the PRB Coal Review Task 2 Report, discrete locations for most of the disturbance related to the projected development could not be determined based on the available information. However, identified future coal reserves were used for the Task 3D

Report to provide some level of quantification of potential future impacts to big game ranges. Tables 4-20 through 4-23 summarize the effects on pronghorn, deer, and elk game ranges as a result of the predicted lower and upper levels of coal production through 2020.

Direct and indirect effects to small game species (i.e., upland game birds, waterfowl, small game mammals) within the Task 3 study area as a result of development activities would be the same as discussed above for big game species. Impacts would result from the incremental surface disturbance of potential wildlife habitat, increased noise levels and human presence, dispersal of noxious and invasive weed species, and dust effects from unpaved road traffic.

Table 4-20. Potential Cumulative Disturbance to Pronghorn Ranges from Development Activities—Lower and Upper Coal Production Scenarios (acres/percent affected).

Time Period/Scenario	Pronghorn Ranges[1]			
	Crucial Winter	Severe Winter	Winter Yearlong	Yearlong
2010/Lower	N/A	1,472 / 3%	33,196 / 2%	32,099 / 1%
2010/Upper	N/A	1,472 / 3%	34,760 / 2%	33,172 / 1%
2015/Lower	N/A	1,460 / 3%	32,649 / 2%	34,828 / 1%
2015 Upper	N/A	1,460 / 3%	34,177 / 2%	36,999 / 1%
2020/Lower	N/A	1,422 / 3%	33,637 / 2%	35,714 / 1%
2020/Upper	N/A	1,422 / 3%	33,580 / 2%	37,437 / 2%

1 Potential coal mine related impacts to big game ranges were determined based on GIS information as follows: the total acres of a big game range (e.g., crucial winter, severe winter, winter yearlong, and yearlong) within the PRB Coal Review Task 3 study area was divided by the sum of the potential disturbance acreage for the time period (based on GIS mapping of coal reserves for the lower coal production scenario) and existing (2003) disturbance from coal mine development.

Source: PRB Coal Review Task 3D Report (BLM 2005f)

Table 4-21. Potential Cumulative Disturbance to White-tailed Deer Ranges from Development Activities—Lower and Upper Coal Production Scenarios (acres/percent affected).

Time Period/Scenario	White-tailed Deer Ranges[1]			
	Crucial Winter	Severe Winter	Winter Yearlong	Yearlong
2010/Lower	N/A	N/A	N/A	1,411 / 0.6%
2010/Upper	N/A	N/A	N/A	1,411 / 0.6%
2015/Lower	N/A	N/A	N/A	1,497 / 0.7%
2015 Upper	N/A	N/A	N/A	1,495 / 0.7%
2020/Lower	N/A	N/A	N/A	1,704 / 0.7%
2020/Upper	N/A	N/A	N/A	1,707 / 0.8%

1 Potential coal mine-related impacts to big game ranges were determined based on GIS information as follows: the total acres of a big game range (e.g., crucial winter, severe winter, winter yearlong, and yearlong) within the PRB Coal Review Task 3 study area was divided by the sum of the potential disturbance acreage for the time period (based on GIS mapping of coal reserves for the lower coal production scenario) and existing (2003) disturbance from coal mine development.

Source: PRB Coal Review Task 3D Report (BLM 2005f)

Operations associated with development activities in the Task 3 study area would result in the use of groundwater. The PRB Coal Review assumes that

most, if not all, of the coal mine-produced water would be consumed during operation and projects that up to approximately 39,108, 41,484, and 37,350 mmgpy of water would be produced in association with oil and gas production in 2010, 2015, and 2020, respectively. The portion of the water that is produced in association with the CBNG and discharged to impoundments or intermittent and ephemeral streams would be available for area wildlife (e.g., waterfowl). Although much of the water would evaporate or infiltrate into the ground, it is anticipated that substantial quantities of water would remain on the surface and would result in the expansion of wetlands, stock ponds, and reservoirs, potentially increasing waterfowl breeding and foraging habitats. The median sodium concentration of CBNG-produced water from the Fort Union Formation is 270 mg/L. If sodium concentrations are maintained below 17,000 mg/L in the evaporation ponds, the potential adverse effects to waterfowl would be minimal.

Table 4-22. Potential Cumulative Disturbance to Mule Deer Ranges from Development Activities—Lower and Upper Coal Production Scenarios (acres/percent affected).

Time Period/Scenario	Mule Deer Ranges[1]			
	Crucial Winter	Severe Winter	Winter Yearlong	Yearlong
2010/Lower	N/A	N/A	6,808 / 0.4%	25,390 / 1%
2010/Upper	N/A	N/A	6,924 / 0.4%	26,641 / 1%
2015/Lower	N/A	N/A	6,956 / 0.4%	26,420 / 1%
2015 Upper	N/A	N/A	7,285 / 0.5%	27,205 / 1%
2020/Lower	N/A	N/A	6,958 / 0.4%	27,004 / 1%
2020/Upper	N/A	N/A	7,413 / 0.5%	27,990 / 1%

1 Potential coal mine-related impacts to big game ranges were determined based on GIS information as follows: the total acres of a big game range (e.g., crucial winter, severe winter, winter yearlong, and yearlong) within the PRB Coal Review Task 3 study area was divided by the sum of the potential disturbance acreage for the time period (based on GIS mapping of coal reserves for the lower coal production scenario) and existing (2003) disturbance from coal mine development.

Source: PRB Coal Review Task 3D Report (BLM 2005f)

Table 4-23. Potential Cumulative Disturbance to Elk Ranges from Development Activities—Lower and Upper Coal Production Scenarios (acres/percent affected).

Time Period/Scenario	Elk Ranges[1]			
	Crucial Winter	Severe Winter	Winter Yearlong	Yearlong
2010/Lower	24 / 0.4%	N/A	375 / 1%	1,444 / 0.9%
2010/Upper	24 / 0.4%	N/A	375 / 1%	1,444 / 0.9%
2015/Lower	24 / 0.4%	N/A	351 / 1%	1,161 / 0.7%
2015 Upper	24 / 0.4%	N/A	351 / 1%	1,162 / 0.7%
2020/Lower	24 / 0.4%	N/A	351 / 1%	1,121 / 0.7%
2020/Upper	24 / 0.4%	N/A	351 / 1%	1,168 / 0.7%

1 Potential coal mine-related impacts to big game ranges were determined based on GIS information as follows: the total acres of a big game range (e.g., crucial winter, severe winter, winter yearlong, and yearlong) within the PRB Coal Review Task 3 study area was divided by the sum of the potential disturbance acreage for the time period (based on GIS mapping of coal reserves for the lower coal production scenario) and existing (2003) disturbance from coal mine development.

Source: PRB Coal Review Task 3D Report (BLM 2005f)

4.2.8.2 Non-game Species

Potential direct impacts to non-game species (e.g., small mammals, raptors, passerines, amphibians, and reptiles) would include the incremental loss or alteration of existing or potential foraging and breeding habitats from construction and operation of past, present and reasonably foreseeable future development activities (e.g., vegetation removal for coal mines and CBNG wells, ancillary facilities, and transportation and utility corridors). Impacts also could result in mortalities of less mobile species (e.g., small mammals, reptiles, amphibians, and invertebrates), nest or burrow abandonment, and loss of eggs or young in the path of vehicles and heavy equipment. Indirect impacts would include increased noise levels and human presence, dispersal and invasion of noxious weeds, and dust effects from unpaved road traffic. Assuming that adjacent habitats would be at or near carrying capacity, and considering variable factors such as drought conditions and human activities in the study area, the PRB Coal Review concluded that displacement of wildlife species from the Task 3 study area would result in an unquantifiable reduction in wildlife populations.

Numerous migratory bird species have been documented within the PRB over the last two to three decades of wildlife monitoring. Development activities that occur during the migratory bird breeding season (April 1 through July 31) could cause the abandonment of a nest site or territory or the loss of eggs or young, resulting in the loss of productivity for the breeding season. Loss of an active nest site, incubating adults, eggs, or young would not comply with the intent of the Migratory Bird Treaty Act and could potentially affect populations of important migratory bird species that may occur in the PRB.

Breeding raptor species that occur within the Task 3 study area include the bald eagle, golden eagle, ferruginous hawk, red-tailed hawk, rough-legged hawk, Swainson's hawk, American kestrel, prairie falcon, northern harrier, great horned owl, short-eared owl, burrowing owl, and long-eared owl (*Asio otus*). Bald eagles and long-eared owls are rare nesters in the area.

One potential direct impact to raptors is habitat (nesting and foraging) loss due to additional surface disturbance within the Task 3 study area. In the event that development activities were to occur during the breeding season (February 1 through July 31), these activities could result in nest or territory abandonment, or loss of eggs or young. Such losses would reduce productivity for the affected species during that breeding season. As discussed above, loss of an active nest site, incubating adults, eggs, or young would not comply with the intent of several laws, including the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Additional direct impacts could result from construction of new overhead power lines in the region. New power line segments in the study area would incrementally increase the collision and/or electrocution potential for migrating and foraging bird species (e.g., raptors and waterfowl) (APLIC 1994). However,

the potential for avian collisions with overhead power lines is typically dependent on variables such as the location of the structures relative to high-use areas (e.g., nesting, foraging, staging, and roosting habitats), the orientation of the power line to flight patterns and movement corridors, species composition, line visibility, and structure design.

In addition, new power lines could pose an electrocution hazard for raptor species attempting to perch on the structure. Configurations less than 1 kV or greater than 69 kV typically do not present an electrocution potential, based on conductor placement and orientation (APLIC 1996). It is assumed that future permitting for power lines would require the use of appropriate raptor-deterring designs, thereby minimizing potential impacts. For example, SMCRA requires that surface coal mine operators use the best technology available to ensure that electric power lines are designed and constructed to minimize electrocution hazards to raptors. Power line impacts to raptors can be reduced with the increased use of underground power lines wherever possible. Many of the power lines for CBNG development currently are being constructed underground.

4.2.8.3 Fisheries

Potential cumulative effects on fisheries as a result of development activities in the Task 3 study area would be closely related to impacts on ground and surface water resources. In general, development activities could affect fish species in the following ways: 1) alteration or loss of habitat as a result of surface disturbance; 2) changes in water quality as a result of surface disturbance or introduction of contaminants into drainages; and 3) changes in available habitat as a result of water withdrawals or discharge. The potential effects of development activities on aquatic communities are discussed below for each of these impact topics.

The predominant aquatic habitat type in the Task 3 study area consists of intermittent and ephemeral streams and scattered ponds and reservoirs. In general, perennial streams within the study area are limited to the Little Powder River and Belle Fourche River. Warm water game fish and non-game species are present in some perennial stream segments and numerous scattered reservoirs and ponds. However, the latter features are typically stocked artificially either following construction or annually, depending on the depth of the water body. Due to the lack of constant water in most of the potentially affected streams and static water bodies, existing aquatic communities are mainly limited to invertebrates and algae that can persist in these types of habitats. The removal of stock ponds would eliminate habitat for invertebrates and possibly fish species. This loss would be temporary if the stock ponds are replaced during reclamation.

Development activities could result in the loss of aquatic habitat as a result of direct surface disturbance. Table 4-9 summarizes the cumulative acres of surface disturbance and reclamation as of 2003 and projects cumulative acres of surface disturbance and reclamation in 2010, 2015, and 2020. Discrete

locations for development disturbance and reclamation areas cannot be determined based on existing information. However, projected development that could result in the loss of aquatic habitat would involve the construction of additional linear facilities, product gathering lines and road systems associated with conventional oil and gas and CBNG activities, as well as any additional disturbance that would be associated with extending coal mine operations onto lands adjacent to the existing mines. The removal of aquatic habitat eliminates existing and potential habitat for invertebrates and some fish species. This loss would be temporary if such ponds are reconstructed and recharged as part of the reclamation process.

Projected activities would result in surface disturbance in each of the six Task 3 study area sub-watersheds. Information relative to the stream crossing locations for the majority of the linear facilities is not available at this time. The proposed Bison Pipeline project is not currently active. If the project is constructed, it would cross Cottonwood Creek, a tributary of the Little Powder River. Typically, the associated disturbance corridor would consist of a 100-foot-wide construction ROW; however, site-specific stream crossing methods and reclamation would be determined at the time of project permitting.

Future coal mining also could remove intermittent or ephemeral streams and stock ponds in the Antelope Creek, Upper Cheyenne River, Upper Belle Fourche River, and Little Powder River sub-watersheds. Coal mine permits provide for removal of first- through fourth-order drainages. During reclamation, third- and fourth-order drainages must be restored; first- and second-order drainages often are not replaced (Martin et al. 1988). As discussed in Section 3.5.2, Antelope Creek and its tributaries drain the existing Antelope Mine permit area and the West Antelope II LBA tract. All streams within and adjacent to the tract are typical for the region, in that flow events are ephemeral. Under natural conditions, aquatic habitat is limited by the ephemeral nature of surface waters in the general analysis area. The results of fish surveys conducted in Antelope Creek and Horse Creek during baseline studies for the Antelope Mine in the late 1970s and in 1998 were discussed in Section 3.10.7.1; no uncommon species were documented during those efforts.

The PRB Coal Review assumes that surface disturbing activities would not be allowed in perennial stream segments or reservoirs on public lands that contain game fish species. It also assumes that other types of development operations would not occur within stream channels nor would they remove ponds or reservoirs as part of construction or operation and, therefore, would not result in the direct loss of habitat for these species.

Water quality parameters such as turbidity and bottom substrate composition can be impacted by surface disturbing activities through erosion of sediment into water bodies. Contaminants can also be introduced into those systems through the chemical characteristics of the eroded sediment. Potential related effects on aquatic biota could include physiological stress, movement to avoid affected areas, or alterations of spawning or rearing areas (Waters 1995).

Studies have shown that TDS levels in streams near reclaimed coal lands have increased from one percent to seven percent (Martin et al. 1988). Typically, sedimentation effects are short-term in duration and localized in terms of the affected area. TDS concentrations would stabilize and return to more typical concentrations after construction or development activities have been completed. The PRB Coal Review anticipated that the use of appropriate erosion and spill control measures during both development and reclamation activities, as determined during the permitting process, would minimize the introduction of additional sediments into the sub-watershed.

The removal of streamside vegetation would impact both riparian vegetation and stream parameters in those locations. Loss of vegetation along stream channels would reduce the shade and increase bank erosion, both of which would degrade aquatic habitats. Effects on aquatic habitats from linear projects, such as ROWs, would be limited to a relatively small portion of the stream (generally no more than 100 feet in width), whereas mine-related disturbance could affect considerably larger stretches. Because perennial streams are protected from development by a buffer zone on either side of center, these types of impacts would presumably be limited to intermittent and ephemeral creeks. It is anticipated that reclamation practices to restore riparian vegetation would be required during future project permitting, thereby minimizing such impacts.

CBNG and coal mining are the primary types of development activities that use or manage water as part of their operations. Based on current trends, the PRB Coal Review assumes that most, if not all, of the water produced during coal mining would be consumed during operation. As discussed in Section 3.5.2.2, changes in surface runoff characteristics and sediment discharges would occur during surface coal mining as a result of the destruction and reconstruction of drainage channels as mining progresses, and the use of sediment control structures to manage discharges of surface water from the mine permit area. State and federal regulations require treatment of surface runoff from mined lands to meet effluent standards. After treatment, coal mine-related surface water in the region would ultimately be discharged into intermittent and ephemeral streams in four sub-watersheds (Antelope Creek, Upper Cheyenne River, Belle Fourche River, and Little Powder River). The PRB Coal Review projects that up to approximately 39,108, 41,484, and 37,350 mmgpy of water would be produced in association with oil and gas production in 2010, 2015, and 2020, respectively, and assumes that a portion of the water that is produced in association with the CBNG would be discharged to intermittent and ephemeral drainages in the general analysis area, much as is currently allowed in the six sub-watersheds in the study area. Based on past monitoring in receiving streams, no change in surface flows would be expected beyond approximately two miles from the discharge points (BLM 2003b). Water discharged from CBNG wells has supplied some drainages and water bodies in the PRB nearly continuously for several years. Within the general analysis area, Spring Creek has experienced an influx of CBNG water in recent years, but has not become perennial. The same is true for other streams elsewhere in the PRB that receive CBNG discharge water.

4.2.8.4 Special Status Species

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed and federally proposed species (species that are protected under the ESA), BLM Sensitive Species, USDA-FS Sensitive Species, and WGFD Species of Special Concern in Wyoming. Further discussions of species that are protected under the ESA, as well as BLM and USDA-FS Sensitive Species, are included in Appendices H and I of this EIS document. The USFWS also has a list of Migratory Bird Species of Management Concern in Wyoming, which is discussed in Section 3.10.6. Special status species potentially occurring in the Task 1 study area are identified in Section 2.4.3.5 of the PRB Coal Review Task 1D Report (BLM 2005c). Additional information about the occurrence of these species in the general analysis area can be found in the Annual Wildlife Reports for the Antelope Mine, on file with the Cheyenne, Wyoming office of the WDEQ/LQD.

Potential impacts to special status terrestrial species would be similar to those discussed above for non-game wildlife (e.g., small mammals, birds, amphibians, and reptiles). Potential direct impacts would include the incremental loss or alteration of potential habitat (native vegetation and previously disturbed vegetation) from construction and operation of development activities (e.g., vegetation removal for coal mines and CBNG wells, ancillary facilities, and transportation and utility corridors). Impacts could also result in mortalities of less mobile species (e.g., small mammals, reptiles, and amphibians), nest or burrow abandonment, and loss of eggs or young in the path of vehicles and heavy equipment. Indirect impacts would include increased noise levels and human presence, introduction and dispersal of noxious weeds, and dust effects from unpaved road traffic.

In general, direct and indirect impacts to special status species would result in a reduction in habitat suitability and overall carrying capacity for species currently inhabiting the PRB Coal Review Task 3 study area. Development within potential habitat for special status species likely would decrease its overall suitability, and potentially would reduce or preclude use by some species due to increased activity and noise. Future use by a special status species of habitats subject to development would be strongly influenced by the quality and composition of remaining habitat, with the degree of impact dependent on variables such as breeding phenology, nest and den site preferences, the species' relative sensitivity to disturbance, and possibly the presence of visual barriers (e.g., topographic shielding) between nesting efforts and disturbance activities.

Bird species that have been identified as occurring within the PRB and are on two or more of the special status species lists include common loon, American bittern, white-faced ibis, trumpeter swan, greater sandhill crane, mountain plover, upland sandpiper, long-billed curlew, black tern, yellow-billed cuckoo, Lewis' woodpecker, pygmy nuthatch, sage thrasher, loggerhead shrike, Baird's sparrow, sage sparrow, Brewers sparrow, and greater sage-grouse. Any

development activities (oil and gas, coal mining, other operations and associated infrastructure) that occur during the breeding season (April 1 through July 31) could result in the abandonment of a nest site or territory, or the loss of eggs or young. As discussed previously, loss of an active nest site, incubating adults, eggs, or young as a result of any of these development activities would not comply with the intent of the Migratory Bird Treaty Act and could potentially impact populations of important migratory bird species that are known to or may occur in the PRB.

A number of raptor species have been documented in the PRB and are on two of more of the special status species lists including bald eagle, ferruginous hawk, northern goshawk, merlin, peregrine falcon, western burrowing owl, and short-eared owl. Those species that have been documented in the West Antelope II LBA general analysis area are discussed at length in Appendices H and I of this EIS. Potential direct impacts to raptors would result from the surface disturbance of nesting and foraging habitat, as well as injury or mortalities due to collisions with vehicles and equipment. Breeding raptors in or adjacent to development activities could abandon their nest sites or territories, or lose eggs or young. As previously described, such losses would constitute non-compliance with the intent of several laws including the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act, and could potentially affect populations of important migratory bird species that are known to or may occur within the region. Incremental construction of new overhead power lines in the area to support energy industries would increase risks of electrocution and collision for perching, migrating, and foraging bird species such as the larger raptors. Use of current APLIC guidelines for construction designs and retrofitting measures for new and existing utility structures would help mitigate these impacts.

A total of 239 greater sage-grouse strutting grounds (leks) were identified in the six sub-watersheds in the PRB Coal Review Task 3 study area as of 2003, though that study did not evaluate the status (i.e., active or inactive) of those leks. As discussed in Section 3.10.5 and in the PRB Coal Review Task 1D Report, the trend in the sage-grouse population for the Sheridan Region suggests about a 10-year cycle with periodic highs and lows. More recent population peaks have been lower than previous highs, suggesting a steadily declining sage-grouse population with the Sheridan Region (Oedekoven 2001). Direct and indirect impacts to sage-grouse as a result of development activities would result from the incremental surface disturbance of existing and potential habitat, increased levels of noise and human presence, introduction or dispersal of noxious and invasive weed species, and effects of dust from increased traffic on unpaved roads. In addition to disturbance-related impacts, sage-grouse are susceptible to infection with West Nile Virus, and the incidence of infection is much higher in northeastern Wyoming than the rest of the state.

No sage-grouse leks occur within five miles of the West Antelope II LBA tract; both suitable habitat and sightings for that species are quite limited or rare, respectively, for that area. Direct and indirect effects to greater sage-grouse

within the West Antelope II general analysis area as a result of development activities are outlined in Appendix H of this EIS.

Based on existing information, the spatial relationship between projected future disturbance and reclamation areas for the coal production scenarios and the resource-specific information in the GIS layers could not be determined for the PRB Coal Review. However, the analysis did use GIS layers for future coal reserves to provide some quantification of potential future coal mining-related impacts to greater sage-grouse. The results of this analysis are summarized in Table 4-24. The difference in the number of lek sites that would occur within two miles of coal mining activities under the lower coal production scenario versus the upper coal production scenario is due to slight variations in the projected disturbance areas. An unquantifiable number of lek sites initially could be impacted by CBNG activity, which would occur in advance of coal mine development. Potential direct impacts to sage-grouse, if present, could include loss of foraging areas, abandonment of a lek site, or loss of eggs or young as a result of development activities.

Table 4-24. Potential Cumulative Impacts to Greater Sage-grouse Leks from Coal Mine Development - Upper and Lower Coal Production Scenarios.

Lek Categories	**2010/ Lower**	**2010/ Upper**	**2015/ Lower**	**2015/ Upper**	**2020/ Lower**	**2020/ Upper**
Number of Directly Affected Leks	10	10	15	15	15	15
Number of Leks within Two Miles of Coal Mining Activity	47	47	47	49	50	49

Source: PRB Coal Review Task 3D Report (BLM 2005f)

Seven special status fish species potentially occur in the PRB Coal Review Task 3 study area sub-watersheds: the flathead chub (*Platygobio gracilis*) (Antelope Creek, Upper Cheyenne River, and Little Powder River sub-watersheds), plains topminnow (*Fundulus sciadicus*) (Upper Cheyenne River), goldeye (*Hiodon alosoides*) (Little Powder River), lake chub (*Couesius plumbeus*) (Little Powder River), mountain sucker (*Catostomus platyrhynchus*) (Little Powder River), silvery minnow (*Hybognathus argyritis*) (Little Powder River), and plains minnow (Upper Cheyenne River, Upper Belle Fourche River, and Little Powder River). Potential impacts to special status fish species as a result of development activities would be similar to effects discussed above for fisheries. Surface disturbance in three sub-watersheds (Upper Cheyenne River, Upper Belle Fourche River, Little Powder River) could alter habitat or affect water quality conditions for special status fish species. Erosion control measures, as required by existing (2003) and future permits, and NPDES permit requirements would be implemented for each project. These efforts would help decrease disturbance-related sediment input into stream segments that may contain one or more of the special status fish species. Therefore, it is anticipated that impacts to special status fish species would be low.

4.2.9 Land Use and Recreation

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts to land use and recreation as a result of projected development activities in the PRB Coal Review Task 3 study area (Figure 4-4). The baseline year (2003) area of disturbance and reclamation related to surface coal mining and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in Tables 4-2 and 4-3. Table 4-9 shows the total area of disturbance and reclamation for the baseline year and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020.

The PRB is a predominantly rural, wide open landscape. With little rainfall and limited alternative sources of water, the primary land use is grazing. Nevertheless, there is a range of other land uses. The major categories include agriculture, forested, mixed rangeland, urban, water, wetlands, coal mines, and barren land. The relative amounts of these lands in the PRB Coal Review Task 1 and Task 2 study area (Figure 4-1) is tabulated in Table 4-25.

Table 4-25. Land Use by Surface Ownership.

	Surface Ownership				Total	
Use Category	**BLM**	**USDA-FS**	**State**	**Private**	**Acres**	**Percent**
Agriculture	2,627	14,197	13,770	472,811	503,405	6.3
Barren	165	205	187	9,396	9,953	0.1
Forested	137,555	14,604	48,645	332,062	532,866	6.7
Mixed Rangeland	732,014	218,156	561,363	5,271,644	6,783,177	86.0
Urban	893	17	1,039	25,469	27,418	0.3
Water	35	73	334	4,773	5,215	<0.1
Wetlands	0	104	559	1,566	2,229	<0.1
Coal Mines	149	7,236	2,805	40,917	51,107	0.6
Total	**873,438**	**254,592**	**628,702**	**6,158,638**	**7,915,370**	**100.0**

Source: PRB Coal Review Task 1D Report (BLM 2005c)

A large part of the PRB consists of split estate lands (privately owned surface lands underlain by federally owned minerals). This results in conflicts between surface users, which are mainly ranching interests, and mineral developers. There also may be conflicts with some dispersed rural residences, although specific locations cannot be identified until development is proposed.

Much of the study area is also used for dispersed recreational activities such as hunting. The study area includes surface lands that are federally, state, and privately owned. With nearly 80 percent of the area privately owned, public lands provide important open space and recreation resources including both developed recreation facilities and areas to pursue dispersed recreation activities. The private sector contributes the elements of commercial recreation opportunities and tourism services such as motels and restaurants. Some private land owners also allow hunting with specific permission, sometimes for a fee.

4.2.9.1 Grazing and Agriculture

Potential impacts to grazing in the Task 3 study area as a result of development activities can be classified as short-term and long- term. Potential short-term impacts arise from:

- the temporary loss of forage as a result of vegetation removal/ disturbance;
- temporary loss of AUMs;
- temporary loss of water-related range improvements, such as improved springs, water pipelines, and stock ponds;
- temporary loss of other range improvements, such as fences and cattle guards; and
- restricted movement of livestock within an allotment due to the development and operation of projects like surface coal mines, which would cease after successful reclamation had been achieved and replacement of water-related and other range improvements had been completed.

The discharge of produced water could increase the availability of water to livestock, which may offset the temporary loss of water-related range improvements. Potential long-term impacts consist of permanent loss of forage and forage productivity in areas, such as power plants, that would not be reclaimed in the near term. Indirect impacts may include dispersal of noxious and invasive weed species within and beyond the surface disturbance boundaries, which decreases the amount of desirable forage available for livestock grazing in the long term.

Development activities could result in short- and long-term impacts to agricultural land, depending on their spatial relationship. Short-term impacts would include the loss of crop production during development and operational phases of the projects. Long-term impacts would result from the permanent loss of agricultural land due the development of permanent facilities such as power plants and railroads.

Table 4-26 contains an estimate of the number of AUMs unavailable on lands disturbed and not yet reclaimed through 2020 for the high and low levels of predicted development activity, along with the acreage of cropland estimated to be affected.

4.2.9.2 Urban Use

It is expected that there would be additional expansion of urban residential and commercial development as a result of the projected 48 percent growth in population (between 2003 and 2020) in Campbell County. Section 4.2.12 and the Task 3C Report of the PRB Coal Review (BLM 2005e) contain additional information on employment and population issues in the study area. A majority of the new urban development would be expected to occur adjacent to existing

communities, primarily Gillette, which accounts for approximately 60 percent of the Campbell County population and, to a lesser extent, Wright and other small communities. Most of this development would occur on land that is currently in use for grazing or agriculture.

Table 4-26. AUMs and Acres of Cropland Estimated Unavailable on Lands Disturbed and Not Yet Reclaimed as a Result of Development Activities.

Category	2003/ Baseline	2010/ Lower	2010/ Upper	2015/ Lower	2015/ Upper	2020/ Lower	2020/ Upper
Unavailable AUMs[1]	18,150	22,467	22,792	23,245	23,761	22,514	23,333
Unavailable Crop Land (acres)	48	59	60	134	139	206	289

[1] Based on an average stocking rate of six acres per AUM.
Source: PRB Coal Review Task 3D Report (BLM 2005f)

4.2.9.3 Recreation

Accessible public lands provide diverse opportunities for recreation, including hunting, fishing, ORV use, sightseeing, and wildlife observation. Public lands generally provide dispersed recreational uses in the study area. Some developed recreational facilities occur in special management areas, including recreation areas. While opportunities are available on public lands throughout the PRB, the majority of dispersed recreational uses occur in the western part of the PRB Coal Review Task 1 and Task 2 study area, including the South Big Horn Mountains area and along the Powder River. Public lands elsewhere consist mainly of isolated tracts of land that are too small to provide a quality recreational experience. Larger parcels of public lands occur in the southwest part of Johnson County and along the Powder River (administered by BLM) and in the Thunder Basin National Grassland (administered by the USDA-FS). Public lands are accessible via public roads or across private land with the landowner's permission.

Hunting is a major recreation use of state and federal lands in the study area. Various big game and upland game bird species are hunted in the region. Fishing is a popular year-round activity for residents of the study area.

Mule deer and pronghorn hunting are by far the most popular hunting activities in the Task 1 study area, accounting for 35,529 and 21,304 hunter days, respectively, in 2003 (Stratham 2005). The next highest were cottontail rabbit (2,348 hunter days) and elk (2,055 hunter days), followed by wild turkey (1,019), sharp-tailed grouse (508), and sage-grouse (38). Consistent trends in hunter activity over the past decade are not discernible from the WGFD data considered in the PRB Coal Review. All of the most prominent species hunted in the study area have had high years and low years. Pronghorn hunting, for example, was greatest from 1993 to 1996, while elk hunting was at its peak in 2001 and 2002. Mule deer hunting has been the most consistent, ranging from a low of 28,311 hunter days in 1996 to a high of 37,307 hunter days in 2002.

ORV use in the Task 1 study area is available on most BLM-managed lands. Most of the public land in Johnson, Sheridan, and Campbell Counties has been inventoried and designated as open, limited, or closed to ORV use. For the baseline year, approximately 20,386 acres were open to unlimited vehicle travel on and off roads. There were 4,680 acres in the area that were closed to all ORV use and approximately 867,534 acres were available for limited use. Limited use typically means ORVs are restricted to existing roads and vehicle routes.

Recreational use of public lands in the Task 1 study area has increased substantially over the past two decades, and is expected to continue to increase by about five percent every five years for most recreational activities (BLM 2003b). Total visitor use by residents and nonresident visitors in Campbell and Converse Counties in 1980 was projected at 1,276,000 visitor days (BLM 1979). The total visitor days of 1,881,763 estimated for 1990 was approximately 47 percent higher than the 1980 visitor days (BLM 2001b). Fewer than three percent of visitor days were estimated to occur on public lands.

Few, if any, of the developed recreation sites in the PRB Coal Review Task 3 study area would be affected by development related disturbance. As most of the projected disturbance area would occur on privately owned surface land, the extent of effects on dispersed recreation activities largely would depend on whether the disturbance areas had been open to public or private lease hunting. It is projected that cumulative development activities, especially the dispersed development of CBNG and, to a lesser extent, conventional oil and gas, would tend to exacerbate the trend toward a reduction in private land available for public hunting, which has been observed by WGFD in recent years (Shorma 2005). A reduction in available private land for dispersed recreation would contrast with the anticipated increase in demand for recreational opportunities and would tend to push more recreationists toward public lands where the BLM has projected a five percent increase in use every five years (BLM 2001a). After coal- and oil and gas-related development activities have been completed and the disturbed areas have been reclaimed, many of the adverse effects on dispersed recreation activities would be reduced.

It is expected that the development activities also would tend to expand and exacerbate the qualitative degradation of the dispersed recreation experience, in general, and of the hunting experience, in particular, as reported by the WGFD (Jahnke 2005). As noted in the Task 1D Report of the PRB Coal Review (BLM 2005c), reductions in land available for hunting also make herd management more difficult for the WGFD and reduce its hunting-derived revenues (Shorma 2005).

No direct effects on wilderness or roadless areas would be expected from the projected development activities. There are no designated wilderness areas in the study area, and mineral development would not be permitted in the Fortification Creek Wilderness Study Area until and unless Congress acts to remove it from Wilderness consideration.

There would be no effects on Wild and Scenic Rivers as the only river segment identified as both "eligible" and "suitable" in the Task 1D Report of the PRB Coal Review is not in the PRB Coal Review Task 3 study area.

4.2.10 Cultural Resources and Native American Concerns

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts to cultural resources as a result of projected development activities in the PRB Coal Review Task 3 study area. The baseline year (2003) area of disturbance and reclamation related to surface coal mining and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in Tables 4-2 and 4-3. Table 4-9 shows the total area of disturbance and reclamation for the baseline year and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020.

Cultural sites occur throughout the study area. Surface disturbing activities can result in the loss or destruction of these sites. Table 4-27 contains an estimate of the amount of projected disturbance through 2020 for the projected lower and upper levels of coal development activity, along with the number of cultural sites estimated to be affected. The sites fall into two categories; prehistoric sites and historic sites, as described below. Also below are a description of Native American traditional cultural places and a summary of the program to protect sites in any of these categories.

4.2.10.1 Prehistoric Sites

All recognized prehistoric cultural periods, from Clovis through Protohistoric (about 11,500 to 200 years ago), are represented in the PRB Coal Review study area (see Section 3.12 for additional discussion about the prehistoric cultural periods.) The earliest prehistoric cultural periods, Paleoindian through Early Plains Archaic, are represented by only a small number of sites. Archaic and later prehistoric period sites (Archaic to Protohistoric) are represented in increasing numbers as a result of higher populations through time and better preservation of more recent sites. Important prehistoric site types in the region include artifact scatters, campsites, stone circles, faunal kill and processing sites, rock alignments and cairns, and stone material procurement areas.

Artifact scatters dominate prehistoric sites in the study area. When there is adequate information to evaluate these types of sites, most are not eligible to the NRHP. However, complex sites and sites with buried and dateable material can yield important information and are often field evaluated as eligible. The proportion of unevaluated sites is lower in the subwatersheds in which more studies and more follow-up studies have been conducted, such as Antelope Creek, Upper Cheyenne River, and Upper Belle Fourche River. Some portions of some of the subwatersheds which have more varied habitats or conditions more conducive to preservation are very rich in significant prehistoric sites. Within the PRB Coal Review Task 3 study area, these areas include the lower Antelope Creek drainage and eastern portions of the Upper Belle Fourche River. Within

Table 4-27. Square Miles of Projected Cumulative Disturbance and Number of Potentially Affected Cultural Resource Sites in the PRB Coal Review Task 3 Study Area – Lower and Upper Coal Production Scenarios.

		Lower Coal Production Scenario						Upper Coal Production Scenario					
		Year 2010		Year 2015		Year 2020		Year 2010		Year 2015		Year 2020	
Sub-watershed	**Average Number of Sites per Square Mile[1]**	**Square Miles[2]**	**Sites[3]**	**Square Miles[2]**	**Sites[3]**	**Square Miles[2]**	**Sites[3]**	**Square Miles[2]**	**Sites[3]**	**Square Miles[2]**	**Sites[3]**	**Square Miles[2]**	**Sites[3]**
Antelope Creek	4.7	74	346	97	484	122	608	75	376	99	496	126	629
Dry Fork Cheyenne River	8.9	8.3	74	12	109	17	151	8.3	74	12	109	17	151
Little Powder River	4.6	90	415	108	495	123	567	91	419	109	502	125	577
Upper Belle Fourche River	4.3	164	704	186	801	209	899	166	713	192	824	219	940
Upper Cheyenne River	5.2	60	314	72	375	83	433	62	321	74	387	85	445
Upper Powder River	5.0	135	674	190	953	232	1,159	135	674	191	953	232	1,159
Total		**531**	**2,527**	**665**	**3,217**	**786**	**3,817**	**537**	**2,577**	**677**	**3,271**	**804**	**3,901**

1 Average number of sites per square mile based on previous surveys in the study area.
2 Calculated, based on database disturbance acreages prepared for the Task 2 Report for the PRB Coal Review, Past and Present and Reasonably Foreseeable Development Activities (Appendices A and D) (BLM 2005d).
3 The number of sites was calculated by multiplying the average density of known cultural sites per square mile (based on previous surveys) by the number of square miles of projected cumulative disturbance.
Source: Task 3D Report for the PRB Coal Review Cumulative Environmental Effects (BLM 2005f)

the West Antelope II general analysis area, these areas include the developed terraces of Antelope Creek, Spring Creek and Horse Creek as well as some unnamed spring fed drainages. More detailed information on the known cultural sites that are present in the PRB based on the existing surveys is included in the Task 1D Report for the PRB Coal Review (BLM 2005c).

4.2.10.2 Historic Sites

In the PRB region, sites are documented within the broad contexts of Rural Settlement, Urban Settlement, Mining, Transportation, Military, Exploration, and Communication. Each of these site categories and the types of sites they include are detailed in the Task 1D Report for the PRB Coal Review (BLM 2005c). Evaluation of the importance of historic sites, districts, and landscapes must consider aspects of both theme and period in assessing the historic character and contributing attributes of the resources.

4.2.10.3 Native American Traditional Cultural Places

General ethnographies of the tribes that may have had traditional ties to this region do not provide information on specific resources in the study area that are likely to be traditional cultural concerns because these resources are considered confidential by the tribes. Within this region, there are prominent and identifiable places such as the Medicine Wheel to the west in the Big Horn Mountains and Devils Tower to the east in the Black Hills area. These known sites offer some indication of the types of places valued by the Plains horse cultures in the historic period. Any identification of sacred or traditional localities must be verified in consultation with authorized tribal representatives.

4.2.10.4 Site Protection

At the time an individual project is permitted, the development activities considered in this study would be subject to the following regulations relative to cultural resources. Section 106 of the National Historic Preservation Act of 1966 as amended, its implementing regulations (including but not limited to 36 CFR 800, 36 CFR 61, and Executive Order 11593), and NEPA and its implementing regulations, including 40 CFR 1500 - 1508, provide the legal environment for documentation, evaluation, and protection of historic properties (i.e., cultural resources eligible for inclusion on the NRHP) that may be affected by development activities. In cases of split estate (where surface ownership and mineral ownership differ), surface resources, such as cultural sites, belong to the surface owner. The surface owner must be consulted about investigation, mitigation, or monitoring.

4.2.11 Transportation and Utilities

The PRB Coal Review Task 3D Report (BLM 2005f) discusses potential cumulative impacts to transportation and utilities systems as a result of projected development activities in the PRB Coal Review Task 3 study area. The

baseline year (2003) area of disturbance and reclamation related to surface coal mining and the projected cumulative areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in Tables 4-2 and 4-3. The total area of disturbance and reclamation for the baseline year and the projected cumulative total areas of disturbance and reclamation for 2010, 2015, and 2020 are shown in Table 4-9.

Generally, transportation systems in the study area would not be directly affected by the disturbance associated with projected development. Site-specific instances of disturbance may require that segments of highways, pipelines, transmission lines, or railroads be moved to accommodate expansion of certain coal mines. In such cases, the agencies authorized to regulate such actions would have to approve any proposal to move any segments of any transportation systems and construction of alternative routing would be required prior to closing existing links so that any disruptive effects on transportation systems would be minimized.

The coal mines in the North Gillette subregion currently ship most of their coal via the east-west BNSF rail line through Gillette. That subregion produced 55 mmtpy in the baseline year (2003), which was just 22 percent of the estimated 250 mmtpy capacity of the BNSF rail line (BLM 2005f). The coal mines in the South Gillette and Wright subregions produced approximately 308 mmtpy in 2003, which was 88 percent of the estimated 350 mmtpy capacity of the joint BNSF & UP line serving those areas in the baseline year.

Potential effects of development activities on transportation and utilities may be either short- or long-term in nature, varying with the type of development. A power plant or an urban community development would be considered long-term, and the demand for transmission line capacity would be virtually permanent, lasting for the economic life of the activity. The effects of coal production and the related demand for rail capacity would vary with market changes. In recent years, coal production has been increasing and the PRB Coal Review projects that the trend would continue, as shown in Tables 4-2 and 4-3. Similarly, the demand for pipeline capacity would vary with market conditions as well as with the rate of depletion of the oil or gas resource.

Potential direct effects of projected development on roads and highways would include increased vehicular traffic and risk of traffic accidents on existing roadways in the PRB Coal Review Task 3 study area from daily travel by workers and their families. Indirect effects would include increased wear and tear on existing roads, additional air emissions from vehicles, additional fugitive dust from roads, noise, increased potential access to remote areas, and an increased risk of vehicle collisions with livestock and wildlife. Direct effects on railroads, pipelines, and transmission lines primarily would include increased demand for capacity to move coal, oil and gas, and electricity from production locations in the study area to markets outside the area.

The socioeconomic analysis conducted as a part of Task 3C of the PRB Coal Review projects a population increase of approximately 48 percent between 2003 and 2020 in Campbell County under the upper coal production scenario (BLM 2005e). Campbell County accounts for most of the population in the PRB Coal Review Task 3 study area. Based on traffic studies conducted independently of the PRB Coal Review, vehicle miles traveled tend to increase at or above the rate of population growth. Consequently, highway traffic would be expected to increase by at least 48 percent by 2020. Approximately 60 percent of the population growth would occur in or near Gillette, which would indicate that the same proportion of traffic would originate in the Gillette area. The remainder of the traffic growth would be dispersed throughout the study area. Under this scenario, the greatest impact on traffic would occur in the Gillette area, where existing traffic volume to capacity ratios are highest. The increased traffic would be expected to cause delays in the Gillette area and might require widening of some streets and roads or other measures to increase traffic capacity. It is anticipated that there would be an increase in the risk of traffic accidents approximately proportional to the increase in traffic. Highway capacity on major routes away from Gillette would be expected to be sufficient to accommodate the growth without substantial constraints.

Existing rail lines, together with proposed upgrades on the joint BNSF & UP line, would be expected to accommodate the projected coal transportation traffic through 2015 (Table 4-28). The PRB Coal Review Task 2 Report (BLM 2005d) projects that the proposed DM&E line would be built and operational by 2015 (pending completion of additional environmental analysis), which would add 100 mmtpy in additional shipping capacity for the South Gillette and Wright subregions.

Table 4-28. PRB Rail Lines Coal Hauling Capacity and Projected Use.

	2010 Projected			**2015 Projected**			**2020 Projected**		
Rail Line	**2010 Capacity**	**Rail Use Increase[1]**		**2015 Capacity**	**Rail Use Increase[1]**		**2020 Capacity**	**Rail Use Increase[1]**	
	mmtpy	**mmtpy**	**%**	**mmtpy**	**mmtpy**	**%**	**mmtpy**	**mmtpy**	**%**
North BNSF	250	62-78	25-31	250	74-104	30-42	250	78-121	31-48
South BNSF & UP	400	349-401	87-100	500	393-439[2]	79-88[2]	500	417-455[2]	83-91[2]
DM&E	0	0	0	-[2]	-[3]	-[3]	-[2]	-[3]	-[3]

[1] The range of increase in use shown for each year reflects the increases that are projected for the Lower and Upper Coal Production Scenarios, respectively.
[2] The DM&E is assumed to be built and operational by 2015, adding 100 mmtpy of capacity for the mines served by the BNSF & UP South line.
[3] The BNSF & UP South figures represent the projected combined traffic and percent capacity on the BNSF & UP South line and the projected DM&E line.
Source: PRB Coal Review Task 3D Report (BLM 2005f)

The Task 2 Report for the PRB Coal Review projected that basin-wide production of CBNG could potentially double by 2020, which would suggest that additional pipelines could be built. One potential additional pipeline (Bison Project) was

identified for completion by 2010 when the PRB Coal Review was prepared, but no filing for this project has been made with FERC. Other potential projects are discussed in Section 4.1.2.3.1.

An estimated 1,700 MW of new power production capacity is anticipated in the cumulative effects area by 2020. This level of production would require construction of additional transmission line capacity. It is assumed that new transmission lines would be constructed to connect new power plants to the grid. However, no specific projects have been identified so the location(s), capacities, and effects on the existing system cannot be determined at this time.

4.2.12 Socioeconomics

The cumulative socioeconomic impact analysis focuses on Campbell County, but also considers Converse, Crook, Johnson, Sheridan, and Weston Counties as directly affected and Niobrara and Natrona Counties as indirectly affected. Recent and projected socioeconomic conditions are described in more detail in the Task 1C and 3C reports for the PRB Coal Review (BLM 2005b and 2005e).

REMI Policy Insight (REMI), a professionally recognized regional economic model, was used to develop the cumulative employment and population projections presented below. The version of the REMI model for the Coal Review was comprised of two economic regions: one being Campbell County alone, the second composed of those Wyoming counties bordering Campbell County and linked to its economy by established industrial and consumer trade linkages and by work force commuting patterns. Results for the second region were analyzed to focus on the five counties, Converse, Crook, Johnson, Sheridan, and Weston, that are the most directly linked. Collectively, these five counties are referred to in the PRB Coal Review Task 3C Report (BLM 2005e) as the surrounding counties. Additional analysis was undertaken to translate the population and employment forecasts for each of the surrounding counties into housing needs and to project future school enrollment.

During the 1970s and early 1980s, the PRB emerged as a major coal producing region. Federal coal leasing has been a high profile activity because over 90 percent of the coal resources in the PRB are federally owned. The surface coal mines that developed during the 1970s and early 1980s are now mature operations, providing a stable economic and social foundation for the region. While energy development has produced periodic surges in population, followed occasionally by population declines in some communities, the growth in domestic energy consumption, coupled with the PRB's vast energy resource base, has resulted in a 50-year growth trend in the region without the severe economic dislocations that have characterized other western U.S. resource booms.

This period of extended energy development has been accompanied by substantial economic changes and benefits, including economic growth, employment opportunity, tax revenue growth, and infrastructure development

for local governments, both locally and across Wyoming, funded by tax revenues generated by production of coal and other energy resources. At the same time, periods of rapid growth have stressed communities and their social structures, housing resources, and public infrastructure and service systems.

The emergence of the coal and other energy resource development industries in the PRB has had long-term cumulative affects on regional social and economic conditions. In general, Campbell County and the entire PRB region have developed an enhanced capacity to respond to and accommodate growth. The regional coal industry also provides a measure of insulation from dramatic economic and social dislocations. Key cumulative social and economic conditions identified in the PRB Coal Review are described below.

4.2.12.1 Employment and the Economic Base

Energy resource development since 1970 has resulted in substantial economic expansion across the PRB. Total employment expanded by 163 percent as 40,674 net new jobs were added between 1970 and 2004. The most rapid expansion occurred between 1975 and 1980. After modest growth and slight decline in the 1980s and early 1990s, employment growth resumed in the late 1990s, led by increases in coal mine employment, including subcontractors, and CBNG development. Across the six-county area, total employment was 65,597 in 2004. Nearly half of the net job gain occurred in Campbell County, where total employment increased from 6,026 jobs in 1970 to 25,921 jobs in 2004. Strong gains also were posted in Sheridan County (9,821 jobs) and Converse County (4,421 jobs).

The economic stimuli associated with the gains in mining and CBNG employment and the long-term population growth triggered secondary job gains in construction, trade, services, and government. In 2004, business and consumer services accounted for 51 percent of all jobs in the region, while mining and government accounted for 14 percent and 16 percent of all jobs, respectively. Farm employment in the region, as a share of total employment, declined from 14 percent in 1970 to 5.0 percent in 2004. However, that shift is primarily due to growth in non-farm employment rather than declines in farming, as total farm employment in the PRB recorded a net decline of only 375 jobs, from 3,571 to 3,196 (U.S. Bureau of Economic Analysis 2006).

The largest impetus to future growth over the PRB Coal Review study period (2003 to 2020) is expected to occur by 2010. Under the lower production scenario, employment in 2010 related to coal mining, oil and gas production, and oil field services is projected to increase by one-third, or more than 2,300 jobs, as compared to 2003 levels. Many of the jobs gained would be the result of increased oil and gas development. While the number of coal mining jobs would increase, the projected coal mine-related productivity gains would limit increases in the number of mine employees required for operations.

Beyond 2010, total mining industry employment would decline as major infrastructure development (e.g., additional CBNG compression capacity) is completed and the pace of conventional oil and gas drilling decreases. Increases in CBNG production and coal mining employment would occur thereafter, such that total mining employment would approach pre-2010 levels by the end of the forecast period (2020). Under the development scenarios, construction of three new power plants, having a combined capacity of 1,000 MW and a peak work force of approximately 1,550 in 2007-2008, is assumed to occur concurrently with the increases in mining employment. Under the upper production scenario, a second temporary construction work force impact would occur between 2016 and 2020 in conjunction with the construction of an additional 700-MW power plant.

The net effects of these activities, including secondary effects on suppliers, merchants, service firms, state agencies and local government in the region, would be the creation of more than 8,700 new jobs in the region between 2003 and 2010. Of those, more than 5,600 jobs (a 22 percent increase over 2003) would be based in Campbell County. The pace of economic expansion, at least in terms of jobs, would moderate after 2010. Total employment growth of 2,017 additional jobs is projected in Campbell County between 2010 and 2020, with 1,741 additional jobs projected in the surrounding counties.

However, to achieve the projected levels of energy and mineral development activity through 2010 assumes that industry has access to the necessary equipment, materials, labor, and other vital inputs. Current oil and gas exploration and development across the Rocky Mountain region has absorbed the available inventory of drilling rigs and crews. A lack of access to resources could delay or limit the job gains below the levels projected, even though prospects for such growth remain. Furthermore, competition for equipment, combined with tight labor markets, could negate the productivity gains that underlie the projections, such that the employment and associated impacts do materialize, but are associated with lower levels of activity (e.g., a lengthier construction period for a power plant or fewer new wells drilled each year).

Employment effects associated with the upper coal production scenario, assuming productivity gains in coal mining equivalent to those in the lower coal production scenario, would result in total employment gains of 11,563 jobs by 2010 in the six-county study area, with an additional 3,667 jobs by 2020[1]. As compared to the employment projections under the lower coal production

[1] The number of jobs in the coal mining industry under the upper production scenario was estimated assuming future productivity gains comparable to those used for the lower production scenario. This approach differs from that described for the upper production scenario in the Task 2 report of the coal study, whereby a 16 percent higher production would be achieved with a 2.5 percent increase in workforce. Although that assumption reflects a continuation of historic productivity gains, it may underestimate population and employment growth and related socioeconomic effects if the production levels are achieved but productivity lags. Using the productivity gains from the lower production scenario provides a more conservative perspective on potential long-term population growth for purposes of the cumulative analysis.

scenario, those gains include 2,821 additional jobs in 2010 and 3,214 additional jobs in 2020. Most of the incremental gains would be in Campbell County, further stressing labor markets, housing, and other community resources. Such pressures could delay or affect the development plans of individual firms and operators, such that the projected employment levels would not be realized in the time frames shown. Nonetheless, substantial growth in employment is expected to occur, and even if the projected total employment levels are not realized, substantial social and economic impacts still would be anticipated.

The economic stimuli associated with the projected development also would stimulate increases in employment in other nearby counties beyond the five surrounding counties identified above. However, the potential effects in these areas are not addressed in the PRB Coal Review Task 3C Report because most of the effects would comprise indirect or induced growth that would be limited in scale relative to the size of the respective economies. Furthermore, the economic outlook for those areas is influenced by factors that are beyond the scope of this study, such as the role of the oil and gas support services industry based in Natrona County in supporting energy development in the south-central and southwestern portions of Wyoming.

4.2.12.2 Labor Market Conditions

Labor market conditions in the PRB reflect a generally healthy economy, with average annual county unemployment rates between 2.1 percent (Campbell) and 3.5 percent (Weston) in 2006. Statewide and national unemployment rates for the period were 3.2 percent and 4.6 percent, respectively (U.S. Bureau of Labor Statistics 2007).

Over time, local unemployment levels and rates have reflected the influences of the large, relatively stable employment baseline associated with the region's coal mining industry and the more transitory and variable influences of natural gas development. Prior to the onset of CBNG development in 1989, unemployment in Campbell County fluctuated between 4.8 and 5.3 percent, slightly above the corresponding statewide averages. Labor demand associated with CBNG development contributed to a decline in unemployment to below 3.0 percent in the 2001. As the pace of CBNG development stabilized, labor demand eased and unemployment rates climbed to 3.7 percent in 2003, before again falling to current record lows.

The employment effects identified above indicate substantial pressures on local labor markets. Strong demand for labor would maintain low unemployment, creating upward pressure on wages and salaries. Those influences would stimulate substantial economic migration into Campbell County, causing impacts to population, housing demand, and other economic and social conditions. Similar influences would occur in surrounding counties, although the implications are less severe because the scale of effects would be smaller and would be distributed over multiple communities and service providers.

4.2.12.3 Personal Income

A benefit associated with energy resource development, whether it is mineral mining or oil and gas development, is local wages and salaries that are among the highest in the state. Personal income registered strong gains across the region, but especially in Campbell County, during the late 1970s and early 1980s. In 1981, per capita personal income in Campbell County was $17,520, compared to the national average of $11,280 and the statewide average of $12,879. Personal income growth was tempered by several years of economic stagnation during the late 1980s. Renewed economic vitality since then resulted in per capita personal income in Campbell County reaching $33,388 in 2004. Those gains notwithstanding, per capita income among Campbell County's residents was below statewide and national norms, as well as that for Sheridan ($35,716) County. When measured on a median household or family income basis in the 2000 census, Campbell County led statewide, national, and other counties in the PRB by considerable margins. That pattern has been maintained due to the strong economic growth in the region; in 2006 the median household income in Campbell County was $60,800 compared to a statewide median of $43,785 and national median of $44,374. Median household incomes for the other five PRB counties ranged from $40,195 to $46,883 (U.S. Census Bureau 2006b).

In terms of total personal income, Campbell County led the six-county region with $1.22 billion in 2004. Sheridan County residents recorded aggregate personal income of $972 million in 2004. Total personal income in the other counties was substantially lower, ranging from $193 million in Crook County to $389 million in Converse County.

Personal incomes in the region would increase over the time period 2007-2020, both in aggregate and on a per capita basis, in conjunction with the economic outlooks foreshadowed by the projected development scenarios. In 2004, total personal income in the six-county area was $3.24 billion. Under the lower production scenario, total personal income would more than double to $7.57 billion in 2020 (in nominal dollars). The upper production scenario would generate an additional $266 million per year in Campbell County and an additional $35 to $40 million per year in the surrounding counties by 2020. Annual per capita incomes are projected to increase by approximately 27 percent (in real terms) across the region between 2003 and 2020. Households with one or more workers employed directly in the energy industry, associated service firms, and the construction industry likely would realize larger shares of the gains (BLM 2005e).

4.2.12.4 Population and Demographics

Population change over time is perhaps the single best indicator of cumulative social and economic change in the PRB. Campbell County was not among the original 13 counties when Wyoming was admitted to statehood, but was carved from Weston and Crook Counties in 1911. Campbell County's 1920 population

of 5,233 ranked it seventeenth among Wyoming's counties. Forty years later and prior to the onset of coal development in the region, Campbell County ranked eighteenth among Wyoming's counties in terms of population, with a 5,861 residents. Neighboring Converse, Sheridan, and Weston Counties all had larger populations.

By 1980, Campbell County's population had increased by more than 300 percent, to 24,367, seventh among Wyoming's counties. Energy development contributed to population growth in Sheridan, Converse, Johnson, and Crook Counties during that period. Weston County recorded a population decline during the period; however, the combined population of the PRB climbed from 49,311 in 1960 to 82,598 in 1980.

Annual coal production in the PRB has increased by nearly 560 percent since 1980, accompanied by expanded mine service and rail transportation capacity, stimulating further growth. The impetus for growth in local employment was tempered by substantial productivity increases in the mining industry, coupled with declining production of other energy resources. Consequently, the region's population gained a relatively modest 11 percent, 9,318 residents, between 1980 and 2000, reaching 91,916. Campbell County registered a net gain of 9,331 residents during that period, raising its total population to 33,698 in 2000, fourth highest in the state. Across the PRB, the loss of about 2,000 residents in Converse County was offset by modest gains in the other four counties (U.S. Census Bureau 2001).

More recently, the PRB has seen renewed population growth, primarily linked to CBNG development. Population estimates for 2006 indicate a total regional population of 100,504, a 9.3 percent increase over the 2000 census population. Gains were reported for all six counties, ranging from 118 persons in Weston County to 5,236 persons in Campbell County (Table 4-29).

Table 4-29. Recent and Projected PRB Population.

Year	Campbell County	Converse County	Crook County	Johnson County	Sheridan County	Weston County	Six County PRB Total
				Census			
2000	33,698	12,104	5,895	7,108	26,606	6,642	92,053
2003	36,381	12,326	5,971	7,530	27,116	6,665	95,989
2006	38,934	12,866	6,255	8,014	27,673	6,762	100,504
				Lower Coal Production Scenario			
2010	45,925	13,103	6,542	8,389	28,459	7,108	109,526
2015	48,905	13,671	6,759	8,867	30,016	7,174	115,392
2020	50,995	14,193	6,989	9,326	31,467	7,208	120,178
				Upper Coal Production Scenario			
2010	47,662	13,160	6,570	8,424	28,579	7,137	111,532
2015	51,558	13,763	6,802	8,924	30,214	7,219	118,480
2020	54,943	14,313	7,045	9,403	31,733	7,266	124,703

Source: U.S. Census Bureau (2006b - historical data) and PRB Coal Review Task 3C Report (BLM 2005e)

The magnitude and timing of projected employment changes from 2003-2020 under either coal production scenario would trigger corresponding effects to population across the PRB, particularly in Campbell County (Figure 4-6).

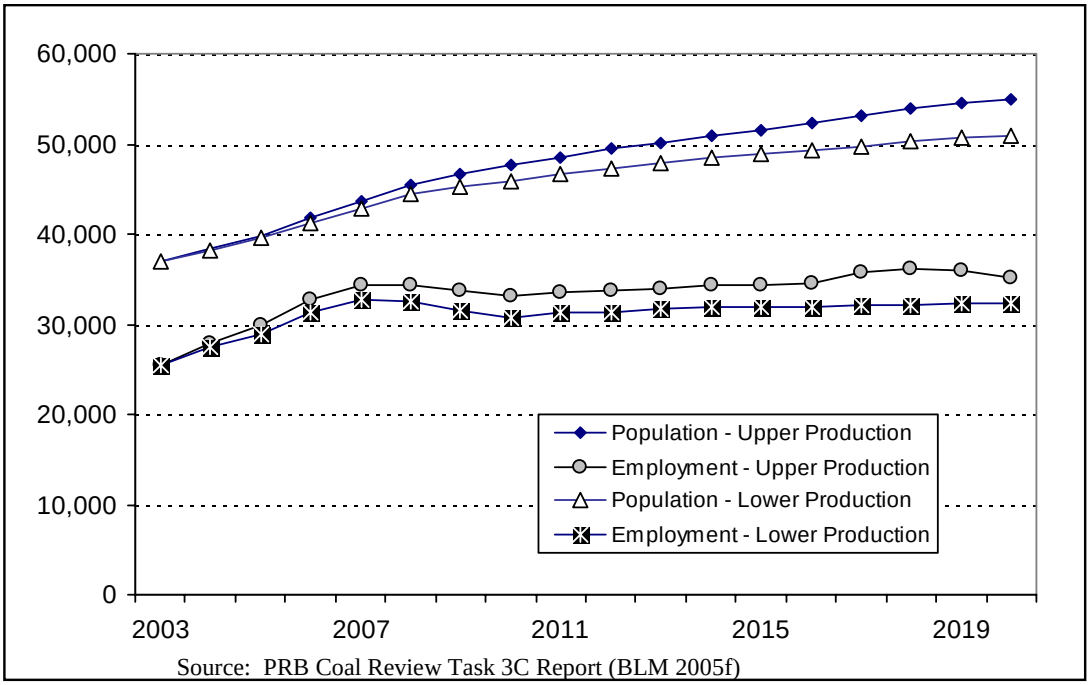


Figure 4-6. Projected Campbell County Population and Employment to 2020.

Under the lower coal production scenario, Campbell County's population is projected to increase by more than 14,550 residents between 2003 and 2020, nearly 9,500 of which are anticipated by 2010. Growth over the next three years will maintain pressures on housing and other community resources. The projected energy and mineral development in the lower coal production scenario would also result in substantial population growth elsewhere in the PRB, with Sheridan, Johnson, and Converse Counties all projected to gain substantial population. Population growth, like employment growth, would moderate after 2010.

Projected population growth between 2003 and 2020 ranges from 0.5 percent CAGR in Weston County to 2.0 percent CAGR in Campbell County. In absolute terms, the net change ranges from 537 additional residents in Weston County to a gain of 14,557 residents in Campbell County. The total population of the six-county study area is projected to climb to 120,178 in 2020, a 1.3 percent CAGR.

As with employment, changing development conditions could result in actual population growth varying from projected growth. If project schedules or levels of development vary from the projected levels, corresponding effects on population growth could result (e.g., lower growth). Population demographics could also change due to migration and commuting, with more immigrating construction workers being single-status, rather than accompanied by families. Another possibility is that the spatial distribution of population growth could

shift as a result of housing or labor constraints, such that less growth would occur in Gillette and Campbell County, and more growth would occur elsewhere.

Projected population growth through 2020 under the upper coal production scenario is approximately 19 percent higher than under the lower coal production scenario (28,625 compared to 24,100, with the six-county population reaching 124,703 by 2020). Much of the incremental population growth would occur by 2010 in Campbell County, and in particular in and near Gillette.

Community population growth under the upper coal production scenario generally would mirror growth under the lower coal production scenario but with higher growth in Wright, Douglas, and Newcastle due to the effects of higher coal production, coal transportation, and power generation concentrated in the southern portion of Campbell County.

4.2.12.5 Housing

While the population grew by 55 percent in the 1970s, the housing stock in the study area grew by almost 78 percent. Housing growth was especially rapid during the 1970s in Campbell County, where population grew by 88 percent and the housing stock grew by 140 percent. The expansion in housing supply, combined with the slowdown in the rate of population growth, produced double-digit vacancy rates for rental housing in the late 1980s and early 1990s. After growth resumed in the mid-1990s, most county-level vacancy rates for ownership units were at or below the state levels in 2000. Vacancy rates for rental units declined even more sharply. Vacancy rates have fallen even more as a result of recent growth, with current rates below 1.5 percent in five of the six-counties, and that in Johnson County at only 2.8 percent (Table 4-30).

Table 4-30. Rental Housing Vacancy Rates, 2004 4Q and 2006 4Q.

YEAR	Campbell County	Converse County	Crook County	Johnson County	Sheridan County	Weston County	Wyoming
2004 4Q	2.8%	8.3%	10.4%	2.1%	4.5%	5.0%	4.8%
2006 4Q	0.4%	1.4%	1.0%	2.8%	0.5%	0.0%	2.4%

Source: Wyoming Housing Database Partnership (2007)

In 2000, the housing inventory in the six-county study area was 41,203 units (Table 4-31). Total housing inventory had expanded to 43,363 units in 2005, a net addition of 2,160 since 2000. However, new construction hasn't kept pace with population growth, resulting in tighter market conditions in terms of availability, and higher prices.

Table 4-31. Total Housing Stock in 2000 and 2005.

YEAR	Campbell County	Converse County	Crook County	Johnson County	Sheridan County	Weston County	Six-county PRB Region
2000	13,288	5,669	2,935	3,503	12,577	3,231	41,203
2005	14,085	5,852	3,132	3,694	13,283	3,317	43,363
Change	797	183	197	191	706	86	2,160

Source: U.S. Census Bureau (2006a)

In 2005, the average sales price of homes in the study area varied from $80,303 in Weston County to $186,095 in Sheridan County. The average home price statewide in 2006 was $178,183 (Wyoming Housing Database Partnership 2007). In addition to Sheridan County, Campbell ($185,874) and Johnson ($180,209) Counties also had average home sale prices above the statewide average in 2006. The average sales price in Converse County was $149,096, 17 percent below the statewide average.

Monthly costs for rental housing in the PRB, measured in the fourth quarter of 2006, were highest in Campbell County (Table 4-32).

Table 4-32. Monthly Housing Rents in 2006[1] in the PRB Study Area and Percent Change from 2004.

County	Apartments		Mobile Home Lots		Houses		Mobile Homes on a Lot	
	Rent	Change	Rent	Change	Rent	Change	Rent	Change
Campbell	$697	25.8%	$283	22.0%	$975	23.0%	$758	20.5%
Converse	$515	31.4%	$152	1.3%	$545	2.8%	$452	22.5%
Crook	$391	17.4%	$125	5.9%	NA	NA	NA	NA
Johnson	$477	-5.4%	$170	16.4%	$700	15.3%	$518	5.5%
Sheridan	$571	14.0%	$285	4.4%	$857	27.9%	$650	26.7%
Weston	$459	47.1%	$119	17.8%	$567	36.3%	$505	27.5%
Wyoming	$567	14.1%	$225	15.4%	$782	13.0%	$561	15.2%

1 Data are for the fourth quarter of 2006. Change is the percent change since fourth quarter of 2004.

NA = information not available due to insufficient sample size.

Source: Wyoming Department of Administration and Information, Division of Economic Analysis (2006 and 2007)

Temporary housing resources are available in the PRB in the form of hotel-motel rooms, private and public campgrounds, and vacant spaces in mobile home parks. In all, there are more than 70 lodging establishments with a total of more than 2,500 rooms. These temporary housing resources, supplemented by whatever apartments, townhouses, and mobile home spaces are available in Gillette, Wright and Douglas, have accommodated temporary housing needs associated with natural resource and energy projects in the past.

Both projected coal production scenarios indicate a strong demand for housing across the six-county study area through 2020. Net housing requirements under the lower coal production scenario are for approximately 9,110 units through 2020, a 21 percent increase above the 2006 existing inventory (Figure 4-7). New housing requirements under the upper coal production scenario are estimated at 10,900 units, a 25 percent increase compared to the 2006 inventory and 1,790 units more than for the lower coal production scenario. Approximately 60 percent of the overall demand for new housing through 2010 would be in Campbell County.

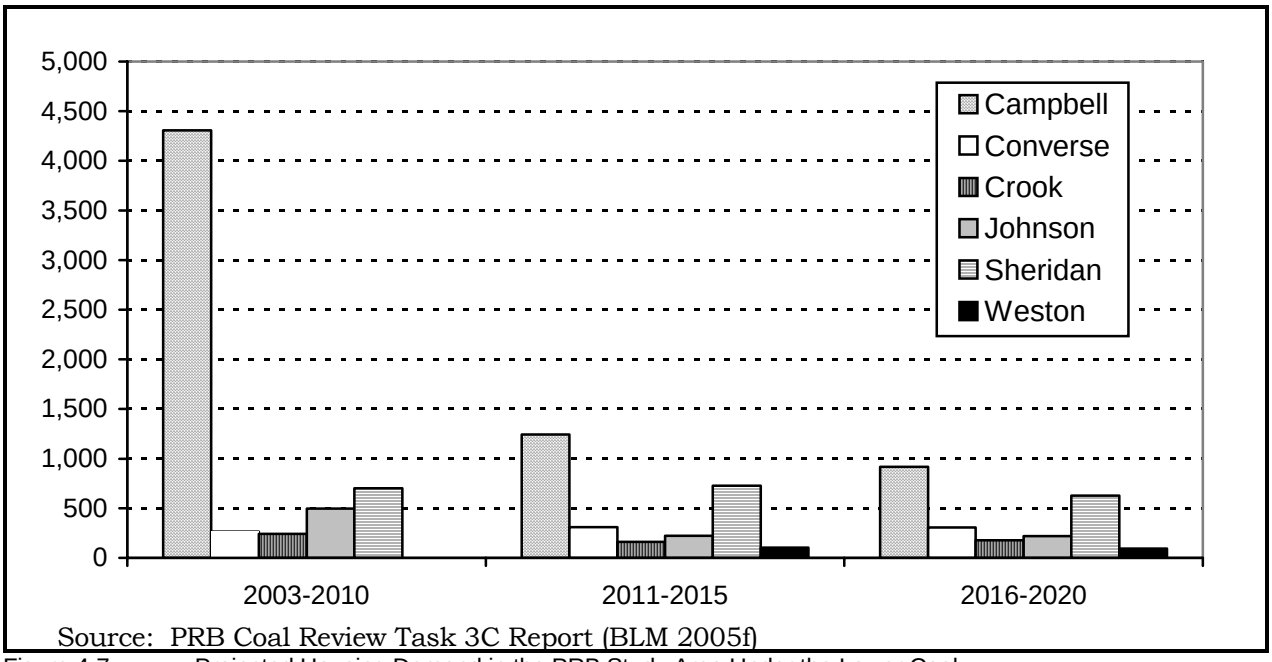


Figure 4-7. Projected Housing Demand in the PRB Study Area Under the Lower Coal Production Scenario.

A substantial portion of the near-term housing demand in Campbell County would be associated with the assumed concurrent construction of three power plants. If that occurs, one or more project sponsors may be required by the Wyoming Industrial Siting Administration to pro-actively provide housing (e.g., a construction camp for single-status workers). Such actions could temper the needs for more housing; however, the remaining needs would nonetheless be substantial, straining public and private sector residential development capacity. Although smaller in scale than those in Campbell County, housing demands in the surrounding counties may also strain the capabilities of the residential construction sector to respond. Furthermore, residential contractors would be competing for available labor, contributing to the population growth and housing demand, and fueling increases in construction costs and housing prices.

The relative scale of the housing needs can be evaluated in comparison to past growth in the study area. One benchmark for comparison is the rapid growth that occurred in the PRB in the 1970s. During that decade, the number of housing units in the six-county study area rose by approximately 14,900 units, approximately 1,500 units per year on average compared to the 850 to 975 new units per year projected under the upper and lower coal production scenarios through 2010. The rapid pace of development in the 1970s coincided with a period of economic expansion and strained the region's construction trade and building supply industries. Although the underlying economies of the region are now larger, the projected needs would tax the ability of communities to respond. Signs of strain are apparent in Gillette and could surface elsewhere as greater housing needs arise in the remaining counties of the six-county study area under the low coal production scenario.

Projected housing demands under either coal production scenario, although lower than what Campbell County and the region experienced in the "boom"

years of the 1970s, would exert substantial pressure on housing markets, prices, and the real estate development and construction industries, all at a time when demand for labor and other resources would be high overall.

4.2.12.6 Public Education

There are 10 school districts in the six-county PRB study area, ranging in size from CCSD #1 with 7,337 students in the 2005 school year to Sheridan County School District # 3 (based in Clearmont, Wyoming) with fewer than 100 students. CCSD #1, based in Gillette, and Converse #1 in Douglas, serve the primary energy and resource development region.

Public school enrollment trends generally mirrored population trends during the period of rapid population growth. District-wide enrollment in Campbell County grew by more than 4,600 students (131 percent) between 1975 and 1985. Enrollment increased in all districts in Converse and Sheridan Counties as well. Enrollment in CCSD #1 subsequently peaked, but remained near record high levels for nearly a decade. Elsewhere in the region enrollments generally declined with a combined enrollment of 9,525 in the other study area districts in 2005, the lowest since 1975 (Wyoming Department of Education 2006). Recent natural gas and mining development has tempered, but not reversed, the trend of declining school enrollments across the region.

Communities across the PRB study area would see population growth due to economic migration from 2003 to 2020; however, the effects of such migration on public school enrollments would vary. As the demographics of the population change, school districts in the PRB would be affected by new trends. In some counties, the size of the school-age population (generally aged five to 17 years) may even trend in the opposite direction of total population in the short-term due to underlying demographics of the established resident population.

The demographic projections for the two coal production scenarios forecast growth in elementary school enrollments in Campbell County through 2010 and after 2010 for most PRB school districts. Projected enrollments in CCSD #1 would be approximately 10 percent higher by 2020 under the upper coal production scenario, with those in the surrounding districts about one percent higher. However, several districts still may experience enrollment levels in 2020 below current levels, as growth from 2010 to 2020 would not offset recent declines or those projected to occur before 2010.

Under the lower coal production scenario, Campbell County would experience an increase of 1,587 students, or 22 percent above recent levels, in school enrollment through 2020. However, the net impact on CCSD #1 would be composed of two trends; a substantial increase in grades K-8 but only small increases in grades 9-12 (Figure 4-8). School districts in the surrounding counties are projected to experience declining elementary and middle school enrollments through 2010 and declining high school enrollments through 2015. Thereafter, growth and the associated influences on demographics would

generate renewed enrollment growth, particularly in the elementary grades in Johnson, Sheridan, and Converse Counties.

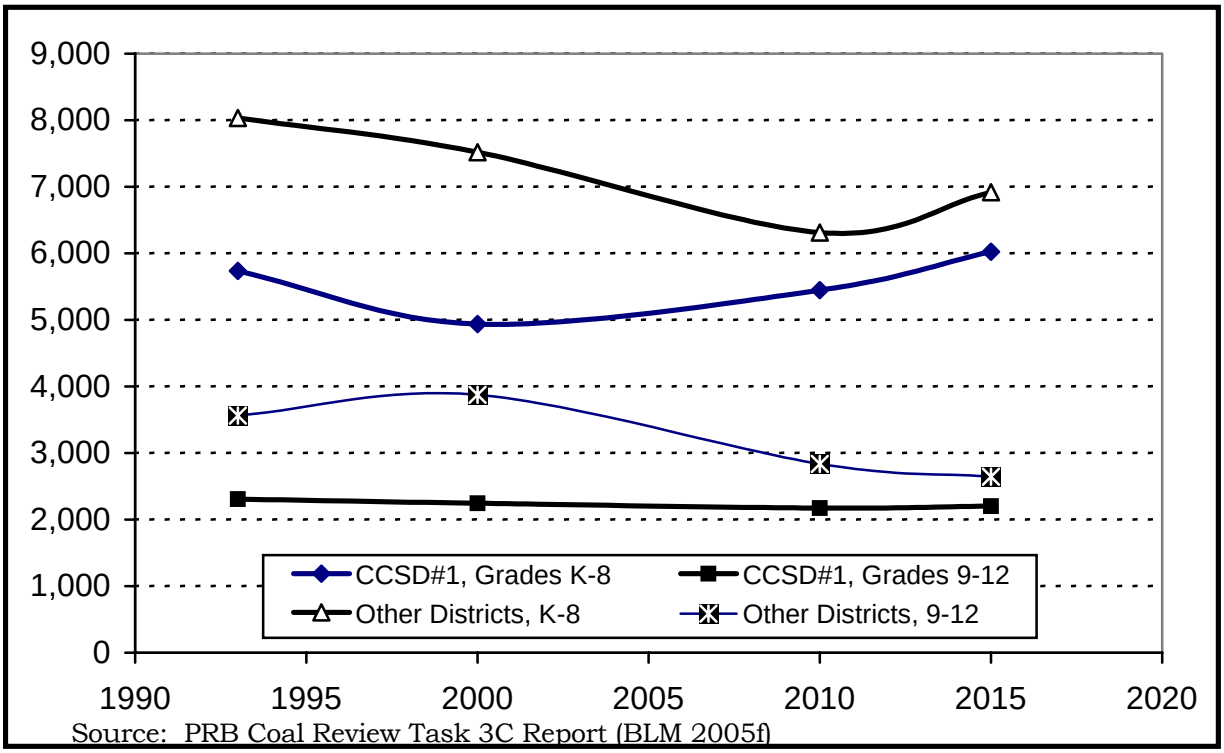


Figure 4-8. Projected School Enrollment to 2020 Under the Lower Coal Production Scenario.

Under either scenario, projected enrollments may cause short-term school capacity shortages, depending on the specific grade levels and residential locations of the additional students. Under the Wyoming School Facilities Commission planning guidelines, impacted school districts generally need to accommodate minor capacity shortages through the use of temporary facilities, such as portable classrooms. For larger and more long-term increases, the Commission's policy is to fund capital expansion where warranted by projections developed during updates of school districts' five-year plans. The approved five-year plan for CCSD #1 has a $57.4 million budget covering construction of several new schools and numerous major maintenance and facility upgrade projects. The approved five-year plans for the other school districts have combined cost of $163 million. Capital investment in public education facilities has been a statewide priority in Wyoming for the past decade, with taxes and royalties on mineral and energy resources the primary source of program funding (Wyoming School Facilities Commission 2007 and Wyoming CREG 2007).

4.2.12.7 Facilities and Services

The types and levels of facilities and services provided by local governments reflect service demand, revenue availability, and community values regarding appropriate services and service standards. As with most socioeconomic characteristics, the level and availability of local government facilities and

services varies by county and community across the PRB. There are literally several hundred separate service providers in the region. Although virtually all local government facilities and services are affected by energy development and the demand related thereto, the critical facilities and services include municipal water and sewer systems, law enforcement at the county level, and hospitals. A comprehensive assessment of facilities and services is beyond the scope of the PRB Coal Review. However, an initial screening revealed no critical needs or shortfalls and indicated that most providers are engaged in an ongoing long-term process to maintain and improve facilities and services to meet community needs and to comply with various regulations and standards.

The PRB Coal Review socioeconomic analysis focuses on water supply and wastewater systems (two essential services that are costly and have the longest lead times to develop) and law enforcement, emergency response, and road maintenance (three services that typically are most affected by energy development).

Water supply and wastewater systems in most communities have the capacity to accommodate the cumulative population growth associated with either projected coal production scenario through 2020, assuming ongoing or planned improvements are completed. In Gillette, there may be a timing issue with planned water supply system expansions, as completion of planned improvements would occur when substantial growth is anticipated under both projected coal production scenarios. Consequently, Gillette may experience water shortages in the summer months for several years, particularly if growth follows that under the upper coal production scenario. Douglas is looking to add water treatment capacity to provide additional capacity and management flexibility to address needs during times of drought.

The ability to provide desired levels of services to the projected energy-related population and development is less clear in Campbell County, Gillette, Wright, and outlying rural communities. Campbell County and its communities would experience a 25 percent increase in population between 2003 and 2010 under the lower coal production scenario and 30 percent under the upper coal production scenario.

Growth rates and the resultant facility and service demand in other counties within the study area would be substantially less during the 2003 to 2010 period under either scenario; all communities other than Johnson County and Buffalo would grow substantially less than 10 percent during the period. The populations of Johnson County and Buffalo would increase 10 percent by 2010, driven primarily by CBNG development.

Growth rates and resultant increases in service demands would slow substantially during both the 2011 to 2015 and 2016 to 2020 periods under either projected coal production scenario. In most communities except Sheridan County and the city of Sheridan, there would be little difference in population growth and service demand between the two scenarios.

4.2.12.8 Fiscal Conditions

Federal mineral royalties and state and local taxes levied on coal and other mineral production are vitally important sources of public revenue in Wyoming. Taxes, fees, and charges levied on real estate improvements, retail trade, and other economic activity supported by energy development provide additional revenues to support public facilities and services. These revenues benefit not only those jurisdictions within which the production or activity occurs, but also the federal treasury, state coffers, school districts, and local governments across the state through revenue-sharing and intergovernmental transfer mechanisms.

Coal and other minerals produced in Wyoming, regardless of ownership, are subject to ad valorem taxation by local taxing entities and a statewide levy to support public education. Statewide ad valorem taxable valuation on coal production in 2005 was $2,280.1 million. Of that total, 88 percent was based on production in the PRB.

The total assessed valuation of Campbell County, boosted by recent increases in CBNG production, was $4,264 million in 2006. Valuations on aggregate mineral production accounted for 87 percent of that total. Because Campbell County has been the primary beneficiary of mineral production gains over the past three decades and the recent gains tied to CBNG, the county's assessed valuation in 2006 was nearly 38 times that of Weston County ($112.5 million) and 31 times that of Crook County ($137.2 million). The 2006 valuation of 2005 coal production in Campbell County was $1,995.3 million (Wyoming Department of Revenue 2006).

Wyoming levies a severance tax on coal and many other minerals produced in the state. The severance tax rate, levied on the value of production, has varied from 1.0 percent to 10.5 percent over time. The current rate of 7.0 percent was established in 1992. Cumulative statewide severance tax proceeds on coal production since 1970 exceed $2.8 billion. Cumulative severance tax revenues on coal produced in Campbell County total $1.89 billion. Cumulative severance tax revenues for the corresponding period total $96.5 million from Converse County, $60.5 million from Sheridan County, and $758.0 million from the remainder of the state (Wyoming CREG 2007 and Wyoming Department of Revenue 2006).

Producers pay a 12.5 percent royalty to the federal treasury on the value of all surface coal production from federal leases. Total federal mineral royalties of nearly $3.3 billion have been paid on coal produced in Wyoming since 1970, approximately half of which is returned to the state. Estimated 2005 mineral royalties of about $377 million were paid on federal coal produced in the PRB (Minerals Management Service 2006).

At the foundation of the mineral development revenue projections for the period 2003 to 2020 are projected levels of future energy and mineral resource production. The projected total value of annual mineral production under the

lower coal production scenario will climb by $3.49 billion (2004 dollars) over 2003 levels, reaching $8.54 billion by 2020, a 69 percent increase over the 2003 value. The aggregate value of energy and mineral resource production under the upper coal production scenario would increase to $9.21 billion in 2020. The incremental difference, compared to the value under the lower coal production scenario, would be $670 million per year, all of which represents the value of higher annual coal output.

The overwhelming majority of future mineral production value is anticipated to be in Campbell County. Over time, the future value of production in Sheridan and Johnson Counties would climb. Total annual mineral production value by 2020 is projected to reach $6.37 billion in Campbell County and $2.17 billion in the surrounding counties. Between 2005 and 2020, total royalty and tax receipts derived from the key selected sources range between $21.1 and $22.6 billion for the lower and upper coal production scenarios, respectively. Receipts derived from coal production would account for the majority of the totals under either scenario, with federal mineral royalties on coal at $4.9 to $5.7 billion being the single largest source. Severance taxes, ranging from $6.3 to $6.7 billion, also would accrue to the state (Tables 4-33 and 4-34).

Table 4-33. Summary of Mineral Development Tax Revenues Associated with Energy Resource Production Under the Lower Coal Production Scenario (million $).

Industry and Taxes	2005-2010	2011-2015	2016-2020	Total
Coal[1]	$3,164.8	$3,178.9	$3,756.3	$10,100.0
CBNG	$2,915.2	$3,076.4	$3,288.7	$9,280.3
Conventional Oil and Gas	$568.5	$576.4	$614.0	$1,759.0
Totals	**$6,648.5**	**$6,831.7**	**$7,659.0**	**$21,139.3**
Severance Tax	$1,995.9	$2,012.4	$2,249.3	$6,257.6
Federal Mineral Royalties	$2,754.1	$2,839.4	$3,166.3	$8,759.8
State Mineral Royalties	$233.5	$225.8	$251.4	$710.7
Ad Valorem Tax (Counties)	$417.6	$443.0	$502.8	$1,363.3
Ad Valorem Tax (Schools)	$1,247.5	$1,311.1	$1,489.3	$4,047.9
Totals	**$6,648.6**	**$6,831.7**	**$7,659.1**	**$21,139.3**

[1] Does not include coal lease bonus bids due to the uncertainty regarding timing.
Source: PRB Coal Review Task 3C Report (BLM 2005e)

The federal and state governments also benefit from coal lease bonus bids derived from future coal leasing. Bonus bids have risen over time, with successful bids for recent sales ranging from 30 cents per ton to 97 cents per ton. There is no guarantee of that trend continuing. Considerable uncertainty also exists with respect to the timing and scale of future leases, although BLM currently has pending applications for more than four billion tons of federal coal, including this application. The state receives 50 percent of the bonus bid revenue.

Table 4-34. Summary of Mineral Development Tax Revenues Associated with Energy Resource Production Under the Upper Coal Production Scenario (million $).

Industry and Taxes	2005-2010	2011-2015	2016-2020	Total[1]
Coal[1]	$3,538.0	$3,703.0	$4,350.0	$11,591.0
CBNG	$2,915.2	$3,076.4	$3,288.7	$9,280.3
Conventional Oil and Gas	$568.5	$576.4	$614.0	$1,759.0
Totals	**$7,021.7**	**$7,355.8**	**$8,252.7**	**$22,630.3**
Severance Tax	$2,104.1	$2,159.0	$2,415.4	$6,678.5
Federal Mineral Royalties	$2,946.3	$3,099.9	$3,461.4	$9,507.6
State Mineral Royalties	$233.5	$225.8	$251.4	$710.7
Ad Valorem Tax (Counties)	$435.8	$472.0	$535.0	$1,442.8
Ad Valorem Tax (Schools)	$1,302.3	$1,398.9	$1,589.8	$4,291.0
Totals	**$7,022.0**	**$7,355.6**	**$8,253.0**	**$22,630.6**

[1] Does not include coal lease bonus bids due to the uncertainty regarding timing.
Source: PRB Coal Review Task 3C Report (BLM 2005e)

Taxes and mineral royalties levied on energy and mineral resource production accruing to the state are disbursed to the Permanent Water Development Trust Fund, Wyoming School Foundation and Capital Facilities funds, capital construction fund for state and local government facilities, and other programs according to a legislatively-approved formula. Through these funds, the revenues derived from resource development benefit the entire state, not just agencies, businesses, and residents of the PRB.

County governments and school districts would realize benefits from future energy and mineral resource development in the form of ad valorem taxes. Such taxes, estimated on the basis of future coal, oil, and natural gas production, are estimated to range between $5.4 billion and $5.7 billion through 2020. Those sums do not include future property taxes levied on the new power plants, expanded rail facilities, or new residential and commercial development associated with future growth, or sales and use taxes levied on consumer and some industrial purchases. These latter revenues are not estimated in this study, but would be substantially lower than those on resource production.

Local governments would benefit from property taxes on new development, as well as from sales and use taxes on taxable sales within their boundaries. Such revenues are not estimated for this study due to the large number of jurisdictions and other analytical considerations.

4.2.12.9 Social Setting

The past 30 years have seen sweeping social change in the U.S. and throughout much of the world. But in addition to the broad forces that have driven social change in the U.S. as a whole, social conditions in some PRB communities have been substantially influenced by energy development. Factors that have affected social conditions in the PRB include industrial and natural resource development, economic and demographic change, housing and public infrastructure development, and institutional change at the local and state government levels.

One of the key drivers of social change in the PRB has been energy-related population growth. When the first oil boom occurred in the late 1950s, Campbell County was a relatively stable, sparsely-populated rural county. Like many places in Wyoming and throughout the rural west, Campbell County was a small, relatively homogeneous ranching community (ROMCOE 1982). The oil booms of the 1950s and 1960s brought an influx of new people. Development of coal mines, continued oil and gas drilling, and power plant construction precipitated another round of growth. In all, Campbell County population grew by almost 600 percent between 1950 and 2000.

On the one hand, this population growth, combined with a robust economy, generated a variety of positive social effects. Financial and technical resources poured into the community as it mobilized to accommodate the new population. Job opportunities were created in the construction industry, as the community responded to demands for housing, public facilities, and retail goods and services. The large and rapid influx of new residents, eager to take advantage of the employment opportunities, created energy, vitality, and a sense of economic optimism about the community. Where economic advancement had been limited before the boom, there was now opportunity (Gardiner 1985).

On the other hand, it is likely that many residents had mixed feelings about these changes (Heinecke 1985). New residents brought new ideas, new ways of doing things, new preferences for goods and services, and new demands for government services. Some long-time residents, particularly those who were not directly participating in the economic benefits of energy development, viewed these changes as negative.

Today, almost any organization, committee, or government body is made up of a cross-section of energy employees, ranchers, and other community members whose tenure in the community may be long or short (Bigelow 2004, Spencer 2004). Moreover, because of the turnover in the energy companies, the community has become accustomed to newcomers.

Cumulative energy development in the PRB through the year 2020 has the potential to generate both beneficial and adverse effects on community social conditions. Social effects of development activities in the PRB would vary from county to county and community to community under the coal production scenarios developed for this study, based on the existing social setting and the type of development that would occur.

Beneficial social effects would be associated with an expanding economy and employment opportunities associated with energy development and resulting improvements in living standards for those employed in energy-related industries. Adverse social effects could occur as a result of conflicts over land use and environmental values. Negative social effects also could occur if the pace of growth exceeds the abilities of affected communities to accommodate

energy-related employees and their families with housing and community services.

In the PRB, social conditions in Campbell County, the city of Gillette, and the town of Wright are most likely to be affected because the county would host much of the cumulative energy development workforce, and the county and its municipalities would receive the largest increments in population growth. Campbell County and its municipalities have a long history of energy development, and they have developed infrastructure and management systems to plan for and manage growth; consequently, major adverse social effects would not be anticipated. However, under either scenario, the county and the two municipalities may face challenges in providing adequate housing and expanding community services in anticipation of population growth through 2010, particularly if several power plant and coal mine construction projects occur simultaneously. As municipalities receive only sales and use tax revenues directly from development and purchases made within their boundaries, Gillette and Wright could face challenges in securing the necessary funding to improve municipal facilities and services. Housing shortages and limitations in public services could contribute to adverse community social effects in these communities.

Many of the people who would immigrate to Campbell County for energy-related jobs are likely to share characteristics with much of the current population; therefore, few barriers to social integration are anticipated.

Social effects on other communities in the PRB are likely to be minimal to moderate. Energy-related population growth is anticipated to be moderate in other communities. Sheridan County, also familiar with coal mining, is the only other county anticipated to host a major construction project under the development assumptions used for either projected coal production scenario. Converse, Weston, and Crook Counties could experience spillover growth from projects in Campbell County.

Johnson, Sheridan, and Campbell Counties could experience continued conflict over split estate and water issues associated with CBNG development, and the pace and scale of energy development across the PRB is likely to continue to generate social and political conflict over environmental issues under either coal production scenario.

4.2.13 Coal Mining and Coal-Fired Power Plant Related Emissions and By-Products

As discussed in Chapter 1, BLM does not authorize mining by issuing a lease for federal coal, but the impacts of mining the coal are considered in this EIS because it is a logical consequence of issuing a maintenance lease to an existing mine. The use of the coal after it is mined is not determined at the time of leasing. However, almost all the coal that is currently being mined in the Wyoming PRB is being utilized by coal-fired power plants to generate electricity for U.S. consumers. As a result, a discussion of emissions and by-products that

are generated when coal is burned to produce electricity is included in this section of the EIS.

As discussed in Chapter 2, under the currently approved mining plan, which represents the No Action Alternative, ACC anticipates that the Antelope Mine would mine its remaining estimated 394.3 million tons of recoverable coal reserves in 11 years at an average annual production rate of approximately 36 million tons. Under the Proposed Action, ACC estimates that the life of the mine would be extended by about 11 additional years at an average annual coal production rate of approximately 36 million tons. If the average annual production rate increases to 42 million tons, which is the maximum rate allowed by the current air quality permit, the life of the mine would be extended by nine additional years under the Proposed Action. Under Alternatives 1 and 2, if the entire BLM study area is leased, ACC estimates the life of the mine would be extended by 11 to 13 years.

Section 3.18.2 contains estimates of greenhouse gas emissions resulting from the specific mine operations at the Antelope Mine from projected operations under the proposed action and alternatives.

4.2.13.1 Global Climate Change and Greenhouse Gas Emissions

Ongoing scientific research has identified the potential impacts of anthropogenic (man-made) greenhouse gas (GHG) emissions and changes in biological carbon sequestration due to land management activities on global climate. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused CO_2(e) concentrations to increase dramatically. As with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and documents trends (EPA 2008f).

The National Assessment of the Potential Consequences of Climate Variability and Change, an interagency effort initiated by Congress under the Global Change Research Act of 1990, Public Law 101-606, has confirmed that climate change is impacting some natural resources that the Department of the Interior has the responsibility to manage and protect (DOI 2001). The Synthesis Report, the final part of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) (available online at http://www.ipcc.ch), was released in preliminary form on November 17, 2007. The Synthesis Report (Bernstein et al. 2007) summarizes the results of the assessment carried out by the three working groups of the IPCC. Observations and projections addressed in the report include:

- "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperature, widespread melting of snow and ice, and rising global average sea level."

- "Observational evidence from all continents and most oceans show that many natural systems are being affected by regional climate changes, particularly temperature increases."

From 1850 to present, historic trend data show an increase of 1°C in global mean temperature. The increase is not linear, and there have been extended periods (decades) where temperature has dropped or stayed constant. This historic warming over that same period has caused sea levels to rise by about 20 cm on average, and has also resulted in changes in climate patterns on land. These changes are not uniform. In some areas near the equator, temperatures have cooled by about 5°C, while closer to the poles, temperatures have risen by equal amounts (Hansen and Lebedeff 1987). In northern latitudes (above 24° N), temperature increases of nearly 1.2°C (2.1°F) have been documented since 1900. Temperature changes can result in shifts of weather patterns (rainfall and winds) which may then affect vegetation and habitat. The importance of temperature change and changes in precipitation in species migration and change is being investigated.

Several activities contribute to the phenomena of climate change, including emissions of GHGs (especially carbon dioxide and methane) from fossil fuel development, large wildlfires and activities using combustion engines, changes to the natural carbon cycle, and changes to radiative forces and reflectivity (albedo). It is important to note that GHGs will have a sustained climatic impact over different temporal scales (EPA 2008f). There has been, and continues to be, considerable scientific investigation and discussion as to the causes of the recent historic rise in global mean temperatures and whether the warming trend will continue.

Solar variability may play a role in global climate change, though the magnitude of the influence of increased sun activity is not well understood. Physical aspects of the sun, like sunspots and solar radiation output, are known to vary over time. The intensity of energy from the sun has varied through time and has resulted in global temperature variation.

Human population doubled to two billion from the period 1780 to 1930, then doubled again by 1974. The atmospheric concentrations of greenhouse gases have increased as human populations have increased. More land and resources were used to provide for the needs of these populations. As human activities have increased, carbon-based fuels have been used to provide for those additional energy needs. Forests and vegetation were cleared in order to provide for food production and human use.

Carbon dioxide (CO_2), methane, water vapor, ozone, and nitrous oxide (NO_2) are recognized as greenhouse gases. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Like glass in a

greenhouse, these gases trap radiation from the sun and act as an insulator around the Earth, holding in the planet's heat.

According to the IPCC's synthesis report (Bernstein et al. 2007):

- "Global atmospheric concentrations of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years."
- "Most of the observed increase in globally-averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations. It is likely there has been significant anthropogenic warming over the past 50 years averaged over each continent (except Antarctica)."
- "There is high agreement and much evidence that with current climate change mitigation policies and related sustainable development practices, global greenhouse gas emission will continue to grow over the next few decades."
- "Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would be very likely to be larger than those observed during the 20th century."
- "There is high confidence that by mid-century, annual river runoff and water availability are projected to increase at high latitudes and in some tropical wet areas and decrease in some dry regions in the mid-latitudes and tropics. There is also high confidence that many semi-arid areas (e.g., Mediterranean Basin, western United States, southern Africa and northeast Brazil) will suffer a decrease in water resources due to climate change."
- "Anthropogenic warming and sea level rise would continue for centuries due to the time scales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized."
- "Anthropogenic warming and sea level rise could lead to some impacts that are abrupt or irreversible, depending upon the rate and magnitude of the climate change."
- "There is high agreement and much evidence that all stabilization levels assessed can be achieved by deployment of a portfolio of technologies that are either currently available or expected to be commercialized in coming decades, assuming appropriate and effective incentives are in place for their development, acquisition, deployment and diffusion and addressing related barriers."

The National Academy of Sciences has confirmed these findings, but also has indicated there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature will not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures are

more likely than increases in daily maxiumum temperatures. Increases in temperatures would increase water vapor in the atmosphere, and reduce soil moisture, increasing generalized drought conditions, while at the same time enhancing heavy storm events. Although large-scale spatial shifts in precipitation distribution may occur, these changes are more uncertain and difficult to predict (EPA 2008f).

Relatively steep elevation gradients between valley floors and adjacent mountain ranges in the western U.S. produce considerable geographic climate variability. Warm, dry, semiarid conditions are typical on valley floors; moist and cool conditions are typical in higher parts of mountain ranges. Different plant communities occur within specific elevation zones. There also have been patterns of historic climatic variation in these areas for more than 10,000 years, during which plant communities gradually shift to higher or lower elevations depending on the direction of temperature and precipitation changes (Tausch et. al., 2004).

If global warming trends continue into the foreseeable future, Chambers (2006) indicates that the following changes may be expected to occur in the West:

- The amount and seasonal variability of precipitation will increase over most areas. IPCC (2001) climate model scenarios indicate that by 2100, precipitation will increase about 10 percent in summer, about 30 percent in fall, and 40 percent in winter. Less snowfall will accumulate in higher elevations, more precipitation will occur as rain, and snowmelt will occur earlier in the spring because of higher temperatures.
- Streamflow patterns will change in response to reduced snowpacks and increasing precipitation. Peak flows in spring are expected to occur earlier and be of lower magnitude because of snowpack changes. Runoff from greater amounts of winter rainfall will cause higher winter flows. Summer flows will be lower, but with higher variability depending on the severity of storm events.
- Some populations of native plants, invasive species, and pests will expand. Increasing amounts of atmospheric carbon dioxide and precipitation during the growing season will provide favorable growth conditions for native grasses, perennial forbs, woody species, and invasive annuals such as cheatgrass. Insect populations also will likely increase because milder winter temperatures will improve reproduction and survival rates.
- Fire frequency, severity, and extent will increase because of the increased availability of fine fuels (grasses, forbs, and invasives) and accumulation of fuels from previous growing seasons. Higher temperatures will extend the length of fire seasons. Expansion of pinyon-juniper species and increasing tree densities could increase the number of high severity crown fires. Higher rates of insect damage and disease also may increase fuel accumulations.
- Sensitive species and overall biodiversity will be reduced. High-elevation habitats will shrink in area or disappear as lower-elevation plant communities expand. It is probable that some mammalian, avian, and other species that currently inhabit these high-elevation habitats may become extinct. Higher

rates of disease and insect damage also may pose threats to other sensitive plant and animal species.

In 2006, transportation sources accounted for approximately 29 percent of total U.S. greenhouse gas emissions (EPA 2008a). Transportation is the fastest growing source of U.S. GHGs, accounting for 47 percent of the net increase in total U.S. emissions since 1990 (EPA 2008a). Transportation is also the largest end-use source of CO_2, which is the most prevalent GHG (EPA 2008a).

Historically, the coal mined in the PRB has been used as one of the sources of fuel to generate electricity in power plants located throughout the United States. Coal-fired power plant emissions include carbon dioxide (CO_2), which has been identified as a principal anthropomorphic greenhouse gas. According to the Energy Information Administration (DOE 2007a, 2007b):

- CO_2 emissions represent about 84 percent of the total U.S. greenhouse gas emissions.
- Estimated CO_2 emissions in the U.S. totaled 5,934.2 million metric tons in 2006, which was a 1.8 percent decrease from 2005.
- Estimated CO_2 emissions from the electric power sector totaled 2,343.9 million metric tons, or about 39.5 percent of total U.S. energy-related CO_2 emissions in 2006.
- Estimated CO_2 emissions from coal electric power generation in 2005 totaled 1,937.9 million metric tons or about 33 percent of total U.S. energy-related CO_2 emissions in 2006.
- Coal production from the Wyoming PRB represented approximately 42 percent of the coal used for power generation in 2006, which means that Wyoming PRB surface coal mines were responsible for about 13.9 percent of the estimated U.S. CO_2 emissions in 2006.

Wyoming PRB coal is shipped nationwide. The mines in the Powder River Basin have sold, and are expected to sell coal into the open coal market. Each mine's ability to sell coal in this market will determine annual production rates at that mine. Historically, the coal buyers have been domestic electric producers, although the coal could be used in other coal applications or could be exported.

Relatively little PRB coal, about two percent, is burned in Wyoming. In 2005, Wyoming coal went to 35 states besides Wyoming. As noted above, coal represented 50.2 percent of the fuel mix used by electric generators nationally in 2004. In the NERC power regions where PRB coal is sold, coal use ranges from 74.2 percent in the upper Midwest, to 15.6 percent in the northeast U.S. (EPA 2007f).

There are methods of generating electricity that result in fewer greenhouse gas emissions than burning coal, including natural gas, nuclear, hydroelectric, solar, wind, and geothermal resources. However, coal-burning power plants currently supply about 50 percent of the electric power generated in the U.S. The demand for power is increasing in the U.S. and throughout the world.

According to a recent report by the North American Electric Reliability Council, peak demand for electricity in the U.S. is expected to double in the next 22 years (Associated Press 2007). Many developing countries, including China and India, are also relying heavily on coal to meet their rapidly increasing power demands as coal is more economical and more available than other sources of electrical generation.

Coal sales are made on short term contracts, generally to individual power generators, or coal is sold on a spot market. This market is very dynamic and competitive. During the coal leasing EIS process, it is uncertain and speculative to predict who might purchase future PRB coal, how it would be used, and where the coal might be transported to.

Technologies for producing cleaner, more efficient, and more reliable power from coal are currently available, although not yet commercially established. These include advanced pulverized coal, circulating fluidized bed, and integrated gasification combined cycle (IGCC) technologies. One project that is proceeding, the FutureGen project, proposes to produce electricity by turning coal into gas, remove impurities including CO_2, and then sequester the CO_2 underground. A site in southeastern Illinois was recently selected for the plant, which has a goal of being operational in 2012 (Biello 2007).

At this time, there is no national policy or law in place that regulates CO_2 emissions. A number of bills were introduced in the U.S. Congress in 2007 related to global climate change. The Lieberman-Warner Climate Security Act, which was introduced in October, 2007 by Senators Joseph I. Lieberman (ID-CT) and John W. Warner (R-VA), would establish a cap-and-trade within the United States. This program would require a 70 percent reduction in greenhouse gas emissions from covered sources, which represents over 80 percent of total U.S. emissions. It was voted out of the Senate Environment and Public Works Committee in December, 2007 (http://www.pewclimate.org, accessed 12/21/2007).

Additionally, in 2007, the U.S. Supreme Court (Massachusetts v. EPA) held that CO_2 qualifies as an air pollutant under the Clean Air Act (CAA) Section 302(g). The case was remanded to EPA to take further action to regulate CO_2 under the CAA unless the EPA determines that CO_2 does not endanger public health or welfare. At this time, EPA has not made that determination.

Federal, state, and local governments are also developing programs and initiatives aimed at reducing energy use and emissions. The 2002 Clear Skies and Global Climate Change Initiative is a voluntary national program to reduce greenhouse gas emissions. There are federal tax incentives for energy efficiency and conservation, and some states have renewable energy and energy efficiency policies. Regional initiatives have been started in the northeast (Northeast Regional Greenhouse Gas Initiative) as well as the Western Climate Initiative in the western states. At this time, it is not possible to predict how all of these

programs would be melded into a national regulatory process if one were to be enacted.

A number of U.S. financial and corporate interests have acknowledged that enactment of federal legislation limiting the emissions of CO_2 and other greenhouse gases seems likely (NARUC 2007). There is uncertainty about anticipated CO_2 emission limits and carbon capture/sequestration regulations. This has caused some proponents to cancel or delay their proposed projects that use existing and emerging technologies to produce electricity from coal (Casper Star Tribune 2007c, 2007d).

The regulatory mechanisms proposed under the Climate Security Act, as well as the past regulation of other pollutants under the CAA, are imposed at the point when coal is burned and converted to electric energy and by-products like CO_2. Over 95 percent of coal produced in the PRB is sold in an open market where coal is purchased on short term contracts or spot prices based on a coal feed stock that is suitable for each buyer's power generating facility. Coal production at any one mine is not tied in any predictable way over a period of time to any one power plant. Power plant buyers attempt to buy coal from suppliers at the most economical prices that meet their needs. PRB coal has competed well in this market due to its low sulfur content. This makes it valuable in lowering sulfur dioxide pollution, as well as competitive mining costs when compared to delivered costs of coal from other coal producing areas.

U.S. coal production increased from 1,029.1 million tons in 1990, when the Powder River Federal Coal Region was decertified, to 1,161.4 million tons in 2006, an increase of 12.9 percent (DOE 2007c). Wyoming coal production increased from 184.0 million tons in 1990 to 444.9 million tons in 2006, an increase of 242 percent (Wyoming Department of Employment 2007a). The share of electric power generated by burning coal was consistently around 50 percent during that time frame. Also, the percentage of total U.S. CO_2 emissions related to coal consumption was consistently around 36 percent during that same time frame. The percentage of U.S. CO_2 emissions related to the coal electric power sector increased from about 31 percent in 1990 to about 33 percent in 2006 (DOE 2007a, 2007b).

Wyoming coal production has increased at a more rapid rate than other domestic coal. Wyoming Powder River Basin coal is low in sulfur, providing a way for electric generators to achieve acid rain reduction requirements. Coal coming out of the Wyoming PRB is mined using surface mining methods which are generally safer and less labor intensive than underground mining. Rural rangelands are the areas that are mainly mined; they are reclaimed according to WDEQ/LQD's standards (see Section 3.9.4). PRB coal reserves are in thick seams, resulting in more production from areas of similar land disturbance, and lower mining and reclamation costs.

As discussed earlier in this chapter, future coal mining impacts are estimated based on two forecast scenarios for PRB coal production through 2020. In the

low scenario, the percentage of coal use for electric generation would stay about the same, assuming that all forms of electric generation would grow at a proportional rate to meet forecast electric demand. In the high scenario, percentage of coal use would also remain about the same, but with PRB coal displacing coal from other domestic coal regions.

If public sentiment results in changed electric demand, or if CO_2 emissions are ultimately regulated, the demand forecast for coal for electric generation could change. The Department of Energy has forecasted that by 2030, the coal share of total energy use will increase from 23 percent in 2006 to 25 percent in 2030, while the share of natural gas will fall from 22 percent to 20 percent, and the liquids share is predicted to fall from 40 percent to 37 percent. The combined share of carbon-neutral renewable and nuclear energy is forecasted to grow from 15 percent in 2006 to 17 percent in 2030.

Taken together, projected growth in the absolute level of primary energy consumption and a shift toward a fuel mix with slightly lower average carbon content will cause projected energy-related emissions of CO_2 to grow by 16 percent from 2006 to 2030. This is slightly lower than the projected 19 percent increase in total energy use. Over the same period, the economy becomes less carbon-intensive, because the 16 percent increase in CO_2 emissions is about one-fifth of the projected increase in GDP (79 percent), and emissions per capita decline by 5 percent.

In the 2008 study, projected energy-related CO_2 emissions grew from 5,890 million metric tons in 2006 to 6,851 million metric tons in 2030. In the Annual Energy Outlook 2008 study, energy-related CO_2 emissions were projected to grow by about 35 percent, to 7,950 million metric tons in 2030. This reflects both a higher projection of overall energy use and, to a lesser extent, a different mix of energy sources (DOE 2008a). This forecast is within the range of the high and low scenarios presented in Chapter 4.

The Annual Energy Outlook 2008 report projected that energy-related emissions of CO_2 will grow by 16 percent from 2006 to 2030. In this projection, the mix of sources for this generation include coal, natural gas, nuclear, liquids (petroleum), hydro-power, and non-hydro renewable (wind, solar, etc.). The forecasted generation mix by 2030 as compared to 2007 is included in Table 4-35.

Table 4-35. Projected Percent of CO_2 Emissions by Source (2007 and 2030).

Source	2007	2030
Coal	51%	58%
Nuclear	21%	19%
Natural Gas	18%	11%
Petroleum	1%	1%
Hydro Power	7%	6%
Renewable	2	5%

The Electric Power Research Institute (James 2007) attempted to identify a scenario of how the full portfolio of technologies to provide for electric energy would respond if national policy were to require that CO_2 emissions be reduced to 1990 levels. As noted earlier, there is no regulatory structure or CO_2 emission levels or limits that have been set by national policy or law yet. This scenario provides some analysis of the possible effect of regulation as well as decreased demand through energy efficiency at the user end, in transmission, and at the producer end. The forecasted generation mix by 2030 as compared to 2007 is included in Table 4-36.

Table 4-36. Projected Percent of CO_2 Emissions by Source (2007 and 2030) Under a Reduced CO_2 Emissions Scenario.

Source	2007	2030
Coal	51%	52%
Nuclear	21%	29%
Natural Gas	18%	5%
Petroleum	1%	0%
Hydro Power	7%	5%
Renewable	2	9%

This study predicts that national policy that forces a reduction of CO_2 emissions to 1990 levels would promote increased energy efficiency, and the growth of "non-carbon" sources such as nuclear and renewable. Renewable sources include wind and solar, as well as emerging technologies like tidal power and river turbines. Hydropower is limited because most opportunities for hydropower have already been used or require large infrastructure. Carbon-based sources such as coal, gas, and petroleum are reduced as compared to the EIA forecast. Both EIA and EPRI predict increases in electricity cost.

The mines in the PRB, and the Antelope Mine in particular, have sold and are anticipated to sell coal in the open coal market. In both EIA market projections and projections that contemplate CO_2 regulation, the coal market supplies half or more of the electric generation mix through 2020. Each mine's ability to sell coal in this market will determine annual production rates at that mine. Historically, the coal buyers have been domestic electricity producers, although the coal could be used in other coal applications or could be exported.

The Antelope Mine produced 33.9 million tons of coal in 2006, which represents about 7.9 percent of the coal produced in the Wyoming PRB in 2006, or about 1.1 percent of the estimated U.S. CO_2 emissions in 2006. Under the No Action Alternative, CO_2 emissions attributable to burning coal produced by the Antelope Mine would be extended at about this level for approximately eleven years, or until about 2018, while the mine recovers its remaining estimated 394.3 million tons of currently leased coal reserves. It is likely that, by that time, regulations limiting CO_2 emissions will be in place and, potentially, projects utilizing the emerging technologies to reduce and/or sequester CO_2 emissions would be more established.

Section 3.18.2 contains estimates of greenhouse gas emissions resulting from the specific mine operations at the Antelope Mine from projected operations under the proposed action and alternatives.

Under the Proposed Action and Alternatives 1 and 2, the Antelope Mine anticipates producing the coal included in the West Antelope LBA tract at currently permitted levels using existing production and transportation facilities. This would extend CO_2 emissions related to burning coal from Antelope Mine for up to 13 additional years beyond 2018. It is not possible to project the level of CO_2 emissions that burning the coal in the West Antelope II LBA tract would produce due to the uncertainties about what emission limits will be in place at that time or where and how the coal in the West Antelope II LBA tract would be used after it is mined. It is not likely that selection of the No Action Alternative would result in a decrease of U.S. CO_2 emissions attributable to coal-burning power plants in the long term. There are multiple other sources of coal that, while not having the cost, environmental, or safety advantages, could supply the demand for coal beyond the time that the Antelope Mine completes recovery of the coal in its existing leases.

CBNG is composed primarily of methane, another greenhouse gas. CBNG is released into the atmosphere when coal is mined. According to the U.S. Energy Information Administration (DOE 2007a, 2007b):

- U.S. anthropogenic methane emissions totaled 605 million metric tons CO_2 equivalent in 2006.
- U.S. 2006 methane emissions from coal mining were estimated at 64.7 million metric tons CO_2 equivalent, which represents approximately 10.7 percent of the U.S. total anthropogenic methane emissions in 2006.
- Surface coal mining operations in the U.S. were estimated to be responsible for methane emissions of about 14.2 million metric tons of CO_2 equivalent in 2006, which represents about 2.35 percent of the estimated U.S. anthropogenic methane emissions in 2006, and about 22 percent of the estimated methane emissions attributed to coal mining of all types.
- The Wyoming PRB produced approximately 53.7 percent of the coal mined in the U.S. in 2006 using surface mining techniques. Based upon the U.S Energy Information Administration analysis, Wyoming PRB surface coal mines were responsible for approximately 1.26 percent of the estimated U.S. anthropomorphic methane emissions in 2006. Antelope Mine contributes about eight percent of the Wyoming PRB production.

Since 1990, when BLM began leasing using the lease by application process, total U.S. anthropogenic methane emissions declined from 708.4 million metric tons CO_2 equivalent to 605.1 million metric tons CO_2 equivalent in 2006. Total coal mining related emissions declined from 97.7 million metric tons CO_2 equivalent to 64.7 million metric tons CO_2 equivalent during the same time period. The Energy Information Administration (DOE 2007b) attributes the overall decrease in coal mine emissions of methane since 1990 to the fact that

the coal production increases during that time had been largely from surface coal mines that produce relatively little methane.

CBNG is currently being commercially produced by oil and gas operators from wells within and near the West Antelope II LBA tract. CBNG that is not recovered prior to mining would be vented to the atmosphere during the mining process. Selection of the No Action Alternative would potentially allow more complete recovery of the CBNG from the West Antelope II LBA tract in the short term (ten years) during the time that the mine's currently leased coal is being recovered.

However, BLM's analysis suggests that a large portion of the CBNG resources that are currently present on the tract would be recovered prior to mining under the Proposed Action or Alternatives 1 or 2. Selection of the No Action Alternative would not likely directly decrease U.S. methane emissions attributable to coal mining in the long term because there are multiple other sources of coal that could supply the coal demand beyond the time that Antelope Mine recovers the coal in its existing leases.

4.2.13.2 Mercury, Coal Combustion Residues, and Other By-Products

To meet the nationwide consumer demand and requirement for electricity, coal is burned in power plants to produce electricity for the United States. Coal is an important component of the U.S. energy supply partly because it is the most abundant domestically available fossil fuel (USGS 2002b). One-quarter of the world's coal reserves are found within the United States (DOE 2008b); the energy content of U.S. coal resources exceeds that of all the world's known recoverable oil (DOE 2008b). Coal resources supply more than half of the electricity consumed by Americans (DOE 2008b). Many countries are even more reliant on coal for their energy needs than is the United States (USGS 2000). More than 70 percent of the electricity generated in China and India comes from coal (USGS 2000). The value of coal is partially offset by the environmental impacts of coal combustion (USGS 2000). As described below, some of these impacts may have direct or indirect effects on human health (USGS 2000).

One of the concerns associated with burning coal for electricity production is the release of elements from coal to the environment (USGS 2002b). When coal is burned, carbon dioxide, sulfur dioxide, nitrogen oxides, mercury, and other compounds and elements, including lead and cadmium, are released (EPA 2007g). The principal pollutants generated by coal combustion that can cause health problems are particulates, sulfur and nitrogen oxides, trace elements (including arsenic, fluorine, selenium, and radioactive uranium and thorium), and organic compounds generated by incomplete coal combustion (USGS 2000).

In coal combustion, concentrations of these elements and compounds vary depending on the chemistry of the coal deposits and on the type of air pollution controls in place when the coal is burned. Coal use in developing countries can potentially cause serious human health impacts (USGS 2000). Some coal mined

in China is known to have caused severe health problems in several local populations because the coal was mined and burned with little regard to its chemical composition (USGS 2000). Chinese coals that contained high levels of arsenic, fluorine, selenium, and polycyclic aromatic hydrocarbons have caused severe life-threatening health impacts to people that burned the coal in unvented stoves in their homes (USGS 2000).

Coal that is burned in the U.S. generally contains low to modest concentrations of potentially toxic trace elements and sulfur (USGS 2000). Specifically, Powder River Basin coal is recognized as being a clean burning coal due to its low sulfur and low ash properties. In a 2002 analysis conducted by USGS (2002b), PRB coal was found to contain, on average, approximately 8 times less sulfur than coals being utilized from the Appalachian and Illinois basins to supply U.S. power plants (feed coal). PRB feed coal was also found to contain nearly half as much uranium (8.9 ppm), 7 times less arsenic (17 ppm), 5 times less lead (19 ppm), and 3 times less cadmium (1.1 ppm) as compared to Appalachian and Illinois basin feed coals. When burned, PRB coal produced, on average, 38 percent less fly ash than Appalachian and Illinois basin coals (USGS 2002b).

Additionally, many U.S. coal burning power plants use sophisticated pollution-control systems that efficiently reduce the emission of hazardous elements (USGS 2000). The EPA conducted a detailed study of possible health impacts from exposure to emissions of approximately 20 potentially toxic substances from U.S. coal-burning power plants (USGS 2000). The EPA concluded that, with the exception of possibly mercury, there is no compelling evidence to indicate that emissions from U.S. coal-burning power plants cause human health problems (USGS 2000).

Mercury is a naturally occurring element and enters the environment as a result of natural sources, such as active volcanoes, and through human activities such as industrial combustion and mining (EPA 2006a). Natural sources of mercury, such as volcanic eruptions and emissions from the ocean, have been estimated to contribute about 33 percent of the current worldwide mercury air emissions; anthropogenic (human-caused) mercury emissions account for the remaining 67 percent, though these estimates are highly uncertain (EPA 2007n).

When fossil fuels burn, mercury vapor can be released into the atmosphere where it may drift for a year or more, spreading with air currents over vast regions of the globe (DOE 2006b). In 1995, an estimated 5,500 tons of mercury was emitted globally from both natural and human sources (DOE 2006b). Coal-fired power plants in the United States contributed to less than 1 percent of that total (DOE 2006b).

Mercury is a global problem that knows no national or continental boundaries. It can travel thousands of miles in the atmosphere before it is eventually deposited back to the earth in rainfall or in dry gaseous forms (EPA 2007n). EPA estimates that about one-third of the U.S. anthropogenic mercury

emissions are deposited within the contiguous U.S. and the remainder enters the global cycle (EPA 2007n).

Table 4-37 summarizes how the various continents contributed to the worldwide anthropogenic mercury emissions in 2004. The 2004 U.S. anthropogenic mercury emissions were estimated to account for about three percent of the global total (EPA 2007n). EPA (2006a) estimates that 83 percent of the mercury deposited in the U.S. originates from international sources, with the remaining 17 percent coming from the U.S. and Canada. These figures include mercury from natural and anthropogenic sources.

Table 4-37: 2004 Percent Contribution to Worldwide Anthropogenic Mercury Emissions

Continent	Percent
Asia	53%
Africa	18%
Europe	11%
North America	9%
Australia	6%
South America	4%

Source: (EPA 2007n)

In 2006, EPA estimated that 50-70 percent of current global anthropogenic atmospheric emissions came from fuel combustion, and much of it came from China, India, and other Asian countries (EPA 2006b). Coal consumption in Asia is expected to grow significantly over the next 20 years (EPA 2006b). This international source of mercury emissions may grow substantially if left unaddressed (EPA 2006b).

Over the past decade, addressing environmental and human health mercury risks has been a focus for EPA (EPA 2006a). Overall U.S. mercury air emissions have been reduced by 45 percent since 1990 (EPA 2006a). EPA is most concerned with methyl mercury, a potent form of mercury and the form to which humans are primarily exposed (EPA 2006a).

Atmospheric mercury can settle into water or onto land where it can be washed into the water. Certain microorganisms can transform mercury into methyl mercury, a highly toxic mercury compound that builds up in fish and shellfish when they feed. Methyl mercury is the only form of mercury that biomagnifies in the food web. Concentrations of methyl mercury in fish are generally on the order of a million times the methyl mercury concentration in the water (EPA 2006a). The primary pathway of human exposure to mercury is through eating fish containing methyl mercury (EPA 2006a).

There are adverse health effects to humans and other animals that consume these fish and shellfish. Birds and mammals that eat fish may be more exposed to mercury more than other animals in water ecosystems (EPA 2008d). At high levels of exposure, methyl mercury's harmful effects may include death, reduced reproduction, slower growth and development, and abnormal behavior (EPA

2008d). Research has shown that most people's fish consumption does not cause a health concern, but high levels of methyl mercury in the bloodstream of unborn babies and young children may harm the developing nervous systems of those children (EPA 2006a).

DOE's Office of Fossil Energy has been sponsoring studies on mercury emissions from coal-based power generators to identify effective and economical control options for the past decade (DOE 2006b). The Office of Fossil Energy manages the largest funded program in the U.S. for developing an understanding of mercury emissions and developing emission control technologies for the coal-fired electric generating industry in the U.S. (DOE 2006b). Research on advanced and improved mercury control technology is ongoing (DOE 2006b).

In the U.S., coal-burning power plants are the largest human-caused source of mercury emissions being released into the air, accounting for about 40 percent of all domestic human-caused mercury emissions (EPA 2008d). However, these emissions contribute little to the global mercury pool. EPA estimated that mercury emissions from U.S. coal-fired power plants account for about one percent of the global total (EPA 2007e).

Coal production from the Wyoming PRB represented approximately 42 percent of the coal used for power generation in 2006, which would represent about 0.4 percent of the global anthropogenic mercury emissions. The Antelope Mine produced about 7.9 percent of the coal produced in the Wyoming PRB in 2006, which would represent about 0.03 percent of the global mercury emissions. Under the No Action Alternative, mercury emissions attributable to burning coal produced by the Antelope Mine would be extended at about current levels for approximately eleven years, or until about 2018, while the mine recovers its remaining estimated 394.3 million tons of currently leased coal reserves. Under the Proposed Action or Alternatives 1 or 2, the Antelope Mine's contributions to global mercury emissions would be extended from 9 to 13 additional years beyond 2018. As discussed above, uncertainties about what emissions limits will be in place at that time and where and how the coal in the West Antelope II LBA tract would be used after it is mined make the level of mercury emissions that burning the coal in the West Antelope II LBA tract would produce unpredictable at this time.

Additionally, burning coal in electric utility boilers generates residual materials which are referred to as coal combustion residues. These residues include non-combustible materials left in the furnaces and ash that is carried up the smokestacks and collected by air pollution control technologies. As previously referenced, coal and coal combustion residues can contain a variety of compounds, metals, and other elements depending on the coal deposit and upon the site-specific characteristics of where the coal originated from. Coal-fired boilers are required to have control devices to reduce the amount of emissions that are released into the atmosphere (EPA 2007g). The use of air pollution control equipment at power plants has resulted in fewer emissions but has also increased the amount of solid residues. In the past, coal combustion residues

have generally been recycled or disposed of in landfills or surface impoundments. More recently, these residues have been disposed of in mines. There can potentially be risks of contamination of drinking water supplies and surface water bodies by coal combustion residues, particularly when they are disposed of in mines (National Research Council 2006). The EPA is evaluating management options for solid wastes from coal combustion, including whether current management practices pose risks to human health or ecological receptors. A draft report, dated August 6, 2007, prepared for the EPA Office of Solid Waste, and entitled "Human and Ecological Risk Assessment of Coal Combustion Wastes", is available at http://www.earthjustice.org/library; however, the report is labeled as a draft document which is not to be cited or quoted.

As discussed above, the Antelope Mine produced about 7.9 percent of the coal produced in the Wyoming PRB in 2006. Coal produced by the Antelope Mine prior to this time has been shipped to coal-burning power plants around the country. It has not been burned by local power plants and, therefore, coal combustion residues produced from burning the Antelope Mine coal were not disposed of at the mine. Under the No Action Alternative, production of coal combustion residue attributable to burning coal from the Antelope Mine would be extended at about current levels for approximately eleven years, or until about 2018, while the mine recovers its remaining estimated 394.3 million tons of currently leased coal reserves. Under the Proposed Action or Alternatives 1 or 2, coal combustion residue related to burning coal mined at the Antelope Mine would be extended from 9 to 13 additional years beyond 2018. As discussed above, uncertainties about future regulatory requirements and where and how the coal in the West Antelope II LBA tract would be used after it is mined do not make it possible to project what the impacts of disposing of coal combustion residues produced by burning the coal in the West Antelope II LBA tract would be. Depending on the size, shape, and chemical composition, some coal combustion residues can be recycled and beneficially reused as components of building materials or as replacement to raw materials that would ordinarily need to be mined such as sand, gravel, or gypsum (EPA 2007h). Coal combustion products (CCPs) are the materials produced primarily from the combustion of coal in coal-fired power plants (EPA 2007h) and can include the following materials: fly ash, bottom ash, boiler slag, and flue gas desulfurization material (EPA 2007h). Studies and research conducted or supported by the EPA, Electric Power and Research Institute (EPRI), other government agencies, and universities have indicated that the beneficial uses of coal combustion products have not been shown to present significant risks to human health or the environment (EPA 2008c).

Fly ash is a byproduct of burning finely ground coal in a boiler to produce electricity (EPA 2007k). Physically, fly ash is a fine, powdery material composed mostly of silica and nearly all particles are spherical in shape (EPA 2007e). Fly ash is a pozzolan—a siliceous material which, in the presence of water, will react with calcium hydroxide at ordinary temperatures to produce cementitious compounds (EPA 2007k). Because of its spherical shape and pozzolanic

properties, fly ash can be useful in cement and concrete applications (EPA 2007k).

Bottom Ash is agglomerated ash particles, formed in pulverized coal furnaces that are too large to be carried in the flue gases (EPA 2007j). Bottom ash is coarse with grain sizes spanning from fine sand to fine gravel (EPA 2007j). It can be used as a replacement for aggregate and is usually sufficiently well-graded in size to avoid the need for blending with other fine aggregates to meet gradation requirements (2007d).

Boiler slag is the molten bottom ash collected at the base of slag tap and cyclone type furnaces (EPA 2007l). Boiler slag particles are uniform in size, hard, and durable with a resistance to surface wear (EPA 2007l). The permanent black color of this material is desirable for asphalt applications and aids in the melting of snow (EPA 2007l).

Flue Gas Desulfurization (FGD) material is a product of a process typically used for reducing SO_2 emissions from the exhaust gas system of a coal-fired boiler (EPA 2007m). These materials can be used as embankment and road base material, wallboard manufacturing, and in place of gypsum for the production of cement (EPA 2007m). Currently, the largest single market for FGD material is in wallboard manufacturing (EPA 2007m).

Utilizing CCPs can generate significant environmental and economic benefits (EPA 2007h). CCPs can be used for raw feed for cement clinker, concrete, grout, flowable fill, structural fill, road base/sub-base, soil modification, mineral filler, snow and ice traction control, blasting grit and abrasives, roofing granules, mining applications, wallboard, waste stabilization/solidification, and soil amendment (EPA 2007h).

Using CCPs can reduce energy consumption and greenhouse gas emissions and can help reduce the need for landfill space (EPA 2007i). Economic benefits include reduced costs associated with managing coal ash and slag disposal, potential revenue from the sale of CCPs, and savings from using CCPs in place of other more costly raw materials (EPA 2003b).

CCPs offer product-performance benefits as well. Boiler slag is a sought-after replacement for sand in blasting grit because it is free of silica and eliminates the potential health risk of silicosis (EPA 2007i). High coal ash content concrete is used for building long-lived pavements designed to last 50 years—twice the lifetime of conventional pavements (EPA 2003b). Coal fly ash can create superior products because of its self-cementing properties (EPA 2007i). Using coal fly ash in concrete can also produce stronger and longer-lasting buildings (EPA 2007i). This not only reduces the costs of maintaining buildings, but provides the additional environmental benefit of reducing the need for new concrete to repair or replace aging buildings. This translates to a significant reduction in future energy consumption and GHG emissions (EPA 2007i).

In 2005, demand had become so strong for coal ash that some power plants were selling all the ash they produced (EPA 2005c). EPA (2008e) estimated that through the utilization of 15 million tons of coal fly ash, the U.S. reduced their greenhouse gas emissions equivalent to the annual emissions of nearly 2.5 million passenger vehicles.

Because of the many potential uses of CCPs, EPA has sponsored the Coal Combustion Products Partnership (C2P2) Program to further the beneficial use of these coal combustion by-products (EPA 2003b). With more than 170 private and public partners (EPA 2008e), the C2P2 Program is a cooperative effort between EPA and various organizations to help promote the beneficial use of CCPs and the environmental benefits which can result from the proper use of these potentially recyclable materials (EPA 2003b). The C2P2 program will help meet the national waste reduction goals of the Resource Conservation Challenge—an EPA effort to find flexible yet more protective ways to conserve valuable natural resources through waste reduction, energy recovery, and recycling (EPA 2008b).

In 2007, the U.S. used approximately 43 percent of its coal combustion products (EPA 2008e). The C2P2 program aims to reduce adverse effects on air and land by increasing the use of coal combustion products to 50 percent in 2011 from 31 percent in 2001 (EPA 2008b). The program also plans to increase the use of CCPs as a supplementary cementitious material in concrete by 50 percent, from 12.4 million tons in 2001 to 18.6 million tons in 2011 (EPA 2008b); this would decrease GHG emissions from avoided cement manufacturing by approximately 5 million tons (EPA 2008b).

5.0 CONSULTATION AND COORDINATION

In addition to this EIS[1], other factors and consultations are considered and play a major role in determining the decision on this proposed lease application. These include the following:

Regional Coal Team Consultation

The West Antelope II coal lease application was reviewed and discussed at the April 27, 2005 PRRCT public meeting in Gillette, Wyoming. ACC presented information about the existing Antelope Mine and the pending lease application to the PRRCT at that meeting. Voting and nonvoting members of the PRRCT include the governors of Wyoming and Montana, the Northern Cheyenne Tribe, the Crow Tribal Council, the USDA-FS, OSM, USFWS, NPS, and USGS. The PRRCT determined that the lands in the application met the qualifications for processing as a production maintenance tract and recommended that the BLM continue to process the West Antelope II lease application.

Governor's Consultation

On April 13, 2005, the BLM Wyoming State Director notified the Governor of Wyoming that ACC had filed a coal lease application with BLM for the West Antelope II LBA tract.

Public Notice

BLM published a Notice of Intent to Prepare an Environmental Impact Statement and Notice of Public Meeting in the *Federal Register* on October 17, 2006. The publication served as public notice that the West Antelope II coal lease application had been received, initiated the public scoping process, announced the time and location of a public scoping meeting, and requested public comment on the lease application.

Parties on the distribution list were sent letters announcing the time and location of a public scoping meeting. The public scoping meeting was held on November 1, 2006 in Douglas, Wyoming. At the public meeting, the applicant orally presented information about their mine and their need for the coal. The presentation was followed by a question and answer period. The scoping period extended from October 17 through December 1, 2006.

The EPA published a Notice of Availability for the DEIS in the *Federal Register* on February 8, 2008. A 60-day comment period on the Draft EIS commenced with publication of the EPA's notice of availability and ended on April 8, 2008. The BLM published a Notice of Availability/Notice of Public Hearing in the *Federal*

[1] Refer to page xvi for a list of abbreviations and acronyms used in this document.

Register on March 17, 2008. A formal public hearing was held on March 24, 2008, at 7:00 p.m. at the Best Western Douglas Inn in Douglas, Wyoming to solicit public comments on the DEIS and on the fair market value, the maximum economic recovery, and the proposed competitive sale of federal coal from the West Antelope II LBA tract. The applicant and three members of the public made statements during the hearing, and the BLM received fourteen written comments on the DEIS. These comments are included, with agency responses, as Appendix J of this Final EIS.

Parties on the distribution list will be sent copies of the FEIS when it is completed, and the EPA and BLM will each publish a Notice of Availability for the FEIS. After a 30-day availability period, BLM will make a decision to hold or not to hold a competitive lease sale for the federal coal in this LBA tract and a ROD will be signed. Copies of the ROD will be mailed to parties on the mailing list and others who commented on this LBA during the NEPA process. After the ROD is signed, there will be a 30-day appeal period before the ROD is implemented. If lands administered by USDA-Forest Service are included in the tract that is offered for lease, the USDA-FS will prepare and sign a separate ROD and the applicable Forest Service regulations for appeal will be followed.

Department of Justice Consultation

After a competitive coal lease sale, but prior to issuance of a lease, BLM will solicit the opinion of the Department of Justice on whether the planned lease issuance creates a situation inconsistent with federal anti-trust laws. The Department of Justice is allowed 30 days to make this determination. If the Department of Justice has not responded in writing within the 30 days, BLM can proceed with issuance of the lease.

Other Consultations

Other federal, state, local, and Native American governmental agencies that have been or will be consulted prior to making a decision to hold or not to hold a federal coal lease sale are listed in the following tables.

Contributors, Reviewers, and Preparers

This EIS was prepared by EDE Consultants, a third-party contractor, under the direction of the BLM. Representatives from cooperating agencies reviewed and contributed to the EIS. Tables 5-1 and 5-2 provide listings of the BLM, cooperating agency, and third-party consultant personnel who prepared and reviewed this EIS.

Distribution List

This EIS was distributed to Congressional offices, federal agencies, state

governments, local governments, industry representatives, interest groups, and individuals for their review and comment (Table 5-3).

Table 5-1. List of Contributors and Reviewers.

Name	Project Responsibility
BLM Casper Field Office	
Mike Karbs	Project Supervisor
Sarah Bucklin	EIS Project Leader, Environmental Specialist, Wildlife
Nancy Doelger	EIS Project Advisor, Environmental Specialist
Chris Arthur	Paleontology, Cultural, Recreation, Visual Resources
Jim Wright	Wildlife
Shane Gray	Wildlife
Mike Brogan	Water Resources
Shane Evans	Water Resources
Bob Specht	Mining Claims
BLM Wyoming State Office	
Bob Janssen	Coal Program Coordination
Janet Kurman	NEPA Coordination
Mavis Love	Land Adjudication
Larry Jensen	Socioeconomics
Steve Hageman	Minerals Appraiser
Susan Caplan	Air Quality and Climate
John Zachariassen	Air Quality and Climate
Rick Schuler	Water Resources
BLM Wyoming Reservoir Management Group	
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Lee Almasy	CBNG Reservoir Engineering
BLM Buffalo Field Office	
B.J. Earle	Cultural Resources
Leigh Grench	Cultural Resources
Clint Crago	Cultural Resources
Buck Damone	Cultural Resources
Larry Gerard	Wildlife
Jerry Queen	Mining Claims
BLM National Science and Technology Center (Powder River Basin Coal Review)	
Craig Nicholls	Air Quality and Climate
Paul Summers	Water Resources
Office of Surface Mining Reclamation and Enforcement Western Regional Coordinating Center	
Foster Kirby	Acting NW Branch Manager
Heather Erickson	EIS Project Coordinator

Table 5-1. List of Contributors and Reviewers (Continued).

Name	Project Responsibility
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Cristi Lockman	Wildlife
Richard Stem	Vegetation
Kathy Roche	Vegetation
Tim Byer	Wildlife
	Wyoming State Planning Office
Steve Furtney	Coal Issues Coordination/Cooperating Agency Representative
	Board of Converse County Commissioners
James H. Willox - Chairman	EIS Cooperating Agency Representative
	Wyoming Department of Environmental Quality
Dan Clark	Ombudsman
	Land Quality Division
Don McKenzie	Administrator
Kathy Muller Ogle	CHIA Program Supervisor
Lowell Spackman	District One Supervisor/EIS Cooperating Agency Division Representative
Doug Emme	Blasting Program Principal
Mark Rogaczewski	District Three Supervisor
	Air Quality Division
Kelly Bott	Engineer/EIS Cooperating Agency Division Representative
Paige Smith	Planning Section Manager
	Water Quality Division
John Wagner	Water Resources
	University of Wyoming
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Ron Hartman	Rocky Mountain Herbarium Curator
B. Ernie Nelson	Rocky Mountain Herbarium Manager
	ENSR International (Powder River Basin Coal Review)
Valerie Randall	Project Manager
Dolora Koontz	Assistant Project Manager and Task 2 Manager (Existing Development and Reasonably Foreseeable Development)
Eldon Strid, Matt Reilly	Existing and Projected Coal Development and Coal Transportation Scenarios
Doree Dufresne	Database Development
Bruce MacDonald, PhD	Air Quality
Robert Berry, PhD	Water Resources

Table 5-1. List of Contributors and Reviewers (Continued).

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Brad Anderson	Surface Water
Ron Dutton, George Blankenship	Socioeconomics
Bernhard Strom	Land Use, Transportation, and Utilities
William Berg	Topography, Geology, and Minerals
James Burrell, James Nyenhuis	Soils and Alluvial Valley Floors
Jon Alstad	Vegetation, Wetlands, and Grazing
Charles Johnson	Wildlife
Rollin Daggett	Fisheries
Kim Munson	Native American Concerns, and Paleontological Resources

Table 5-2. List of Preparers.

Name	Education/Experience	Responsibility
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Nancy Doelger	M.S., B.S. Geology, 30 years professional experience	EIS Project Advisor
	EDE Consultants Third-Party Contractor	
Cheryl Naus	B.S. Geology, M.S. Geology and Geological Engineering, 12 years professional experience, Licensed Professional Geologist	Project Management Report Preparation
Bruce Nelson	B.S. Fish and Wildlife Management, M.S. Civil Engineering, 28 years professional experience, Registered Professional Engineer	Project Management
Kevin Lyon	B.S. Environmental Biology/Landscape Ecology, 4 years professional experience	Report Preparation
Sara Nelson	B.S. Mechanical Engineering, 28 years professional experience, registered EIT	CAD and GIS Map Production
	GCM Services Subcontractor for AM	
Dave Ferguson	M.A. Anthropology, 19 years professional experience	Cultural Resources, Paleontological Resources
	Intermountain Resources Subcontractor for AM	
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Russell Tait	B.S. Wildlife Management, 15 years professional experience	Wetlands and Vegetation
	James Nyenhuis Subcontractor for Intermountain Resources	
James Nyenhuis	M.A., Certified Professional Soil Scientist, 29 years professional experience	Soils
	McVehil-Monnett Associates Subcontractor for AM	
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John Gilpin	B.S. Atmospheric Science 19 years professional experience	Air Quality

Table 5-2. List of Preparers (Continued).

Name	Education/Experience	Responsibility
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	Thunderbird - Jones & Stokes **Subcontractor for AM**	
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	WWC Engineering **Subcontractor for AM**	
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Dale Brown	B.S., M.S. Agricultural Engineering, 15 years professional experience, Licensed Professional Engineer	Water Resources and Geology
Nic Bateson	B.S. Civil/Environmental Engineering, 7 years professional experience, Licensed Professional Engineer	Water Resources

Table 5-3. BLM Distribution List for Coal Leasing.

Federal and State Officials

Governor of Montana Brian Schweitzer
Governor of Wyoming Dave Fruedenthal
US Representative Barbara Cubin
US Senator John Barrasso
US Senator Mike Enzi
Wyoming Representative Timothy Hallinan
Wyoming Representative Erin Mercer
Wyoming Representative Sue Wallis
Wyoming Representative Thomas Lubnau
Wyoming Representative Dave Edwards
Wyoming Senator Jim Anderson
Wyoming Senator John Hines
Wyoming Senator Michael Von Flatern

Federal Agencies

BLM Library, Denver CO
BLM Library, Washington DC
BLM, Billings MT
BLM, Buffalo WY
BLM, Casper WY
BLM, Cheyenne WY
BLM, Miles City MT
BLM, Washington DC

Bureau of Indian Affairs, Washington DC
Bureau of Reclamation, Denver CO
Department of Energy, Casper WY
Department of Energy, Cheyenne WY
Department of Energy, Washington DC
Department of Interior, Denver CO
Dept of Interior Natural Resources Library
Devils Tower National Monument
EPA Region VIII, Denver CO
MMS, Denver CO
MMS, Herndon VA
NPS Air Resources Division
NPS, Denver CO
NPS, Washington DC
NRCS, Douglas, WY
OSM Library, Denver CO
OSM, Casper WY
OSM, Denver CO
OSM, Washington DC
Rocky Mountain Regional Solicitor
US Air Force Environmental Division
US Army Corps of Engineers, Cheyenne WY
US EPA, Washington D.C.
US Fish & Wildlife Service, Arlington VA
US Fish & Wildlife Service, Cheyenne WY
US Geological Survey, Cheyenne WY
US Geological Survey, Denver CO
US Geological Survey, Reston VA
US Government Printing Office
USDA-FS Douglas Ranger District
USDA-FS Medicine Bow Forest, Laramie WY
USDA-FS Rocky Mtn Region, Denver CO

State Agencies

Montana Mineral Mgmt Bureau
Montana Office of the Governor
WDEQ Air Quality Division
WDEQ Land Quality Division, Cheyenne WY
WDEQ Land Quality Division, Sheridan WY
WDEQ Water Quality Division
WY Business Council, NE Region
WY Department of Education
WY Dept of Agriculture
WY Dept of Employment Research & Planning
WY Dept of Environmental Quality, Director
WY Dept of Transportation
WY Economic Analysis Division
WY Game & Fish Dept, Cheyenne WY
WY Game & Fish Dept, Lander WY
WY Game & Fish Dept, Sheridan WY
WY Industrial Siting Division
WY O&G Conservation Commission
WY Office of State Lands & Investments
WY Office of the State Treasurer
WY Parks & Cultural Resources Dept
WY Public Service Commission
WY State Engineer's Office
WY State Geological Survey
WY State Historic Preservation Office
WY State Inspector of Mines
WY State Planning Office
WY Water Dev Commission

Local Government and Agencies

Big Horn County Commission, MT
Campbell County Commission, WY
Campbell County Conservation District, WY
Campbell County School District, WY
City of Douglas, WY
City of Gillette, WY
Converse County Commission, WY
Converse County School District, WY
Converse County Special Projects, WY
Converse Joint Powers Board
Gillette Dept of Community Dev, WY

Rocky Mountain Region Solicitor, CO
Rosebud County Commission, MT
Town of Wright, WY
Weston County Commission, WY

Tribal Organizations and Individuals

Apache Tribe of Oklahoma
Arapahoe Business Council
Cheyenne River Sioux Tribe
Comanche Business Committee
Crow Creek Sioux Tribe
Crow Tribal Council
Flandreau Santee Sioux Tribe
Kiowa Business Committee

Table 5-3. BLM Distribution List for Coal Leasing (Continued).

Tribal Organizations and Individuals (Continued)

Lower Brule Sioux Tribal Council
Northern Cheyenne Tribal Council
Oglala Sioux Tribal Council
Rosebud Sioux Tribal Council
Cheyenne-Arapaho Tribes of Oklahoma
Santee Sioux Tribal Council
Shoshone Business Council
Standing Rock Sioux Tribal Council

Organizations

Advisory Council on Historic Preservation
Biodiversity Conservation Alliance
Campbell County Economic Dev
CANDO
Fdn for North American Wild Sheep
National Mining Association
National Wildlife Federation
Natural Resources Defense Council
Petroleum Association of Wyoming
Powder River Basin Resource Council
Sierra Club
Thunder Basin Coalition
WY Assoc of Professional Archeologists
Wyoming Bankers Association
Wyoming Business Alliance
Wyoming Mining Association
Wyoming Outdoor Council
Wyoming Stock Growers Association
Wyoming Wildlife Federation
Wyoming Wool Growers Association

Companies/Businesses

All American Equipment
American Colloid Co
Antelope Coal Company
Ark Land Company
Belle Fourche Pipeline Company
Bjork Lindley Little PC
BKS Environmental
BNSF Railway Company
Bridgeview Coal Co
Buckskin Mine
Burns & McDonnell
CH Snyder Company
CONSOL Inc Expl & Land
Cordero Rojo Mine
Dry Fork Coal Company
Ducker Montgomery et al
EDE Consultants
ENSR
Environmental Solutions Inc
EOG Resources
Foundation Coal West Inc
Great Points Energy
Hardin & Associates
HQ-USA/CEVP
Intermountain Resources
Interwest Mining
Jacobs Ranch Coal Company
JIREH Exploration & Consulting
Kenneth R Paulsen Consultants
Kiewit Mining Company
Kiewit Mining Group Inc
Kiewit Mining Properties Inc
LE Peabody & Associates
M&K Oil Company Inc
Marston & Marston
McGraw-Hill
McVehil-Monnett Assoc Inc
Meineadair Consultants
Mine Engineers Inc
Mining Associates of Wyoming
Nerco Coal Company
Norwest Mine Services
Norwest Corporation
P&M Coal Mining Co
Peabody Energy
Powder River Coal Co
Powder River Energy Corp
Rio Tinto Energy America
Riverside Technology Inc
San Juan Coal Company
Tetra Tech EC, Inc.
Thunder Basin Coal Co
Thunderbird-Jones & Stokes
TRC Environmental
Union Pacific Railroad
URS Greiner Woodward
US West Communications
Western Energy Company
Western Fuels Association
WWC Engineering
Yates Petroleum Corp.

Press

Associated Press
Casper Star Tribune
Douglas Budget
Gillette News-Record
PLATTS
Rocky Mountain Oil Journal
Western Coal Newsletter
Wyoming Tribune-Eagle

Educational Institutions

CSU Libraries
NWU Policy Research Institute
URS Greiner Woodward Clyde Library
UW Libraries

Table 5-3. BLM Distribution List for Coal Leasing (Continued).

Individuals

Addison, Myra M
Barbero, Ralph
Benson, Scott
Bierman, Sheldon
Bishop, Valeri J & Hugh
Burch, Trey
Cain, Tessa C M
Crary, Calvert D
Cundy, Cecil
Dilts, Fred W
Dilts, Jerry J
Dilts, Steve
Earnest, Terry L
Foster, Roxanne L
Funk, Wendell
Glustrom, Leslie
Isenberger, Matthew L & Peggy
Jacobs, Donald B & Rosemae
Jacobs, Donald F
Kane, Frank W
Klurfeld, Gregor
Litton, Patricia L Isenberger
Paul McAfee
McBride, Dorothy L
McCurley, Te' Atta D
Nimmo, Jolynn J & Terry
Nyenhuis, Jim
Papp, Alex
Petty, Tachana LM
Provine, Charles H & Evelyn J
Putnam, Teckla N
Reno, Floyd C & Sons
Reynolds, Kathleen A Kane
Robertson, Elizabeth G
Saulcy, Bill
Shainholtz, James D & Barbara H
Shillington, Barbara S
Snow, Billie R
Thompson, Rose L
Voiles, Joy Lynn Kane
Williams, John
Winland, Mark

Businesses/Organizations/Trusts

AE Investments Inc
B&J Resources LLC
Big West Oil & Gas Inc
Bill Barrett Production Co
BNSF Railroad
Bowers Oil & Gas Inc
Bridle Bit Ranch Co
David E & Audrey Markle Trust
Deena L Wangler Trust
Dyno Nobel Inc
FDM Property Trust
JA & Deloris A Markle Trust
JRJ Ranches Inc
Lance O&G Co Inc
Liberty Petroleum
LL Jorgenson Family Trust
Middle Prong Land & Livestock
Nance Petroleum Corp
Panhandle Eastern Pipeline Co.
Pathfinder Energy
Petro Atlas Corporation
Rocky Mtn Power
Spring Creek Ranch
Standard Labs Inc
Teton Capital Mgmt Inc
Thunder Basin Grazing Association
Vejay Energy & Land Inc
Wellstar Corp

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7.0 GLOSSARY

aboriginal - Related to early or primitive cultures in a region.

ad valorem tax - A tax paid as a percentage of the assessed value of property.

adverse impact - An apparent direct or indirect detrimental effect.

aliquot - An exact portion.

alkalinity - The degree to which the pH of a substance is greater than 7.

alluvial deposit - Deposits of clay, silt, sand, gravel, and/or other materials carried by moving surface water, such as streams, and deposited at points of weak water flow; alluvium.

alluvial valley floor (AVF) - An area of unconsolidated stream-laid deposits holding streams with water availability sufficient for subirrigation or flood irrigation agricultural activities (see 30 CFR 701.5).

alluvium - Sorted or semi-sorted sediment consisting of clay, silt, sand, gravel, or other unconsolidated rock material deposited in comparatively recent geologic time by a stream or other body of running water in the bed of that stream or on its flood plain or delta.

alternative - In terms of the National Environmental Policy Act, one of several substitute or alternate proposals that a federal agency is considering in an environmental analysis.

ambient - Surrounding conditions (or environment) in a given place and time.

annual precipitation - The quantity of water that falls yearly in the form of rain, hail, sleet, and snow.

approximate original contour - Post-mining surface configuration achieved by backfilling and grading of mined-out areas so that the reclaimed land surface resembles the general surface configuration of the land prior to mining (see 30 CFR 701.5).

aquatic - Living or growing in or on the water.

aquifer - A layer of permeable rock, sand, or gravel that stores and transmits water in sufficient quantities for a specific use.

aquitard - A confining bed that retards but does not totally prevent the flow of water to or from an adjacent aquifer; a leaky confining bed.

area source – A plant site that does not emit any single HAP at a rate of 10 tons or greater per year, or any combination of HAPs at a rate of 25 tons or greater per year.

arithmetic mean - The sum of the values of n numbers divided by n. It is usually referred to as simply the "mean" or "average".

ash - The residual non-combustible matter in coal that comes from included silt, clay, silica, or other substances. The lower the ash content, the better the quality of the coal.

avian - Of, relating to, or derived from birds.

backfill - The operation of refilling an excavation. Also, the material placed in an excavation when it is refilled.

baseline - Conditions, including trends, existing in the human environment before a proposed action is begun; a benchmark state from which the environmental consequences of an action are forecast; the no-action alternative.

beneficial impact - An apparent direct or indirect advantageous effect.

bentonite - A clay formed by the decomposition of volcanic ash which has the ability to absorb large amounts of water and to expand to several times its normal volume; used in adhesives, cements and ceramic fillers.

bonus - That value in excess of the rentals and royalties that is paid to the United States as part of the consideration for receiving a lease for publicly owned minerals [see 43 CFR 3400.0-5(c)].

braided stream - A stream flowing in several dividing and reuniting channels resembling the strands of a braid.

buffer zone - An area between two different land uses that is intended to resist, absorb, or otherwise preclude development or intrusion between the two use areas.

bypass coal - An isolated part of a coal deposit that is not leased and that can only be economically mined in an environmentally sound manner as a part of continued mining by an existing adjacent operation [see 43 CFR 3400.0.5(d)].

clinker (scoria) - Baked and fused rock resulting from in-place burning of coal deposits.

coal bed natural gas (CBNG) - Natural gas (methane) that is generated during the coal-forming process.

colluvium - Rock fragments, sand, or soil material that accumulates at the base of slopes; slope wash.

confluence - The point at which two or more streams meet.

conglomerate - A rock that contains rounded rock fragments or pebbles cemented together by another mineral substance.

contiguous - Lands or legal subdivisions having a common boundary, lands having only a common corner are not contiguous.

cooperating agency - An agency which has jurisdiction by law in an action being analyzed in an environmental document and who is requested to participate in the NEPA process by the agency that is responsible for preparing the environmental document [see 40 CFR 1501.6 and 1508.5].

crucial wildlife habitat - Parts of the habitat necessary to sustain a wildlife population during periods of their life cycle. It may be a limiting factor on the population, such as nesting habitat or winter habitat.

cultural resources - The remains of human activity, occupation, or endeavor reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features that reveal the nature of historic and prehistoric human events. These resources consist of (1) physical remains, (2) areas where significant human events occurred, and (3) the environment immediately surrounding the resource.

cumulative impact - The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

decibel - A unit of sound measurement. In general, a sound doubles in loudness for every increase of 10 decibels.

deciview (dv) - A general measure of view impairment (13 deciview equals a view of approximately 60 miles) caused by pollution. A 10 percent change in extinction corresponds to 1.0 dv.

dip - The angle at which a rock layer is inclined from the horizontal.

direct (or primary) impact - An impact caused by an action that occurs at the same time and place as the action (see 40 CFR 1508.8).

discharge - Any of the ways that ground water comes out of the surface, including through springs, creeks, or being pumped from a well.

dissected upland - An upland or high area in which a large part of the original surface has been deeply cut into by streams.

dragline - A type of excavating crane that casts a rope- or cable-hung bucket a considerable distance, collects the dug material by pulling the bucket toward itself on the ground with a second rope or cable, elevates the bucket, and dumps the material on a backfill bank or pile.

eolian deposit - Sediment carried, formed, or deposited by the wind, as sand dunes.

ephemeral stream - A stream that flows occasionally because of surface runoff, and is not influenced by permanent ground water.

erosion - The wearing away of the land surface by running water, wind, ice or other geologic agents.

evapotranspiration - The sum total of water lost from the land by evaporation and plant transpiration.

excavation (archeological) - The scientifically controlled recovery of subsurface materials and information from a cultural site. Recovery techniques are relevant to research problems and are designed to produce maximum knowledge about the site's use, its relation to other sites and the natural environment, and its significance in the maintenance of the cultural system.

fair market value - The amount in cash, or in terms reasonably equivalent to cash, for which in all probability a coal deposit would be sold or leased by a knowledgeable owner willing but not obligated to sell or lease to a knowledgeable purchaser who desires but is not obligated to buy or lease.

fixed carbon - In coal, the solid combustible material remaining after removal of moisture, ash, and volatile matter. It is expressed as a percentage.

floodplain - The relatively flat area or lowland adjoining a body of flowing water, such as a river or stream, that is covered with water when the river or stream overflows its banks.

forage - Vegetation used for food by wildlife, particularly big game wildlife, and domestic livestock.

formation (geologic) - A rock body distinguishable from other rock bodies and useful for mapping or description. Formations may be combined into groups or subdivided into members.

fossil - The remains or traces of an organism or assemblage of organisms that have been preserved by natural processes in the earth's crust. Many minerals that may be of biologic origin are not considered to be fossils (e.g. oil, gas, asphalt, limestone).

geometric mean - The nth root of the product of the values of n positive numbers.

ground water - Subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated.

habitat - A place where a plant or animal naturally or normally lives and grows.

habituation - The process of becoming accustomed to, or used to, something; acclimation.

hazardous materials - Substance which, because of its potential for corrosivity, toxicity, ignitability, chemical reactivity, or explosiveness, may cause injury to persons or damage to property.

hazardous waste - Those materials defined in Section 101 (14) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, and listed in 40 CFR § 261.

heterogenous - Made up of dissimilar constituents.

human environment - The natural and physical environment and the relationship of people with that environment (see 30 CFR 1508.14).

hydraulic conductivity - The capacity of a medium to transmit water; permeability coefficient. Expressed as the volume of water at the prevailing temperature that will move in unit time under a unit hydraulic gradient through a unit area. Units include gallons per day per square foot, centimeters per second.

hydraulic - Pertaining to fluid in motion, or to movement or action caused by water.

hydric soil - A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic (water-loving) vegetation. Hydric soils that occur in areas having positive indicators of hydrophytic vegetation and wetland hydrology are wetland soils.

hydrocarbon - Any organic compound, gaseous, liquid, or solid, consisting solely of carbon and hydrogen.

hydrogeology - The science that deals with subsurface waters and with related geologic aspects of surface waters.

hydrology - The science dealing with the behavior of water as it occurs in the atmosphere, on the surface of the ground, and underground.

hydrophytic vegetation - The plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. When hydrophytic vegetation comprises a community where indicators of hydric soils and wetland hydrology also occur, the area has wetland vegetation.

impermeable - Not capable of transmitting fluids or gasses in appreciable quantities.

incised - Having a margin that is deeply and sharply notched.

indirect (or secondary) impact - A reasonably foreseeable impact resulting from an action but occurring later in time than or removed in distance from that action (see 40 CFR 1508.8).

in-place coal reserves - The estimated volume of all of the coal reserves in a lease without considering economic or technological factors that might restrict mining.

in-situ leach mining - Removal of the valuable components of a mineral deposit through chemical leaching without physical extraction of the rock.

interbedded - Layers of one type of rock, typically thin, that are laid between or that alternate with layers of another type of rock.

interburden - A layer of sedimentary rock that separates two mineable coal beds.

interdisciplinary - Characterized by participation or cooperation among two or more disciplines or fields of study.

intermittent stream - A stream that does not flow year-round but has some association with ground water for surface or subsurface flow.

laminated - Consolidated or unconsolidated sediment that is characterized by thin (less than 1 cm thick) layers.

land and resource management plan (LRMP) - A land use plan that directs the use and allocation of U.S. Forest Service lands and resources.

lead agency - The agency or agencies preparing or having taken primary responsibility for preparing an environmental document (see 40 CFR 1508.16).

lease (mineral) - A legal document executed between a mineral owner or lessor and another party or lessee which grants the lessee the right to extract minerals from the tract of land for which the lease has been obtained [see 43 CFR 3400.0-5(r)].

lek - A traditional breeding area for grouse species where territorial males display and establish dominance.

lenticular - Term describing a body of rock or earth that thins out in all directions from the center like a double convex optical lens.

limb (geologic) - One side of a fold (syncline or anticline).

limestone - A sedimentary rock consisting chiefly of calcium carbonate.

lineament - A linear topographic feature of regional extent that is believed to reflect crustal structure.

loadout facilities - The mine facilities used to load the mined coal for transport out of the mine.

loam - A rich, permeable soil composed of a mixture of clay, silt, sand, and organic matter.

maintenance tract - A federal coal tract that would continue or extend the life of an existing coal mine.

major federal action - An action with effects that may be major and which is potentially subject to federal control and responsibility (see 40 CFR 1508.18).

major sources – Those sources that emit more than 10 tons per year of any single hazardous air pollutant, or 25 tons of all hazardous air pollutants combined. The determination of major is based on all sources of hazardous air pollutants at the site, and not just the equipment affected by the MACT standard.

maximum economic recovery (MER) - The requirement that, based on standard industry operating practices, all profitable portions of a leased federal coal deposit must be mined. MER determinations will consider existing proven technology; commercially available and economically feasible equipment; coal quality, quantity, and marketability; safety, exploration, operating, processing, and transportation costs; and compliance with applicable laws and regulations [see 43 CFR 3480.0-5(a)(24)].

meteorological - Related to the science dealing with the atmosphere and its phenomena, especially as relating to weather.

methane - A colorless, odorless, and inflammable gas; the simplest hydrocarbon; chemical formula = CH_4. It is the principal constituent of natural gas and is also found associated with crude oil and coal.

mineable coal - Coal that can be economically mined using present day mining technology.

mineral rights - The rights of one who owns the mineral estate (subsurface).

mining permit - A permit to conduct surface coal mining and reclamation operations issued by the state regulatory authority pursuant to a state program or by the Secretary pursuant to a federal program (see 30 CFR 701.5).

mitigation - An action to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice.

mudstone - A hardened sedimentary rock consisting of clay. It is similar to shale but lacks distinct layers.

National Register of Historic Places (NRHP) - A list of districts, sites, buildings, structures and objects significant in American history, architecture, archeology and culture maintained by the Secretary of the Interior. Expanded as authorized by Section 2(b) of the Historic Sites Act of 1935 (16 U.S.C. 462) and Section 101(a)(1) (A) of the National Historic Preservation Act.

natural gas - Combustible gases (such as hydrocarbons) or mixtures of combustible gases and non-combustible gases (such as helium) that are in a gaseous phase at atmospheric conditions of temperature and pressure.

NEPA process - All measures necessary for compliance with the National Environmental Policy Act of 1969 (see 40 CFR 1508.21).

No Action Alternative - An alternative where no activity would occur. The development of a no action alternative is required by regulations implementing the National Environmental Policy Act (40 CFR 1502.14). The No Action Alternative provides a baseline for estimating the effects of other alternatives.

outcrop - A rock formation that appears at or near the surface; the intersection of a rock formation with the surface.

overburden - Material of any nature, consolidated or unconsolidated, that overlies a coal or other useful mineral deposit, excluding topsoil.

paleontological resource - A site containing evidence of plant or non-human animal life of past geological periods, usually in the form of fossil remains.

peak discharge or flow - The highest discharge of water recorded over a specified period of time at a given stream location; also called maximum flow. Often thought of in terms of spring snowmelt, summer, fall or winter rainy season flows.

perennial species (vegetation) - Vegetation that lives over from season to season.

perennial stream - A stream or part of a stream that flows continuously during the calendar year as a result of groundwater discharge or surface runoff.

permeability - The ability of rock or soil to transmit a fluid.

permit application package - A proposal to conduct surface coal mining and reclamation operations on federal lands, including an application for a permit, permit revision, or permit renewal and all the information required by SMCRA, the applicable state program, any applicable cooperative agreement, and all other applicable laws and regulations including, with respect to federal leased coal, the Mineral Leasing Act and its implementing regulations.

permit area - The area of land, indicated on the approved map submitted by the operator with his or her application, required to be covered by the operator's performance bond under the regulations at 30 CFR Part 800 and which shall include the area of land upon which the operator proposes to conduct surface coal mining and reclamation operations under the permit, including all disturbed areas (see 30 CFR 701.5).

physiography - Physical geography.

piezometer - A well, generally of small diameter, that is used to measure the elevation of the water table.

playa - The sandy, salty, or mud-caked flat floor of a basin with interior drainage, usually occupied by a shallow ephemeral lake during or after rain or snow storms.

point source (pollution) - A point at which pollution is added to a system, either instantaneously or continuously. An example is a smokestack.

pore volume - The amount of fluid necessary to fill the void space in an unsaturated porus medium (i.e., mine backfill).

porosity - The percentage of the bulk volume of rock, sediment or soil that is not occupied by sediment or soil particles; the void space in rock or sediment. It may be isolated or connected.

postmining topography - The relief and contour of the land that remains after mining has been completed.

potentiometric surface - The surface that coincides with the static level of water in an aquifer. The surface is represented by the levels to which water from a given aquifer will rise under its full hydraulic head.

predator - An animal that obtains food by killing and consuming other animals.

prime or unique farmland - Those lands which are defined by the Secretary of Agriculture in 7 CFR part 657 (*Federal Register* Vol. 4 No. 21) and which have historically been used for cropland (see 30 CFR 701.5).

proposed action - In terms of National Environmental Policy Act, the project, activity, or action that a federal agency proposes to implement or undertake and which is the subject of an environmental analysis.

qualified surface owner - The natural person or persons (or corporation, the majority stock of which is held by a person or persons otherwise meeting the requirements of this section) who:

(1) Hold legal or equitable title to the surface of split estate lands;
(2) Have their principal place of residence on the land, or personally conduct farming or ranching operations upon a farm or ranch unit to be affected by surface mining operations; or received directly a significant portion of their income, if any, from such farming and ranching operations; and
(3) have met the conditions of (1) and (2) above for a period of at least three years, except for persons who gave written consent less than three years after they met the requirements of both (1) and (2) above [see 43 CFR 3400.0-5(gg)].

raptor - Bird of prey, such as an eagle, falcon, hawk, owl, or vulture.

recharge - The processes by which groundwater is absorbed into a zone of saturation.

reclamation - Rehabilitation of a disturbed area to make it acceptable for designated uses. This normally involves regrading, replacement of topsoil, revegetation and other work necessary to restore the disturbed area for post-mining use.

record of decision (ROD) - A document separate from, but associated with, an environmental impact statement that publicly and officially discloses the responsible official's decision on the proposed action (see 40 CFR 1505.2).

recoverable coal - The amount of coal that can actually be recovered for sale from the demonstrated coal reserve base.

rental payment - Annual payment from a lessee to a lessor to maintain the lessee's mineral lease rights.

resource management plan (RMP) - A land use plan, as prescribed by FLPMA, that directs the use and allocation of public lands and resources managed by BLM. Prior to selection of the RMP, different alternative management plans are compared and evaluated in an environmental impact statement (EIS) to determine which plan will best direct the management of the public lands and resources.

revegetation - The reestablishment and development of self-sustaining plant cover following land disturbance. This may occur through natural processes, or the natural processes may be enhanced by human assistance through seedbed preparation, reseeding, and mulching.

right of way (ROW) - The right to pass over property owned by another. The strip of land over which facilities such as roadways, railroads, or power lines are built.

riparian - The area adjacent to rivers and streams that lies between the stream channel and upland terrain and that supports specific vegetation influenced by perennial and/or intermittent water.

royalty (mineral) - A share of production that is free of the expense of production. It is generally paid by a lessee to a lessor of a mineral lease as part of the terms of the lease.

runoff - That portion of rainfall that is not absorbed; it may be used by vegetation, lost by evaporation, or it may find its way into streams as surface flow.

salinity - Refers to the solids, such as sodium chloride (table salt) and alkali metals, that are dissolved in water. Often in non-saltwater areas, total dissolved solids is used as an equivalent term.

sandstone - A common sedimentary rock primarily composed of sand grains, mainly quartz, that are cemented together by other mineral material.

scoping - A public informational process required by the National Environmental Policy Act to determine private and public concerns, scope of issues, and/or questions regarding a proposed action to be evaluated in an environmental impact analysis.

scoria (clinker) - Baked and fused rock resulting from in-place burning of coal deposits.

sedimentation pond - An impoundment used to remove solids from water in order to meet water quality standards or effluent limitations before the water leaves the permit area (see 30 CFR 701.5).

semi-arid - A climate or region characterized by little yearly rainfall and by the growth of a number of short grasses and shrubs.

severance tax - A tax on the removal of minerals from the ground.

shale - A very fine-grained clastic rock or sediment consisting predominately of clay-sized particles that is laminated; lithified, layered mud.

significant impact - A qualitative term used to describe the anticipated importance of impacts to the human environment as a result of an action.

siltstone - A fine-grained clastic rock consisting predominately of silt-sized particles.

socioeconomics - The social and economic situation that might be affected by a proposed action.

soil survey - The systematic examination, description, classification, and mapping of soils in an area, usually a county. Soil surveys are classified according to the level of detail of field examination. Order I is the most detailed and Order V is the least detailed.

spontaneous combustion - The heating and slow combustion of coal and coaly material initiated by the absorption of oxygen.

stipulations - Requirements that are part of the terms of a mineral lease. Some stipulations are standard on all Federal leases. Other stipulations may be applied to specific leases at the discretion of the surface management agency to protect valuable surface resources or uses existing on those leases.

storage coefficient - The volume of water that can be released from storage per unit surface area of a saturated confined aquifer, per unit decline in the component of hydraulic head normal to the surface. It is calculated by taking the product of the specific storage and the aquifer thickness.

stratigraphic - Of, relating to, or determined by stratigraphy, which is the branch of geology dealing with the study of the nature, distribution, and relations of layered rocks in the earth's crust.

stripping ratio - The unit amount of overburden that must be removed to gain access to a similar unit amount of coal.

subirrigation - In alluvial valley floors, the supplying of water to plants from underneath, or from a semi-saturated or saturated subsurface zone where water is available for use by vegetation (see 30 CFR 701.5).

subbituminous - A lower rank of coal (35-45 percent carbon) with a heating value between that of bituminous and lignite, usually 8,300-11,500 Btu per pound. Subbituminous coal contains a high percentage of volatile matter and moisture.

surface disturbance - Any disturbance by mechanical actions that alters the soil surface.

surface rights - Rights to the surface of the land, does not include rights to oil, gas, or other subsurface minerals or subsurface rights.

suspended solids - The very fine soil particles that remain in suspension in water for a considerable period of time without contact with the stream or river channel bottom.

tectonic fracture - Fractures caused by deformation of the earth's crust.

threatened and endangered (T&E) species - These species of plants or animals classified as threatened or endangered pursuant to Section 4 of the Endangered Species Act. Any species which is in danger of extinction, or is likely to become so within the foreseeable future.

> ***Category 1*** - Substantial biological information on file to support the appropriateness of proposing to list as endangered or threatened.
> ***Category 2*** - Current information indicates that proposing to list as endangered or threatened is possibly appropriate, but substantial biological information is not on file to support an immediate ruling (U.S. Fish and Wildlife Service).

topography - Physical shape of the ground surface; the configuration of land surface including its relief, elevation, and the position of its natural and manmade features.

topsoil - The surface layer of a soil.

total dissolved solids (TDS) - The total quantity in milligrams per liter of dissolved materials in water.

transmissivity - The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient. Equals the hydraulic conductivity multiplied by the aquifer thickness. Values are given in units of gallons per day per foot.

transpiration - The discharge of water vapor by plants.

truck & shovel - A mining method used to remove overburden and coal in a strip mining operation. Truck and shovel operations use large bucket-equipped digging and loading machines (shovels) and large dump trucks to remove overburden instead of using a dragline for overburden removal.

typic - Typical.

unconfined aquifer - An aquifer where the water table is exposed to the atmosphere through openings in the overlying materials.

unsuitability criteria - The 20 criteria described in 43 CFR 3461, the application of which results in an assessment of federal coal lands as suitable or unsuitable for surface coal mining.

uranium - A very hard, heavy, metallic element that is crucial to development of atomic energy.

vegetation type - A kind of existing plant community with distinguishable characteristics described in terms of the present vegetation that dominates an area.

vertebrate fossils - The remains of animals that possessed a backbone; examples are fish, amphibians, reptiles, dinosaurs, birds, and mammals.

vesicular - Rock containing many small cavities that were formed by the expansion of a bubble of gas or steam during the solidification of the rock.

visual resources - The physical features of a landscape that can be seen (e.g., land, water, vegetation, structures, and other features).

Visual Resource Management (VRM) - The systematic means to identify visual values, establish objectives which provide the standards for managing those values, and evaluate the visual impacts of proposed projects to ensure that objectives are met.

volatile matter - In coal, those substances, other than moisture, that are given off as gas or vapor during combustion.

waterfowl - A bird that frequents water, especially a swimming bird.

wetlands - Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient, under normal circumstances, to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands include marshes, bogs, sloughs, potholes, river overflows, mud flats, wet meadows, seeps, and springs [see 33 CFR 328.3(a)(7)(b)].

wild and scenic river - Rivers or sections of rivers designated by Congressional actions under the 1968 Wild and Scenic Rivers Act as wild, scenic, or recreational by an act of the Legislature of the state or states through which they flow. Wild and scenic rivers may be classified and administered under one or more of the following categories:

> **wild river areas** - Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.
> **scenic river areas** - Rivers or sections of rivers that are free of impoundments, with watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
> **recreational river areas** - Rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

wilderness - An area of undeveloped Federal land designated wilderness by Congress, retaining its primeval character and influence, without permanent improvements or human habitation, protected and managed to preserve its natural conditions and that (1) generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable, (2) has outstanding opportunities for solitude or primitive and unconfined recreation, (3) has at least 5,000 acres or is of sufficient size to make practical its preservation and use in an unimpaired condition, and (4) also may contain features that are of ecological, geological, scientific, educational, scenic, or historical value. These characteristics were identified by Congress in the Wilderness Act of 1964.

8.0 INDEX

agriculture 2-11, 2-34, 2-40, 3-72, 3-73, 3-74, 3-75, 3-127, 3-134, 4-56, 4-58, 4-75, 4-77, B-4, H-47, I-23

alluvial valley floor or AVF 1-6, 2-11, 3-72, 3-73, 3-74, 3-75, 3-116, 4-5, 4-58, B-4

Antelope Creek..... 3-8, 3-10, 3-53, 3-55, 3-57, 3-58, 3-59, 3-65, 3-67, 3-68, 3-69, 3-72, 3-73, 3-74, 3-76, 3-86, 3-87, 3-92, 3-93, 3-95, 3-96, 3-102, 3-104, 3-107, 3-112, 3-114, 3-115, 3-116, 3-117, 3-118, 3-129, 3-138, 4-27, 4-55, 4-56, 4-57, 4-58, 4-60, 4-70, 4-71, 4-74, 4-79, 4-80, 4-81, G-21, H-16, H-17, H-18, H-19, H-23, H-31, H-53, H-60, H-67, I-13, I-14, I-16, I-17, I-18

Belle Fourche River 3-7, 4-27, 4-55, 4-58, 4-69, 4-70, 4-71, 4-74, 4-79, 4-80

blasting..... 1-19, 2-8, 2-11, 3-24, 3-33, 3-38, 3-39, 3-40, 3-41, 3-42, 3-43, 3-44, 3-46, 3-48, 3-50, 3-52, 3-145, 3-174, 4-50, 4-117, F-6, F-12, F-13

bonus payment or bonus bid payment..... 1-3, 1-11, 2-26, 2-27, 2-30, 2-31, 3-130, 3-157, 3-158, 3-159, 4-98, 4-99

coal bed natural gas or CBNG 1-17, 2-5, 2-26, 2-27, 2-28, 2-32, 2-40, 2-41, 3-15, 3-16, 3-17, 3-18, 3-19, 3-20, 3-24, 3-38, 3-58, 3-60, 3-61, 3-64, 3-67, 3-69, 3-70, 3-76, 3-86, 3-92, 3-93, 3-95, 3-114, 3-116, 3-123, 3-125, 3-128, 3-129, 3-130, 3-137, 3-138, 3-139, 3-142, 3-145, 3-175, 4-2, 4-16, 4-18, 4-19, 4-20, 4-21, 4-22, 4-28, 4-30, 4-31, 4-32, 4-42, 4-43, 4-44, 4-45, 4-46, 4-47, 4-50, 4-52, 4-53, 4-54, 4-56, 4-57, 4-58, 4-59, 4-60, 4-64, 4-65, 4-67, 4-68, 4-69, 4-70, 4-71, 4-72, 4-74, 4-78, 4-83, 4-85, 4-86, 4-87, 4-89, 4-96, 4-97, 4-98, 4-99, 4-101, 4-111, 4-112, 5-4, F-10, G-1, G-2, G-3, G-4, G-5, G-6, G-7, G-8, G-9, G-10, G-11, G-12, G-13, G-14, G-15, G-18, H-18, H-33, H-39, H-51, H-55, H-58, H-63, H-64, I-14, I-17, I-18, I-23, I-24

fair market value 1-1, 1-3, 1-20, 2-7, 2-19, 2-23, 2-2, 3-130, 5-2

fugitive dust 1-19, 2-10, 2-33, 2-43, 3-23, 3-24, 3-26, 3-30, 3-33, 3-34, 3-36, 3-37, 3-39, 3-40, 3-42, 3-43, 3-44, 3-46, 3-50, 3-51, 3-52, 3-53, 3-171, 3-173, 3-174, 3-175, 4-28, 4-32, 4-33, 4-34, 4-36, 4-39, 4-42, 4-52, 4-82, 4-101, 4-102, 4-103, 4-104, 4-106, 4-107, 4-108, 4-109, 4-110, 4-111, 4-112, 4-113, 4-114, 4-115, 4-117, 4-118, F-1, F-2, F-4, F-5, F-6, F-7, F-10, F-11, F-12, F-13

grazing 1-10, 2-12, 2-13, 2-35, 2-36, 3-84, 3-86, 3-87, 3-90, 3-92, 3-121, 3-129, 3-130, 3-131, 3-133, 3-134, 3-135, 3-172, 4-75, 4-76, 4-77, H-40, H-48, H-51, H-55, H-64, I-13, I-16, I-21

Horse Creek 1-5, 2-8, 3-8, 3-10, 3-53, 3-55, 3-57, 3-58, 3-65, 3-67, 3-68, 3-73, 3-74, 3-76, 3-80, 3-86, 3-92, 3-93, 3-116, 3-117, 3-118, 3-119, 3-137, 4-70, 4-81, G-19, H-16, H-17, H-18, H-19, H-23, I-12, I-13, I-14, I-16, I-17, I-18, I-29

hunting 3-106, 3-127, 3-128, 3-131, 3-173, 4-75, 4-77, 4-78, H-36, H-51, H-55, H-60, H-64

migratory birds 3-111, 3-114, 3-116, 3-118, 3-120, 4-68, 4-73, B-3, H-28

mitigation 1-13, 1-19, 2-9, 2-10, 2-11, 2-12, 2-13, 2-14, 2-15, 2-16, 2-19, 3-1, 3-22, 3-33, 3-36, 3-38, 3-48, 3-71, 3-79, 3-90, 3-102, 3-103, 3-112, 3-113, 3-115, 3-118, 3-131, 3-135, 3-136, 3-140, 3-145, 3-153, 3-171, 4-32, 4-36, 4-42, 4-52, 4-81, 4-104, D-1, D-2, F-5, F-6, H-32, H-43, H-45, H-55, H-58, H-59, H-68, I-12, I-18, I-23, I-25, I-28

MLA mining plan 1-3, 1-12, 1-13, 2-27, 3-20, I-22

monitoring plan 2-9, 2-10, 2-11, 2-12, 2-13, 2-14, 3-15

nitrogen oxide or NO_2 ..... 1-19, 2-11, 2-39, 3-24, 3-26, 3-39, 3-40, 3-41, 3-42, 3-43, 3-44, 3-45, 3-46, 3-50, 3-52, 3-171, 3-173, 4-34, 4-35, 4-36, 4-38, 4-42, 4-103, 4-112, F-2, F-3, F-6, F-8, F-10, F-12, F-13

PM_{10}..... 2-10, 2-25, 2-38, 2-39, 3-24, 3-25, 3-26, 3-28, 3-29, 3-30, 3-33, 3-34, 3-36, 3-38, 3-40, 3-42, 3-171, 4-34, 4-35, 4-36, 4-38, 4-39, 4-42, F-2, F-3, F-4, F-5, F-6, F-7, F-9, F-10, F-11

power plant(s) 1-11, 1-19, 2-27, 3-26, 3-151, 3-173, 4-9, 4-13, 4-14, 4-15, 4-16, 4-23, 4-28, 4-32, 4-33, 4-42, 4-50, 4-61, 4-63, 4-65, 4-76, 4-82, 4-84, 4-86, 4-93, 4-99, 4-100, 4-101, 4-106, 4-108, 4-111, 4-112, 4-113, 4-115, 4-116, 4-118, F-5, H-64, I-23, I-25

reclamation bond 2-12, 2-29, 3-5, 3-88, 3-89, 3-90, 3-130, 3-131

recreation..... 2-36, 2-42, 3-4, 3-121, 3-127, 3-131, 3-173, 4-75, 4-77, 4-78, H-51

royalty..... 1-3, 1-12, 2-13, 2-26, 2-27, 2-28, 2-30, 2-31, 3-19, 3-157, 3-158, 3-159, 3-170, 4-97, 4-98, D-3, D-4

sage-grouse..... 1-19, 2-35, 3-88, 3-104, 3-105, 3-106, 3-107, 3-108, 3-110, 3-111, 3-112, 3-115, 3-119, 3-172, 4-72, 4-73, 4-74, 4-77, B-3, H-4, H-10, H-14, H-48, H-49, H-50, H-51, H-52, H-62, H-63, H-66, H-69, H-70, H-71, I-28

Spring Creek 3-8, 3-10, 3-55, 3-65, 3-67, 3-68, 3-73, 3-74, 3-76, 3-86, 3-87, 3-92, 3-93, 3-112, 3-115, 3-116, 3-117, 3-118, 3-119, 3-126, 3-129, 3-135, 4-71, 4-81, 5-11, G-19, G-21, H-16, H-17, H-18, H-19, H-23, H-31, H-53, H-54, I-13, I-14, I-17, I-18

T&E species 3-4, 3-120, I-1, I-5, I-11, I-14, I-21, I-25

total dissolved solids or TDS..... 2-33, 3-55, 3-56, 3-57, 3-58, 3-59, 3-63, 3-64, 3-65, 3-67, 4-51, 4-55, 4-71

total suspended solids or TSS..... 3-67

U.S. Environmental Protection Agency or EPA..... 1-20, 2-10, 2-15, 3-24, 3-25, 3-26, 3-28, 3-29, 3-30, 3-33, 3-36, 3-38, 3-39, 3-40, 3-41, 3-45, 3-46, 3-48, 3-51, 3-171, 4-33, 4-35, 4-36, 4-102, 4-103, 4-105, 4-106, 4-107, 4-112, 4-113, 4-114, 4-115, 4-116, 4-117, 4-118, 5-2, 5-9, F-1, F-2, F-3, F-6, F-11, F-12

U.S. Fish and Wildlife Service or USFWS 2-36, 3-76, 3-78, 3-91, 3-93, 3-97, 3-98, 3-101, 3-103, 3-105, 3-106, 3-110, 3-112, 3-118, 3-119, 3-120, 4-72, 5-1, B-2, B-3, H-17, H-18, H-33, H-35, H-41, H-43, H-45, H-52, H-53, H-55, H-59, H-63, H-68, H-72, I-11, I-12, I-14, I-15, I-16, I-17, I-18, I-19, I-20, I-21, I-23, I-27, I-29, I-30, I-31

U.S. Forest Service or USDA-FS 1-3, 1-14, 1-15, 1-16, 1-20, 2-17, 2-20, 3-51, 3-79, 3-91, 3-98, 3-101, 3-106, 3-112, 3-117, 3-118, 3-121, 3-127, 3-130, 3-134, 3-143, 4-61, 4-72, 4-75, 4-77, 5-1, 5-2, 5-9, B-3, H-1, H-2, H-3, H-7, H-8, H-9, H-10, H-11, H-12, H-13, H-14, H-15, H-16, H-17, H-18, H-19, H-20, H-21, H-22, H-23, H-24, H-25, H-26, H-27, H-28, H-30, H-31, H-32, H-33, H-34, H-35, H-36, H-37, H-38, H-39, H-40, H-41, H-42, H-43, H-44, H-45, H-46, H-47, H-48, H-49, H-50, H-51, H-52, H-53, H-56, H-57, H-58, H-59, H-60, H-61, H-62, H-63, H-64, H-65, H-66, H-67, H-68, H-69, H-70, H-72, I-9, I-12, I-19, I-20, I-21, I-30

wetland(s) 1-19, 2-11, 2-34, 3-75, 3-76, 3-78, 3-79, 3-84, 3-86, 3-90, 4-60, 4-64, 4-75, 5-6, 5-7, A-1, H-6, H-19, H-23, H-32, H-39, H-67, I-14, I-15, I-16, I-18, I-27

Wyoming Department of Environmental Quality or WDEQ..... 1-3, 1-10, 1-12, 1-13, 2-7, 2-10, 2-11, 2-15, 2-16, 2-25, 2-26, 2-27, 2-34, 3-4, 3-5, 3-8, 3-10, 3-20, 3-24, 3-25, 3-26, 3-29, 3-30, 3-33, 3-34, 3-36, 3-37, 3-38, 3-40, 3-42, 3-43, 3-44, 3-46, 3-48, 3-50, 3-51, 3-53, 3-56, 3-57, 3-58, 3-61, 3-64, 3-65, 3-69, 3-70, 3-71, 3-72, 3-73, 3-74, 3-75, 3-79, 3-80, 3-84, 3-88, 3-89, 3-90, 3-91, 3-93, 3-97, 3-98, 3-103, 3-111, 3-115, 3-118, 3-131, 3-153, 3-154, 3-171, 3-173, 4-7, 4-10, 4-15, 4-33, 4-36, 4-42, 4-44, 4-45, 4-47, 4-49, 4-51, 4-58, 4-60, 4-63, 4-64, 4-72, 4-108, 5-5, 5-9, A-1, B-4, F-1, F-2, F-5, F-6, F-7, F-8, F-10, F-11, F-12, F-13, H-15, H-18, H-28, H-30, H-37, H-38, H-44, H-53, I-12, I-13, I-18, I-22, I-25, I-27